TO: **Mail Stop 8** **Director of the U.S. Patent & Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Northern District of California on the following:
(x) Patents or ( ) Trademarks

DOCKET NO:	DATE FILED:	UNITED STATES DISCTRICT COURT
5:16-cv-01581-BLF	April 22, 2016	Robert F. Peckham Federal Building 280 South 1st Street San Jose, CA 95113

PLAINTIFF:	DEFENDANT:
Flamm	Micron Technology, Inc.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1. 5711849		
2. 6017221		
3. RE 40264		
4.		
5.		

In the above-entitled case, the following patent(s) have been included.

DATE INCLUDED INCLUDED BY:
( ) Amendment ( ) Answer ( ) Cross Bill ( ) Other Pleading

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1.		
2.		
3.		
4.		
5.		

In the above-entitled case, the following decision has been rendered or judgment issued:

DECISION/JUDGEMENT:

Susan Y. Soong

Susan Y. Soong, Clerk

Sandy Nunes

(by) Deputy Clerk, Sandy Nunes

Copy 1 – Upon initiation of action, mail this copy to Commissioner
Copy 2 – Upon filing document adding patent(s) mail this copy to Commissioner
Copy 3 – Upon termination of action, mail this copy to the Commissioner
Copy 4 – Case file copy

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(x) Patents or ( ) Trademarks

DOCKET NO:	DATE FILED:	UNITED STATES DISCTRICT COURT
5:16-cv-01579-BLF	April 25, 2016	Robert F. Peckham Federal Building 280 South 1st Street San Jose, CA 95113

PLAINTIFF:	DEFENDANT:
Flamm	Intel Corporation

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1. 5711849		
2. 6017221		
3. RE40264		
4.		
5.		

In the above-entitled case, the following patent(s) have been included.

DATE INCLUDED INCLUDED BY:
( ) Amendment ( ) Answer ( ) Cross Bill ( ) Other Pleading

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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Trials@uspto.gov
571-272-7822

Paper 7
Entered: February 24, 2016

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LAM RESEARCH CORP.,
Petitioner,

v.

DANIEL L. FLAMM,
Patent Owner.

Case IPR2015-01768
Patent RE 40,264 E

Before DONNA M. PRAISS, CHRISTOPHER L. CRUMBLEY, and JO-ANNE M. KOKOSKI, *Administrative Patent Judges.*

PRAISS, *Administrative Patent Judge.*

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

Lam Research Corp. ("Petitioner") filed a Petition (Paper 1, "Pet.") to institute an *inter partes* review of claims 51, 55–63, 68, 70, and 71 of U.S. Patent No. RE 40,264 E (Ex. 1001, "the '264 patent") pursuant to 35 U.S.C. §§ 311–319. A Preliminary Response (Paper 6, "Prelim. Resp.") was filed by Daniel L. Flamm ("Patent Owner").

We have jurisdiction under 35 U.S.C. § 314, which provides that an *inter partes* review may be authorized only if "the information presented in the petition . . . and any [preliminary] response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a).

Petitioner challenges claims 51, 55–63, 68, 70, and 71 of the '264 patent under 35 U.S.C. § 103(a). Pet. 12–60. We institute an *inter partes* review as to claims 51, 55–63, 68, 70, and 71 as discussed below.

I. BACKGROUND

A. Related Proceedings

The '264 patent is the subject of concurrently-filed *inter partes* review proceedings IPR2015-01759, IPR2015-01764, and IPR2015-01766.

We are informed that the '264 patent is presently at issue in a declaratory judgment action captioned *Lam Research Corp. v. Daniel L. Flamm*, Case 5:15-cv-01277-BLF (N.D. Cal.) and in an infringement action captioned *Daniel L. Flamm v. Samsung Electronics Co., Ltd., et al.*, Case 1:15-cv-613 (W.D. Tex.). Pet. 3; Paper 4, 1.

B. The '264 Patent (Ex. 1001)

The '264 patent, titled "Multi-Temperature Processing," is directed to a method "for etching a substrate in the manufacture of a device," where the method "provide[s] different processing temperatures during an etching process or the like." Ex. 1001, Abstract. The apparatus used in the method is shown in Figure 1 below.

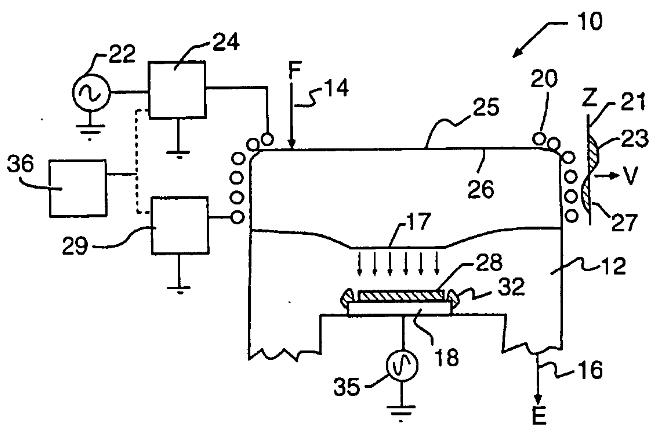


FIG. 1

Figure 1 depicts a substrate (product 28, such as a wafer to be etched) on a substrate holder (product support chuck or pedestal 18) in chamber 12 of plasma etch apparatus 10.

Figures 6 and 7, below, depict a temperature-controlled substrate holder and temperature control systems.

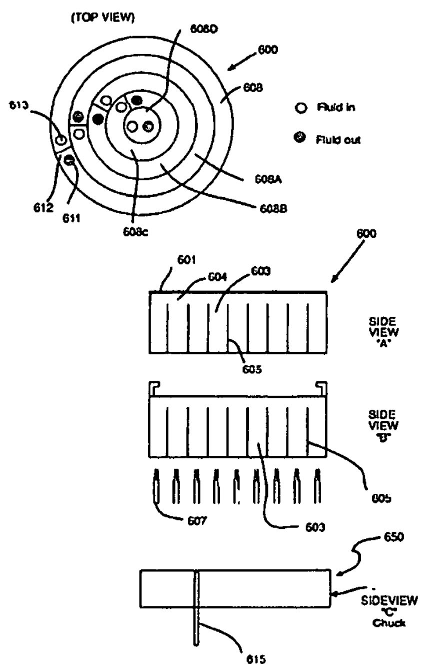


FIG. 6

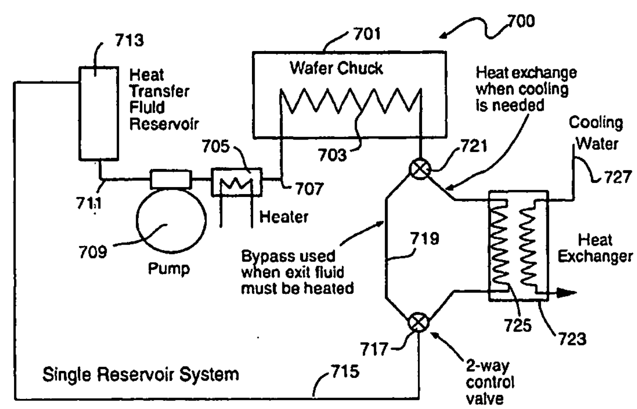


Fig. 7

Figures 6 and 7 depict temperature-controlled fluid flowing through substrate holder (600, 701), guided by baffles 605, where "the fluid [is] used to heat or cool the upper surface of the substrate holder." *Id.* at 14:62–63; 16:5–67. Figure 6 also depicts heating elements 607 underneath substrate holder 600 where "[t]he heating elements can selectively heat one or more zones in a desirable manner." *Id.* at 15:10–26. Referring to Figure 7, the temperature control operation is described as follows:

> The desired fluid temperature is determined by comparing the desired wafer or wafer chuck set point temperature to a measured wafer or wafer chuck temperature . . . . The heat exchanger, fluid flow rate, coolant-side fluid temperature, heater power, chuck, etc. should be designed using conventional means to permit the heater to bring the fluid to a

> setpoint temperature and bring the temperature of the chuck and wafer to predetermined temperatures within specified time intervals and within specified uniformity limits.

Id. at 16:36–39 and 50–67.

An example of a semiconductor substrate to be patterned is shown in Figure 9, below.

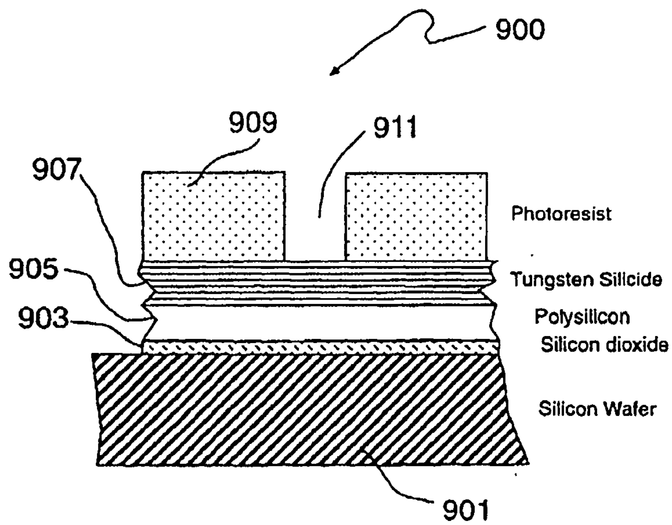


Figure 9 depicts substrate 901 having a stack of layers including oxide layer 903, polysilicon layer 905, tungsten silicide layer 907, and photoresist masking layer 909 with opening 911 from the treatment method shown in Fig. 10 below. *Id.* at 17:58–18:57.

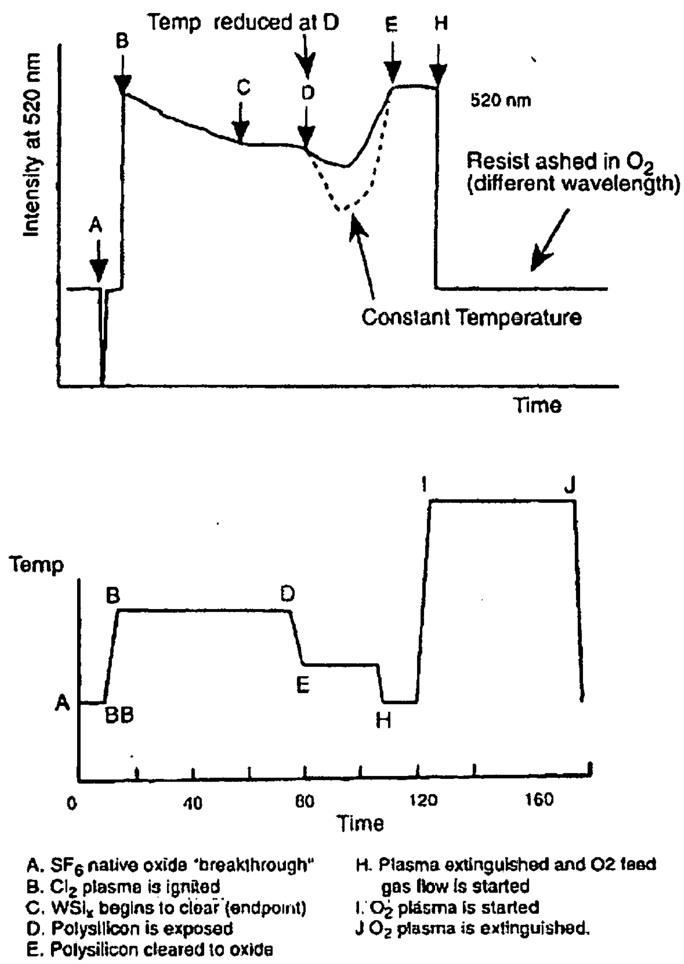


Fig. 10

Figure 10 depicts the tungsten silicide layer being etched between points B and D at a constant temperature; the polysilicon layer being exposed between points D and E; the polysilicon layer being etched at a constant temperature beyond point E; and the resist being ashed beyond point I. *Id.* at 18:58–19:64. The plasma's optical emission at 530 nm is monitored to determine when there is breakthrough to the polysilicon layer (Point D) and a lower etch temperature is required to etch the polysilicon layer (Point E). *Id.* at 19:8–24.

C. Illustrative Claim

Claims 51, 56, and 60 are the only independent claims of the '264 patent challenged in the Petition. Claim 51, reproduced below, is illustrative of the claims at issue:

> 51. A method of processing a substrate in the manufacture of a device, the method comprising:
>
> placing a substrate having a film thereon on a substrate holder in a processing chamber; the processing chamber comprising the substrate holder, a substrate control circuit operable to adjust the substrate temperature, a substrate holder temperature sensor, and a substrate holder control circuit operable to maintain the substrate holder temperature;
>
> performing a first etching of a first portion of the film at a selected first substrate temperature;
>
> performing a second etching of a second portion of the film at a selected second substrate temperature, the second temperature being different from the first temperature;
>
> wherein at least one of the film portions is etched while heat is being transferred to the substrate holder with the substrate holder control circuit; and
>
> the substrate temperature control circuit effectuates the change from the first substrate temperature to the second substrate temperature within a preselected time period.

Ex. 1001, 24:4–26.

Claim 56 is directed to a method for processing layers which are included in a stack of layers positioned on a substrate. *Id.* at 24:40–61. Claim 56 recites "wherein the substrate holder is heated to a temperature operable to maintain at least one of the selected first and the selected second substrate temperatures above 49°C," and "a preselected time period that is less than the overall process time associated with the etching the first silicon-containing layer and the second silicon-containing layer." *Id.* at 24:52–55, 24:58–61. Claim 60 is directed to a method for manufacturing a device comprising an integrated circuit. *Id.* at 25:9–31. Claim 60 recites "a stack of layers including a silicide layer," "processing the substrate . . . at a second substrate temperature to etch at least a portion of the silicide layer," and "the first substrate temperature is changed to the second substrate temperature with a substrate temperature control circuit within a preselected time to etch the silicide layer." *Id.* at 25:11–12, 25:23–25, 25:28–31.

D. The Prior Art

Petitioner relies on the following prior art:

Reference	Publication	Date	Exhibit
Tegal	EP 0 399 676 A1	Nov. 28,1990	1002
Matsumura	US 5,151,871	Sept. 29, 1992	1003
Narita	US 4,913,790	Apr. 3, 1990	1004
Thomas	US 4,680,086	July 14, 1987	1005
Wang '485	US 5,219,485	June 15, 1993	1006
Fischl	Etching of Tungsten and Tungsten Silicide Films by Chlorine Atoms, J. ELECTROCHEM. SOC. 135(8) 2016–2019	Aug. 1988	1007
Wang '391	US 4,992,391	Feb. 12, 1991	1008
Hwang	US 5,174,856	Dec. 29, 1992	1009
Ooshio	US 4,645,218	Feb. 24, 1987	1013

Petitioner also relies on the Declaration of Joseph L. Cecchi, Ph.D., dated August 18, 2015 ("Cecchi Declaration" Ex. 1010), American Heritage

Dictionary, Third Edition, 1993 (Ex. 1011), and Merriam-Webster's Dictionary, Tenth Edition, 1993 (Ex. 1012).

E. The Asserted Grounds

Petitioner challenges claims 51, 55–63, 68, 70, and 71 of the '264 patent on the following grounds:

Claims Challenged	Basis	Reference(s)
56–58	§ 103(a)	Tegal, Matsumura, Narita, Thomas, and Wang '485
60, 62, 63, and 71	§ 103(a)	Tegal, Matsumura, Narita, Thomas, and Fischl
51, 55, and 68	§ 103(a)	Tegal, Matsumura, Narita, and Thomas
56 and 59	§ 103(a)	Tegal, Matsumura, Narita, Thomas, Wang '485, and Wang '391
61	§ 103(a)	Tegal, Matsumura, Narita, Thomas, Fischl, and Ooshio
70	§ 103(a)	Tegal, Matsumura, Narita, Thomas, Fischl, and Hwang

F. Claim Construction

Before proceeding with claim construction, we must determine the proper standard to apply. Petitioner contends that the claims of the '264 patent should be given their broadest reasonable construction. Pet. 9. That standard, however, is applicable only to unexpired patents. *See* 37 C.F.R. § 42.100(b) ("A claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the patent in which it appears.").

The term of a patent grant begins on the date on which the patent issues and ends 20 years from the date on which the application for the patent was filed in the United States "or, if the application contains a specific reference to an earlier filed application or applications under section

120, 121, or 365(c) of this title, from the date on which the earliest such application was filed." 35 U.S.C. § 154(a)(2) (2002). The earliest patent application referenced for the benefit of priority under 35 U.S.C. § 120, for the '264 patent, was filed on December 4, 1995, and the patent has no term extensions. The term of the '264 patent, thus, expired no later than December 4, 2015.

Because, on this record, we conclude that the term of the '264 patent expired subsequent to the filing of the Petition and the Preliminary Response, but prior to the end of an *inter partes* review, for purposes of this Decision we treat the patent as expired. For claims of an expired patent, the Board's claim interpretation is similar to that of a district court. *See In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–17 (Fed. Cir. 2005) (en banc)). There is, however, a "'heavy presumption'" that a claim term carries its ordinary and customary meaning. *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002).

Petitioner proposes constructions for the claim terms "portion of the film" (claims 51 and 68), "portion of . . . layer" (claims 56, 59, and 60), "preselected time period" (claims 51, 55, and 56), "preselected time" (claim 60), and "selected time period" (claim 61). Pet. 9–11. Patent Owner does not dispute the proposed claim constructions.

Based on the current record, we are not persuaded that express construction of any term is necessary in order to resolve the disputes currently before us. Thus, for purposes of this Decision, we discern no need to provide any express constructions. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) ("[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.").

II. ANALYSIS

We turn now to Petitioner's asserted grounds of unpatentability under 35 U.S.C. § 103(a) to determine whether Petitioner has met the threshold standard of 35 U.S.C. § 314(a). We begin with a description of Tegal, Matsumura, Narita, and Thomas, which are asserted in each ground argued in the Petition.

A. Prior Art References

1. Tegal

Tegal "relates to plasma etch processes for the manufacture of semiconductor wafers . . . ." Ex. 1002, 1:4–5. Figure 1, below, is a schematic for etching a silicon oxide layer at two temperatures in the same chamber.

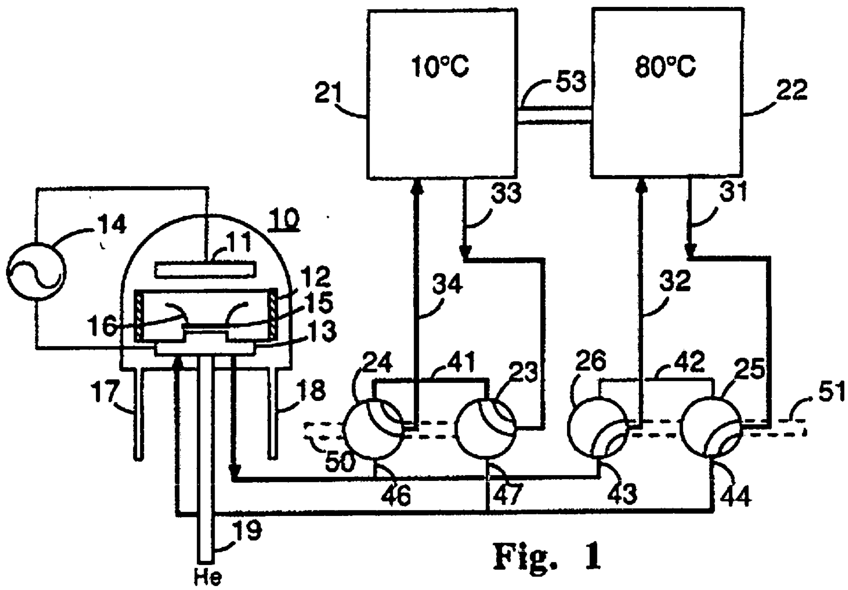


Fig. 1

Figure 1 depicts plasma reactor 10 with a chamber having a substrate (wafer 15) on a substrate holder (electrode 13 with plurality of tines 16). *Id.* at 2:52–3:7. The plasma reactor "performs different types of etch, requiring different temperatures, in a single reactor" on the substrate. *Id.* at 1:43–48. For example, "a tapered etch can be performed in oxide through a patterned photoresist" by a first etching at 80°C for an isotropic etch, followed by a second etching at 10°C–40°C for an anisotropic etch. *Id.* at 5:5–45.

Figure 1 also depicts two reservoirs of water maintained at 10°C and 80°C to control the temperature of the substrate holder and substrate. The 10°C and 80°C waters are mixed, using taps 47 and 44, and delivered to the substrate holder (electrode 13 with plurality of tines 16) at the desired temperature. The return water from the substrate holder is recirculated back to the reservoirs, remixed with hot or cold water to the desired temperature, and recirculated to the substrate holder. The valves that interconnect the reservoirs to the substrate holder "may be individually actuated electronically." *Id.* at 3:36–4:32.

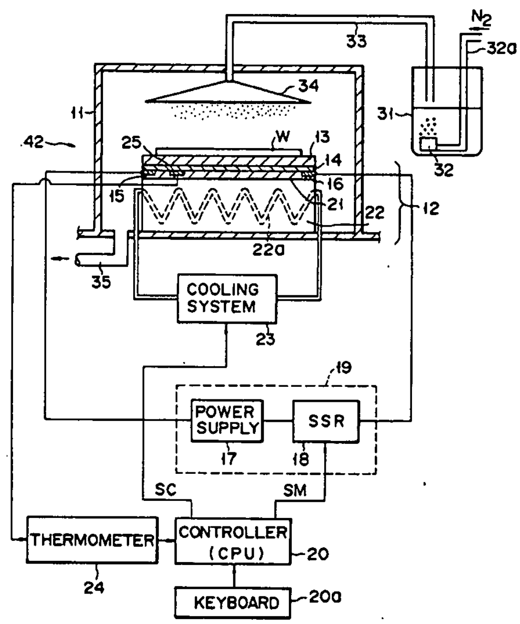
Figure 1 further depicts controlling substrate (wafer) temperature using "an external source of helium gas to the underside of wafer 15 through one or more channels, not shown, in the upper surface of electrode 13. As known per se in the art, this provides better thermal coupling between wafer 15 and electrode 13." *Id.* at 3:4–26. The passageways in the substrate holder (electrode 13 with plurality of tines 16) for water "are separate from the passageways conveying helium from port 19." *Id.* at 3:15–26.

While Tegal provides the example of "etching an oxide layer on a semiconductor wafer," Tegal envisions "enhance[d] throughput" by "performing two different types of etch in the same reactor" and performing "different types of etch, requiring different temperatures, in a single reactor." *Id.* at 6:43–44, 1:43–48. Tegal also provides an example of "etching an oxide layer on a semiconductor wafer" at temperatures between 10°C and 80°C, but envisions that "any two temperatures can be used." *Id.* at 6:4–13, 6:43–44.

2. Matsumura

Matsumura discloses a "method of heat-processing semiconductor devices whereby temperatures of the semiconductor devices can be controlled at devices-heating and -cooling times so as to accurately control their thermal history curve." Ex. 1003, 2:60–65. Matsumura discloses applying the method to plasma etching when it states that "the present invention has been applied to the adhesion and baking processes for semiconductor wafers in the above-described embodiments . . . it can also be applied to any of the ion implantation, CVD, etching and ashing processes." *Id.* at 10:3–7.

Figure 5A, below, is a schematic of an embodiment for heat-processing a substrate (wafer W) on a substrate holder (wafer-stage 12, which includes upper plate 13 and conductive thin film 14) in chamber 11.



F I G. 5A

Figure 5A depicts adhesion unit 42 with control system 20, which measures the temperature of thin film 14 deposited on the underside of upper plate 13 with thermal sensor 25. *Id.* at 5:13–17, 5:32–47, 5:67–6:4. CITE? Control system 20 sends signals (SM) to power supply circuit 19 to heat semiconductor wafer W on upper plate 13 by conductive thin film 14; and sends signals (SC) to cooling system 23 to control the amount of coolant supplied to jacket 22. *Id.* at 5:52–6:32, Figs. 5A and 5B.

Inside the control system is a recipe, such as that shown in Figure 9 below.

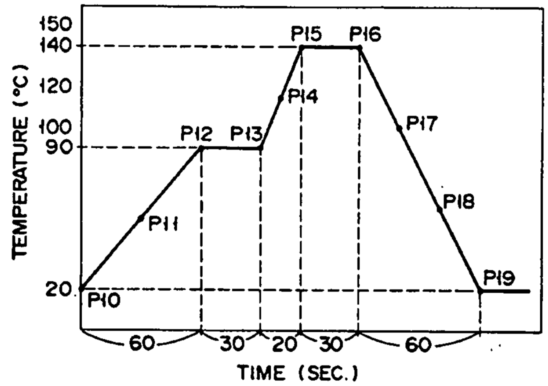
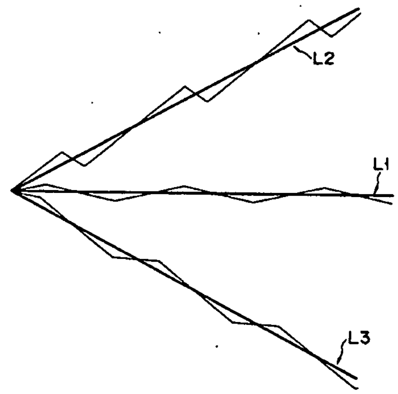


FIG. 9

Figure 9 depicts a "recipe" with a "thermal history curve" showing temperature as a function of time. *Id.* at 4:42–43. At a given time (or pulse), the control system measures the substrate holder temperature with thermal sensor 25, compares thermal sensor 25's measurement to that of the recipe shown in Figure 9, and either (1) sends a signal (SM) to power supply circuit 19 to heat the substrate (wafer W), (2) sends a signal (SC) to cooling system 23 to cool the substrate (jacket 22 under stage 12 exchanges heat with thin film 14), or (3) sends no signal and waits for the next measurement time. *Id.* at 5:52–6:32, Figs. 5A and 5B.

To further explain the temperature control, Matsumura discloses Figure 7, shown below.

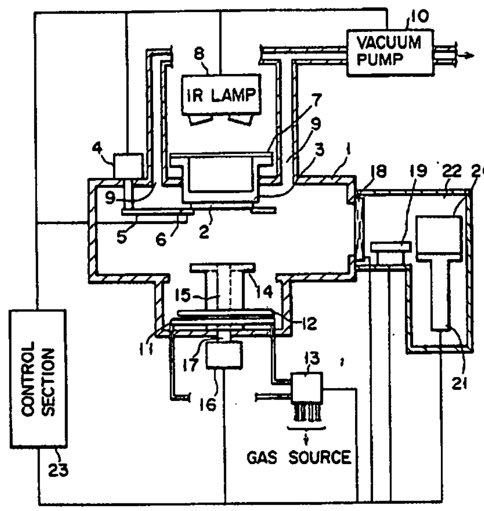


F I G. 7

"FIG. 7 is a chart intended to explain the temperature change (include ripple of temperature) of a heating plate at a time when its temperature is being raised, lowered and kept certain." *Id.* at 4:36–39.

3. Narita

Narita discloses a method for treating "a surface of a workpiece while accurately controlling the temperature of the workpiece." Ex. 1004, 2:7–10. Narita further discloses that the method can be applied to plasma etching and thermal chemical vapor deposition (CVD), among other treatment methods. *Id.* at 3:3–5. The disclosed treating method "includes a temperature rise step in which first temperature control is performed and a treatment step in which second temperature control is performed." *Id.* at Abstr. Figure 1, below, is a schematic of an embodiment for a CVD process where there is a substrate (semiconductor wafer 2) on a substrate holder (support member 5).



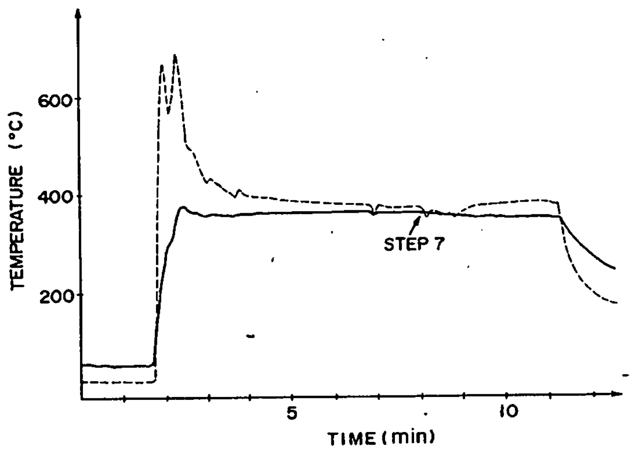
F I G. 1

Figure 1 depicts control section 23 that controls the temperature using two temperature detecting mechanisms: thermocouple 6, which contacts substrate 2, and pyrometer 16, which does not contact the substrate. *Id.* at 3:13–37, 3:65–4:13, 4:26–31. Narita discloses that two temperature sensors are used because the thermocouple has a thermal mass and

> reliability is decreased with respect to quickly rising temperatures because it takes a considerably long period of time to increase the temperature of the thermocouple itself. Therefore, when the substrate is quickly heated, the thermocouple cannot follow the temperature rise. As a result, the difference between a temperature detected by the thermocouple and an actual temperature becomes large, and a set value to be kept constant after quick rise is greatly overshot. . . .
>
> In contrast to this, if a pyrometer is used for temperature control of a substrate, the pyrometer can properly respond to quick heating because it has good response characteristics.

Id. at 1:42–54.

Figure 2, below, depicts temperature as a function of time when a wafer is quickly heated.



F I G. 2

Figure 2 shows (1) overshooting the temperature set value (dashed line) when the control circuit only uses thermocouple 6 measurements to control the process; and (2) not overshooting the temperature set value (solid line) when the control circuit switches from thermocouple 6 to pyrometer 16 measurements to control the process, during the time when the temperature is quickly increasing. *Id.* at 6:18–49.

4. *Thomas*

Thomas discloses a method for "dry etching refractory metal silicide/polysilicon structures in the manufacture, for instance, of semiconductor integrated circuits." Ex. 1005, 1:7–10. "Of particular interest are refractory metal silicide materials such as tungsten disilicide . . . . In the preferred embodiment . . . the temperature is approximately 20 degrees C." *Id.* at 3:35–56. "The second stage process is, according to the preferred embodiment, optimized to rapidly and anisotropically etch the polysilicon without significant undercutting and with a high selectivity to the underlying dielectric, typically silicon dioxide . . . the temperature is approximately 5 degrees C." *Id.* at 3:57–4:13. Thomas discloses that the two stage process for etching multiple layer structures "provides rapid, anisotropic etching of the overlying silicide and also provides rapid, anisotropic etching of the underlying polysilicon with a high degree of selectivity to the underlying dielectric." *Id.* at 4:57–66.

B. Obviousness Grounds

1. Tegal, Matsumura, Narita, Thomas, and Wang '485

Based on our review of Petitioner's analysis and supporting evidence, we are persuaded that Petitioner has shown, on the current record, that there is a reasonable likelihood that it would prevail in its obviousness challenge to claims 56–58 over the combination of Tegal, Matsumura, Narita, Thomas, and Wang '485.

As argued by Petitioner (Pet. 12–29), Tegal discloses the desire for increased throughput in plasma etching by running multiple etches at different temperatures in the same chamber having a substrate and a substrate holder as required by each of the independent claims. Ex. 1002, 1:43–45, 4:30–31. Thomas provides a stack of layers to be plasma etched in the same chamber at different temperatures that is substitutable in the Tegal process to benefit from the increased throughput. Ex. 1005, 3:57–68; Ex. 1010 ¶ 65. Thomas's stack of layers includes two silicon-containing layers, specifically a silicide layer and a polysilicon layer, as required by claim 56. Ex. 1005, 3:33–47. Wang '485 increases processing temperatures to above 49°C during plasma etching of silicides and polysilicon structures, as further required by claim 56, in order to increase etch rate or throughput. Ex. 1006, 5:7–15, 6:1–5, Fig. 21.

Tegal further includes a control system for plasma etching temperatures, but without details. Ex. 1002, 4:28–31. Matsumura provides in detail a temperature control system for use in a plasma etching process, where the control system has the flexibility of being responsive to "inputted recipes and temperature detecting signal." Ex. 1003, 5:60–63. Therefore, the control system of Matsumura effects temperature changes during the process as required by claim 56 and in accordance with a "predetermined recipe" that has a "time-temperature relationship." *Id.* at 3:1–7, 6:36–37. In order to better control temperature during process temperature changes, Narita provides two temperature sensors used in a control system for plasma etching. Ex. 1004, 4:4–10, 5:30–31, Figs. 1, 4.

Regarding claim 57, which depends from claim 56, Petitioner argues that it would have been obvious to change the substrate temperature within a time period less than about 5 percent of the total etching process time in view of Matsumura's disclosure of a predetermined recipe and also to increase throughput. Pet. 23–24 (citing Ex. 1003, 3:1–7, 6:36–37, Figs. 8, 9; Ex. 1010 ¶¶ 77, 78, 80). Regarding claim 58, which depends from claim 56, Petitioner contends that Thomas teaches etching at least one layer in a chlorine-containing ambient as required by the claim. *Id.* at 24–25 (citing Ex. 1005, 2:5–8; Ex. 1010 ¶¶ 79, 80).

Patent Owner responds that Petitioner's citation to Wang '485 (Ex. 1006, 6:1–5) on page 22 of the Petition (claim chart for claim 56) does not support the proposition of maintaining one of the substrate temperatures above 49°C (claim element 56.e). Prelim. Resp. 6. Patent Owner also contends that the Petition improperly segments the elements of claim 56 and fails to show that element 56.g ("operable to effectuate the changing within a preselected time period that is less than the overall process time associated with the etching the first silicon-containing layer and the second silicon-containing layer") is disclosed in the prior art. *Id.* at 7–8. According to Patent Owner:

> Matsumura teaches control of the time for temperature ramp up; the time to hold the desired temperature; and the time to cool down the temperature. Matsumura *does not teach* the length of the preselected time between the first and second etch, *i.e.*, there is no teaching that the preselected time period, let alone a preselected time period that is "less than the overall process time associated with the etching the first silicon-containing layer and the second silicon-containing layer," as required by claim 56, and Tegal has no time interval between temperatures. Accordingly, [Petitioner] fails to show this element of claim 56 in the prior art.

Id. at 8.

We are not persuaded, at this early stage of the proceeding, that the arguments presented in the Petition are not supported by Wang '485 and Matsumura. Petitioner contends that Figure 21 of Wang '485 shows that the etch rate of molybdenum silicide increases from 750 to 1250 angstroms/minute over a temperature range from 45°C to 80°C. Pet. 17 (citing Ex. 1006, 6:1–5, Fig. 21). Therefore, the Petition does not rely upon the text of lines 1 to 5 in column 6 of Wang '485 alone, and Patent Owner does not dispute that Figure 21 indicates increased etch rate over a temperature range of 45°C to 80°C. Regarding Matsumura, the predetermined recipes that depend upon a time and temperature relationship for the heat-processing of semiconductor devices consequently preselect the time and temperature conditions during which processing is conducted. *See*

Pet. 20 (citing Ex. 1003, 1–7, 6:36–37, Ex. 1010 ¶ 73); Ex. 1010 ¶ 74. Therefore, the Petition sufficiently shows how independent claim 56 would have been obvious in view of the combination of Tegal, Matsumura, Narita, Thomas, and Wang '485.

In sum, Petitioner shows sufficiently that, on the current record, there is a reasonable likelihood it would prevail in showing that claims 56–58 would have been obvious in view of the combination of Tegal, Matsumura, Narita, Thomas, and Wang '485.

2. Tegal, Matsumura, Narita, Thomas, and Fischl

Based on our review of Petitioner's analysis and supporting evidence, we are persuaded that Petitioner has shown, on the current record, that there is a reasonable likelihood that it would prevail in its obviousness challenge to claims 60, 62, 63, and 71 over the combination of Tegal, Matsumura, Narita, Thomas, and Fischl.

As argued by Petitioner (Pet. 29–43), Tegal discloses the desire for increased throughput in plasma etching by running multiple etches at different temperatures in the same chamber. Ex. 1002, 1:43–45, 4:30–31. Thomas provides a stack of layers to be plasma etched in the same chamber at different temperatures that is substitutable in the Tegal process to benefit from Tegal's increased throughput. Ex. 1005, 3:57–68; Ex. 1010 ¶ 65. Thomas further teaches a tungsten silicide layer that is etched at 20°C. Ex. 1005, 3:33–47. Fischl teaches that a silicon dioxide layer forms on tungsten silicide when it is exposed to air, which must be removed by etching at 25°C–150°C before etching the disclosed tungsten silicide layer. Ex. 1007, 3; Ex. 1010 ¶ 91. Therefore, plasma etching the tungsten silicide layer of Thomas in view of Fischl means the temperature for etching the surface oxide is different from the temperature for etching the tungsten silicide, and the substrate is processed at a second different temperature as required by claim 60. Pet. 33–34. Because Fischl teaches etching at 25°C–150°C, Fischl discloses maintaining a substrate temperature above room temperature while processing the substrate as required by claim 60. *See id.* at 34–35.

Tegal provides a control system for plasma etching temperatures, but lacks details. Ex. 1002, 4:28–31. Matsumura provides, in detail, a temperature control system suitable for plasma etching processes that includes a contact sensor and predetermined recipes which provide process flexibility. Ex. 1003, 5:60–63. Therefore, the control system of Matsumura effects temperature change to a second substrate temperature with a substrate temperature control circuit within a preselected time as required by claim 60 and in accordance with a "predetermined recipe" that has a "time-temperature relationship." *Id.* at 3:1–7, 6:36–37. Narita improves temperature control during temperature changes in plasma etching processes by using two temperature sensors—a non-contact sensor in addition to a contact sensor. Ex. 1004, 4:4–10, 5:30–31, Figs. 1, 4.

Patent Owner responds that the challenge to claim 60 "fails to identify any prior art that teaches changing the first substrate temperature to the second substrate temperature 'within a preselected time to etch the silicide layer.'" Prelim. Resp. 9. As discussed above, at this stage in the proceeding, we are not persuaded by Patent Owner's argument in view of Matsumura's control system that includes recipes with a time and temperature relationship that can be applied to etching processes.

We are persuaded, on this record, that Petitioner's discussion of the particular operations and structures in Tegal, Matsumura, Narita, Thomas, and Fischl together with the explanations in the Petition, are sufficient to establish a reasonable likelihood that claim 60 would have been obvious over the combination of the references.

Regarding claims 62, 63, and 71, which each depend from claim 60, changing to the second substrate temperature is "by transferring heat using at least a pressure of gas behind the substrate" as recited in claim 62 or "by transferring energy using at least radiation" as recited in claim 63, and the substrate temperature is maintained "at a selected value within 50 to 100 degrees centigrade" as recited in claim 71. We have considered Petitioner's arguments and evidence and are persuaded, on the present record, that Petitioner has established a reasonable likelihood that it would prevail as to those claims as well.

3. *Tegal, Matsumura, Narita, and Thomas*

Based on our review of Petitioner's analysis and supporting evidence, we are persuaded that Petitioner has shown, on the current record, that there is a reasonable likelihood that it would prevail on its obviousness challenge to claims 51, 55, and 68 over the combination of Tegal, Matsumura, Narita, and Thomas.

As argued by Petitioner (Pet. 43–48), the same reasons for combining the disclosures of Tegal, Matsumura, Narita, and Thomas provided in the Petition with respect to claims 56–58 also apply to claim 51, 55, and 68. Petitioner additionally relies on Matsumura's disclosure of a pulse wide modulation signal and cooling control signal sent from its control system to show that Matsumura's control system alternates periods of heating and cooling the substrate holder and the substrate on the substrate holder, to demonstrate that "heat is being transferred to the substrate holder with the substrate holder control circuit" during etching as required by claim 51. *Id.* at 45–46 (citing Ex. 1003, 4:32–35, 6:64–68, 8:18–22, Figs. 6A and 7; Ex. 1010 ¶¶ 121–122). Regarding claims 55 and 68, which depend from claim 51, Petitioner relies upon the same disclosures from Tegal and Matsumura (regarding changing the substrate temperature within less than about 5 percent of the total etching process time) as applied to claim 57, and the same disclosures from Thomas (regarding etching two silicon-containing layers at two substrate temperatures) as applied to claim 56. *Id.* at 47–48.

Patent Owner contends that the Petition is deficient because "Matsumura does not teach a time interval between a first etch temperature and a second etch temperature." Prelim. Resp. 11. As discussed above, we are not persuaded on the present record that Matsumura's control system for changing the temperature of a substrate holder, which includes predetermined recipes and time and temperature relationships, does not disclose the substrate temperature control circuit required by claim 51.

At this preliminary stage of the proceeding, we find the Petition sufficiently shows that Petitioner is reasonably likely to demonstrate that claims 51, 55, and 68 would have been obvious in view of the combination of Tegal and Matsumura, Narita, and Thomas.

4. Tegal, Matsumura, Narita, Wang '391, Thomas, and Wang '485

Based on our review of Petitioner's analysis and supporting evidence, we are persuaded that Petitioner has shown, on the current record, that there is a reasonable likelihood that it would prevail in its obviousness challenge to claim 59, which depends from claim 56, over the combination of Tegal, Matsumura, Narita, Thomas, Wang '485, and Wang '391.

Wang '391 discloses a multi-layered stack that includes a polysilicon layer over a silicide layer and an oxide layer as required by claim 59. Ex. 1008, 5:10–26 (claim 1); Pet. 49. Petitioner argues that it would have been obvious to perform the process of Wang '391 in the chamber of Tegal, because Wang '391 does not provide details about the etch chamber, process, or temperatures, and Tegal teaches an etching chamber in which any two temperatures can be used (Pet. 49–50, 54). Petitioner further argues that the substrate of Wang '391 can be etched in the process taught by Tegal in view of Thomas because both Thomas and Wang '391 etch a silicon-containing layer. *Id.* at 50. In Thomas's process, the polysilicon layer is etched using chlorine and the polysilicon layer is etched at a different temperature than the silicide layer as required by claim 59. *Id.* at 52 (citing Ex. 1005, 2:5–8, 3:33–47, 3:57–68; Ex. 1010 ¶ 135). Wang '391 additionally teaches that the oxide layer serves as an etch-stop layer, thus, selective etching relative to the oxide layer, as required by claim 59, is taught by Wang '391. *Id.* at 52–53.

At this preliminary stage of the proceeding, Petitioner shows sufficiently that, on the current record, there is a reasonable likelihood it would prevail in showing that claim 59 (and 56 from which it depends) would have been obvious in view of the combination of Tegal, Matsumura, Narita, Thomas, Wang '485, and Wang '391.

5. *Tegal, Matsumura, Narita, Thomas, Fischl, and Ooshio*

Based on our review of Petitioner's analysis and supporting evidence, we are persuaded that Petitioner has shown, on the current record, that there is a reasonable likelihood that it would prevail in its obviousness challenge to claim 61 over the combination of Tegal, Matsumura, Narita, Thomas, Fischl, and Ooshio.

Claim 61 depends from claim 60 and requires "heat transfer to the substrate using at least an electrostatic chuck." Ex. 1001, 25:33–34. Ooshio discloses that in the past "a variety of means for securing a wafer have been used. In recent years electrostatic chucks are used for securing a specimen wafer by electrostatic forces." Ex. 1013, 1:10–14. Petitioner argues that it would have been obvious to combine Ooshio's electrostatic chuck in the method of claim 60 for better thermal coupling, as taught by Tegal. Pet. 57 (citing Ex. 1002, 3:9–14; Ex. 1010 ¶ 145).

At this preliminary stage of the proceeding, Petitioner shows sufficiently that, on the current record, there is a reasonable likelihood it would prevail in showing that claim 61 would have been obvious in view of the combination of Tegal and Matsumura, Narita, Thomas, Fischl, and Ooshio.

6. Tegal, Matsumura, Narita, Thomas, Fischl, and Hwang

Based on our review of Petitioner's analysis and supporting evidence, we are persuaded that Petitioner has shown, on the current record, that there is a reasonable likelihood that it would prevail in its obviousness challenge to claim 70 over the combination of Tegal, Matsumura, Narita, Thomas, Fischl, and Hwang.

Claim 70 depends from claim 60 and requires "maintaining the substrate temperature at a selected value within 180 to 220 degrees centigrade." Ex. 1001, 26:28–29. Hwang discloses raising the substrate temperature to between 100°C and 400°C in order to etch the patterned photoresist layer off of the substrate. Pet. 58 (citing Ex. 1009, 4:1–29, 5:21–30, 6:11–13; Ex. 1010 ¶¶ 147–148). Petitioner argues it would have been obvious to combine Hwang's temperature for etching photoresist in the method of claim 60 for the purpose of removing the photoresist layer from the stack of layers taught by Thomas, and also because Hwang suggests the use of a single chamber for both the metal etch step and the photoresist etching process, but does not provide specific teachings regarding the apparatus. *Id.* at 59–60.

At this preliminary stage of the proceeding, Petitioner shows sufficiently that, on the current record, there is a reasonable likelihood it would prevail in showing that claim 70 would have been obvious in view of the combination of Tegal and Matsumura, Narita, Thomas, Fischl, and Hwang.

C. Conclusion

For the foregoing reasons, we determine that the information presented in the Petition establishes that there is a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of claims 51, 55–63, 68, 70, and 71 of the '264 patent.

The Board has not made a final determination on the patentability of any challenged claim.

III. ORDER

Accordingly, it is

ORDERED that *inter partes* review is *instituted* with respect to the following grounds of unpatentability:

(1) claims 56–58 as obvious over Tegal, Matsumura, Narita, Thomas, and Wang '485 under 35 U.S.C. § 103(a);

(2) claims 60, 62, 63, and 71 as obvious over Tegal, Matsumura, Narita, Thomas, and Fischl under 35 U.S.C. § 103(a);

(3) claims 51, 55, and 68 as obvious over Tegal, Matsumura, Narita, and Thomas under 35 U.S.C. § 103(a);

(4) claims 56 and 59 as obvious over Tegal, Matsumura, Narita, Wang '391, Thomas, and Wang '485 under 35 U.S.C. § 103(a);

(5) claim 61 as obvious over Tegal, Matsumura, Narita, Thomas, Fischl, and Ooshio under 35 U.S.C. § 103(a); and

(6) claim 70 as obvious over Tegal, Matsumura, Narita, Thomas, Fischl, and Hwang under 35 U.S.C. § 103(a).

FURTHER ORDERED that no ground other than those specifically instituted above is authorized for the *inter partes* review; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(a), *inter partes* review of the '264 patent is hereby instituted commencing on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial.

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Paper 7
Entered: February 24, 2016

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LAM RESEARCH CORP.,
Petitioner,

v.

DANIEL L. FLAMM,
Patent Owner.

Case IPR2015-01766
Patent RE 40,264 E

Before DONNA M. PRAISS, CHRISTOPHER L. CRUMBLEY, and JO-ANNE M. KOKOSKI, *Administrative Patent Judges.*

PRAISS, *Administrative Patent Judge.*

DECISION
Denying Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Lam Research Corp. ("Petitioner") filed a Petition (Paper 1, "Pet.") to institute an *inter partes* review of claims 27, 31, 32, 34, 37, 40, 41, 44, 47, 48, and 50 of U.S. Patent No. RE 40,264 E (Ex. 1001, "the '264 patent") pursuant to 35 U.S.C. §§ 311–319. Daniel L. Flamm ("Patent Owner") filed a Preliminary Response (Paper 6, "Prelim. Resp.").

We have jurisdiction under 35 U.S.C. § 314, which provides that an *inter partes* review may be authorized only if "the information presented in the petition . . . and any [preliminary] response . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." 35 U.S.C. § 314(a).

Upon consideration of the Petition, we conclude the information presented does not demonstrate a reasonable likelihood that Petitioner would prevail in showing the unpatentability of any of the challenged claims. Accordingly, we do not institute an *inter partes* review.

A. Related Proceedings

The '264 patent is the subject of concurrently filed *inter partes* review proceedings IPR2015-01759, IPR2015-01764, and IPR2015-01768.

We are informed that the '264 patent is presently at issue in a declaratory judgment action captioned *Lam Research Corp. v. Daniel L. Flamm*, Case 5:15-cv-01277-BLF (N.D. Cal.), and in an infringement action captioned *Daniel L. Flamm v. Samsung Electronics Co., Ltd., et al.*, Case 1:15-cv-613 (W.D. Tex.). Pet. 3; Paper 4, 1.

B. The '264 Patent (Ex. 1001)

The '264 patent, titled "Multi-Temperature Processing," is directed to a method "for etching a substrate in the manufacture of a device," where the method "provide[s] different processing temperatures during an etching process or the like." Ex. 1001, Abstract. The apparatus used in the method is shown in Figure 1 below.

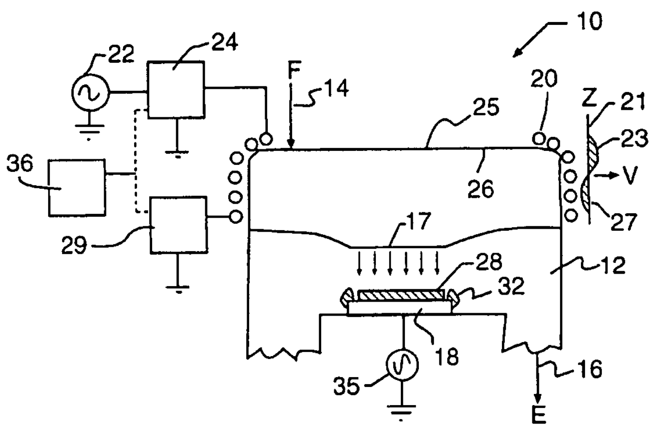


FIG. 1

Figure 1 depicts a substrate (product 28, such as a wafer to be etched) on a substrate holder (product support chuck or pedestal 18) in a chamber (chamber 12 of plasma etch apparatus 10). *Id.* at 3:24–25, 3:32–33, 3:40–41.

Figures 6 and 7, below, depict a temperature-controlled substrate holder and temperature control systems.

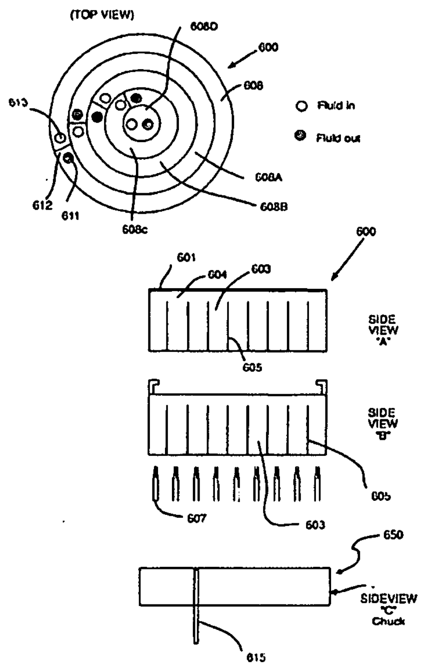


FIG. 6

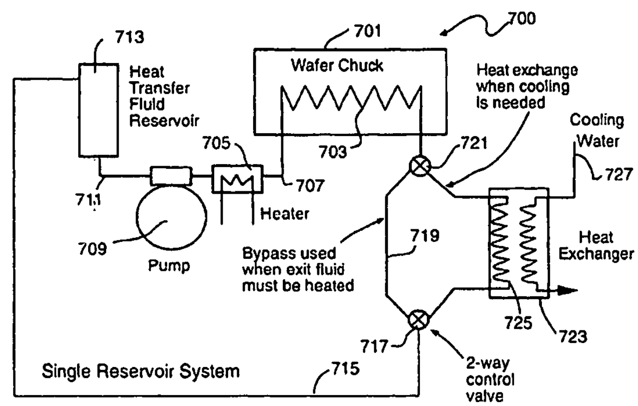


Fig. 7

Figures 6 and 7 depict temperature-controlled fluid flowing through substrate holder (600, 701), guided by baffles 605, where "the fluid [is] used to heat or cool the upper surface of the substrate holder." *Id.* at 14:62–63; 16:5–67. Figure 6 also depicts heating elements 607 underneath the substrate holder, where "[t]he heating elements can selectively heat one or more zones in a desirable manner." *Id.* at 15:10–26. Referring to Figure 7, the temperature control operation is described as follows:

> The desired fluid temperature is determined by comparing the desired wafer or wafer chuck set point temperature to a measured wafer or wafer chuck temperature . . . . The heat exchanger, fluid flow rate, coolant-side fluid temperature, heater power, chuck, etc. should be designed using conventional means to permit the heater to bring the fluid to a

> setpoint temperature and bring the temperature of the chuck and wafer to predetermined temperatures within specified time intervals and within specified uniformity limits.

Id. at 16:36–39 and 50–67.

An example of a semiconductor substrate to be patterned is shown in Figure 9, below.

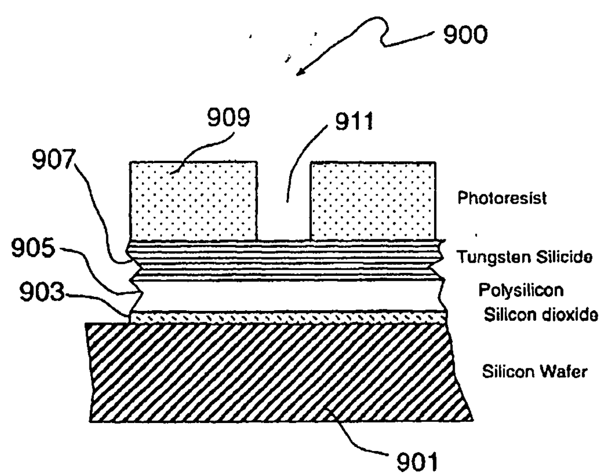


Figure 9 depicts substrate 901 having a stack of layers including oxide layer 903, polysilicon layer 905, tungsten silicide layer 907, and photoresist masking layer 909 with opening 911 from the treatment method shown in Fig. 10, below. *Id.* at 17:58–18:57.

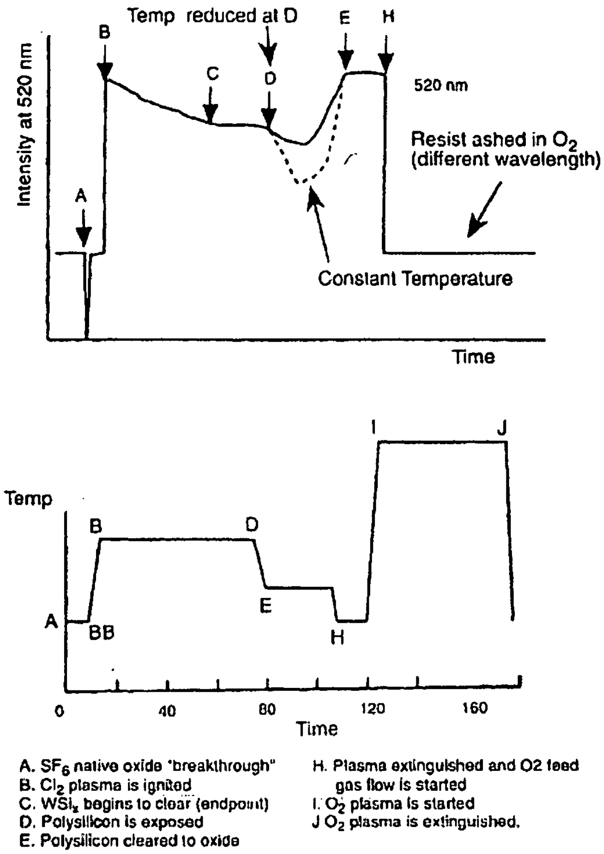


Fig. 10

Figure 10 depicts the tungsten silicide layer being etched between points B and D at a constant temperature; the polysilicon layer being exposed between Points D and E; the polysilicon layer being etched at a constant temperature beyond point E; and the resist being ashed beyond Point I. *Id.* at 18:58–19:64. The plasma's optical emission at 530 nm is monitored to determine when there is breakthrough to the polysilicon layer (Point D) and a lower etch temperature is required to etch the polysilicon layer (Point E). *Id.* at 19:8–24.

C. Illustrative Claim

Claims 27 and 37 are the only independent claims of the '264 patent challenged in the Petition. Claim 37, reproduced below, is illustrative of the claims at issue:

> 37. A method of processing a substrate during the manufacture of a device, the method comprising:
>
> placing a substrate having a film thereon on a substrate holder within a chamber of a plasma discharge apparatus, the plasma discharge apparatus comprising: a substrate temperature control system comprising a substrate temperature sensor and a substrate temperature control circuit operable to adjust the substrate temperature to a predetermined substrate temperature value with a first heat transfer process; and a substrate holder temperature control system comprising a substrate holder temperature sensor and a substrate holder temperature control circuit operable to adjust the substrate holder temperature to a predetermined substrate holder temperature value with a second heat transfer process;
>
> performing a first film treatment of a first portion of the film at a selected first substrate temperature;
>
> with the substrate temperature control circuit, changing from the selected first substrate temperature to a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature; and
>
> performing a second film treatment of a second portion of the film at the selected second substrate temperature;
>
> wherein the substrate holder is heated above room temperature during at least one of the first or the second film treatments, and the substrate temperature control circuit is operable to change the substrate temperature from the selected first substrate temperature to the selected second substrate temperature within a preselected time period to process the film.

Ex. 1001, 22:57–23:20. Claim 27 is directed to a method of etching a substrate in the manufacture of a device. *Id.* at 22:8–9. Claim 27 recites "etching a first portion of the film," "etching a second portion of the film," and a substrate temperature change "within a preselected time interval for processing, and at least the first substrate temperature or the second substrate temperature, in single or in combination, is above room temperature." *Id.* at 22:16–17, 22:25–28.

D. The Prior Art

Petitioner relies on the following prior art:

Reference	Publication	Date	Exhibit
Tegal	EP 0 399 676 A1	Nov. 28, 1990	1002
Matsumura	US 5,151,871	Sept. 29, 1992	1003
Narita	US 4,913,790	Apr. 3, 1990	1004
Hwang	US 5,174,856	Dec. 29, 1992	1005
Nakamura	US 5,316,616	May 31, 1994	1006
Wang	EP 0 272 140 A2	June 22, 1988	1007

Petitioner also relies on the Declaration of Joseph L. Cecchi, Ph.D., dated August 18, 2015 ("Cecchi Declaration," Ex. 1008), American Heritage Dictionary 1066 (3d ed. 1993) (Ex. 1009), and Merriam-Webster's Dictionary 921 (10th ed. 1993) (Ex. 1010).

E. The Asserted Grounds

Petitioner challenges claims 27, 31, 32, 34, 37, 40, 41, 44, 47, 48, and 50 of the '264 patent on the following grounds (Pet. 13, 30, 35):

Claim(s) Challenged	Basis	References
27, 31, 32	§ 103(a)	Hwang, Tegal, Matsumura, and Narita
34	§ 103(a)	Nakamura, Tegal, Matsumura, and Narita
37, 40, 41, 44, 47, 48, 50	§ 103(a)	Wang, Tegal, Matsumura, and Narita

F. Claim Interpretation

Before proceeding with claim construction, we must determine the proper standard to apply. Petitioner contends that the claims of the '264 patent should be given their broadest reasonable construction. Pet. 10. That standard, however, is applicable only to unexpired patents. *See* 37 C.F.R. § 42.100(b) ("A claim in an unexpired patent shall be given its broadest reasonable construction in light of the specification of the patent in which it appears.").

The term of a patent grant begins on the date on which the patent issues and ends 20 years from the date on which the application for the patent was filed in the United States, "or, if the application contains a specific reference to an earlier filed application or applications under section 120, 121, or 365(c) of this title, from the date on which the earliest such application was filed." 35 U.S.C. § 154(a)(2) (2002). The earliest patent application referenced for the benefit of priority under 35 U.S.C. § 120, for the '264 patent, was filed on December 4, 1995, and the patent has no term extensions. The term of the '264 patent, thus, expired no later than December 4, 2015.

Because, on this record, we conclude that the term of the '264 patent expired subsequent to the filing of the Petition and the Preliminary Response, but prior to the end of the preliminary stage of an *inter partes* review, for purposes of this Decision we treat the patent as expired. For claims of an expired patent, the Board's claim interpretation is similar to that of a district court. *See In re Rambus Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing Phillips, 415 F.3d at 1312–17). There is, however, a "'heavy presumption'" that a claim term carries its ordinary and customary meaning. *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002).

Petitioner proposes constructions for the claim terms "portion of the film" (claims 27, 34, 37, and 41), "preselected time interval" (claim 27), and "preselected time period" (claim 37). Pet. 10–12. Patent Owner does not dispute the proposed claim constructions in the Preliminary Response.

Based on the current record, we are not persuaded that express construction of any term is necessary in order to resolve the disputes currently before us. Thus, we discern no need to provide any express constructions at this time. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) ("[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.").

II. DISCUSSION

We turn now to Petitioner's asserted grounds of unpatentability under 35 U.S.C. § 103(a) to determine whether Petitioner has met the threshold standard of 35 U.S.C. § 314(a). We begin with a description of Tegal, Matsumura, and Narita, which are asserted in each ground argued in the Petition.

A. Prior Art References

1. Tegal

Tegal "relates to plasma etch processes for the manufacture of semiconductor wafers . . . ." Ex. 1002, 1:4–5. Figure 1, below, is a schematic of an embodiment for etching a silicon oxide layer at two temperatures in the same chamber.

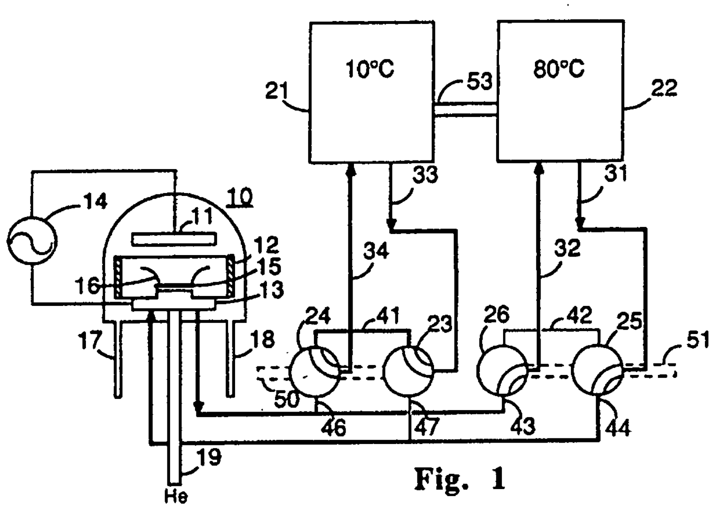


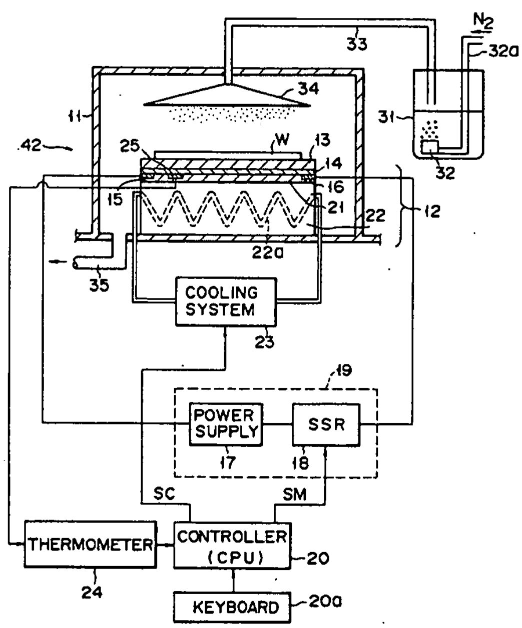
Fig. 1

Figure 1 depicts plasma reactor 10 with a chamber having a substrate (wafer 15) on a substrate holder (electrode 13 with plurality of tines 16). *Id.* at 2:52–3:7. The plasma reactor "performs different types of etch, requiring different temperatures, in a single reactor" on the substrate. *Id.* at 1:43–48. For example, "a tapered etch can be performed in oxide through a patterned photoresist" by a first etching at 80°C for an isotropic etch, followed by a second etching at 10°C–40°C for an anisotropic etch. *Id.* at 5:5–45.

2. Matsumura

Matsumura discloses a "method of heat-processing semiconductor devices whereby temperatures of the semiconductor devices can be controlled at devices-heating and -cooling times so as to accurately control their thermal history curve." Ex. 1003, 2:60–65. Matsumura envisions applying the method to plasma etching when Matsumura states that while "the present invention has been applied to the adhesion and baking processes for semiconductor wafers in the above-described embodiments . . . it can also be applied to any of the ion implantation, CVD, etching and ashing processes." *Id.* at 10:3–7.

Figure 5A, below, is a schematic of an embodiment for heat-processing a substrate (wafer W) on a substrate holder (wafer-stage 12 which includes upper plate 13 and conductive thin film 14) in chamber 11.

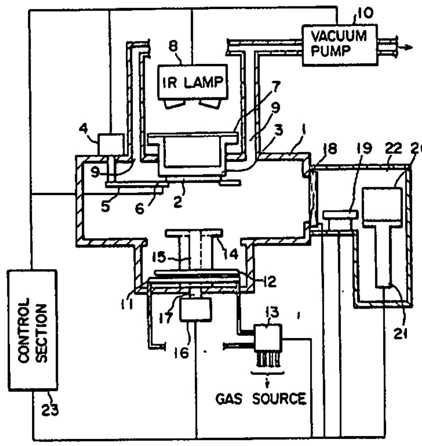


F I G. 5A

Figure 5A depicts adhesion unit 42 with control system 20. Control system 20 measures the temperature of thin film 14 deposited on the underside of upper plate 13 with thermal sensor 25. *Id.* at 5:13–17, 5:32–47, 5:67–6:4. Control system 20 sends signals (SM) to power supply circuit 19 to heat semiconductor wafer W on upper plate 13 by conductive thin film 14; and sends signals (SC) to cooling system 23 to control the amount of coolant supplied to jacket 22. *Id.* at 5:52–6:32, Figs. 5A, 5B.

3. Narita

Narita discloses a method for treating "a surface of a workpiece while accurately controlling the temperature of the workpiece." Ex. 1004, 2:7–10. Narita further discloses that the method can be applied to plasma etching and thermal chemical vapor deposition (CVD), among other treatment methods. *Id.* at 3:3–5. The disclosed treating method "includes a temperature rise step in which first temperature control is performed and a treatment step in which second temperature control is performed." *Id.* at Abstract. Figure 1, below, is a schematic of an embodiment for a CVD process where there is a substrate (semiconductor wafer 2) on a substrate holder (support member 5).



F I G. 1

Figure 1 depicts control section 23 that controls the temperature using two temperature detecting mechanisms: (1) thermocouple 6, which contacts substrate 2, and (2) pyrometer 16, which does not contact the substrate. *Id.* at 3:13–37, 3:65–4:13, 4:26–31.

B. *Obviousness over Hwang, Tegal, Matsumura, and Narita*

Petitioner contends that claim 27 would have been obvious in view of the etching process disclosed by Hwang as modified by the chamber, control system, and heating and cooling systems of Tegal, Matsumura, and Narita, described above. Pet. 13–23. Petitioner also contends that claims 31 and 32, which each depend from claim 27, would have been obvious in further view of Narita, Tegal, and Matsumura. *Id.* at 23–25. After identifying in the prior art the limitations of claims 27, 31, and 32, Petitioner provides a reason for combining the references. *Id.* at 25–30. We begin with a summary of the Hwang etching process.

1. Hwang

Hwang discloses a method "for removing from an integrated circuit structure photoresist remaining after a metal etch." Ex. 1005, Abstract. The method can be done in the same chamber where the metal etch was done. *Id.* at 3:13–16. The method includes "a first stripping step . . . followed by a subsequent step." *Id.* at Abstract. The first stripping step maintains the substrate (wafer) temperature from "about 40°C to about 100°C." *Id.* at 3:13–42. The substrate temperature is then "slowly ramped up, at a rate of about 10° C./second," to a second temperature. *Id.* at 3:58–4:6. The subsequent step maintains the substrate at the second temperature "of from about 150°C to about 400°C, typically about 245°C . . . ." *Id.* at 4:1–32.

2. Analysis

Based on our review of Petitioner's analysis and supporting evidence, in light of the arguments presented by Patent Owner, we are not persuaded that Petitioner has shown that there is a reasonable likelihood that it would prevail in its obviousness challenge to claims 27, 31, and 32.

A showing of obviousness must be supported by an articulated reasoning with rational underpinning to support a motivation to combine the prior art teachings. *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 418 (2007) (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.")). As explained in *KSR*, "a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *Id.*

We find that Petitioner's reason for combining Hwang with Tegal lacks a sufficient rational underpinning. Petitioner contends that Hwang teaches a "metal etch chamber" or a "vacuum stripping chamber" in which to perform a dry etch process for removing a photoresist mask, but "does not provide details about the etch chamber itself." Pet. 25–26. According to Petitioner, a person of ordinary skill in the art would have had reason "to use the chamber taught by Tegal, Matsumura, and Narita to perform the Hwang process" because "Hwang suggests the use of a single chamber but does not provide the specific teachings of the apparatus." *Id.* at 26 (citing Ex. 1008 ¶ 85). The single chamber suggested by Hwang, however, is a stripping chamber. *Id.* at 25 ("Hwang suggests using a single stripping chamber for both photoresist etching steps"). Petitioner states that the Hwang process "could" be performed in the chamber of Tegal, but does not explain why one of ordinary skill in the art *would* have chosen to modify Hwang with the chamber of Tegal. *Id.* at 26. Without such articulated reasoning, Petitioner's contentions are insufficient to establish that claim 27 of the '264 patent would have been obvious based on the combination of Hwang, Tegal, Matsumura, and Narita. *KSR*, 550 U.S. at 418.

For at least this reason, we conclude that Petitioner has not shown a reasonable likelihood of prevailing in its obviousness challenge to claim 27, as well as claims 31 and 32, which depend therefrom, based on the combination of Hwang, Tegal, Matsumura, and Narita.

C. Obviousness over Nakamura, Tegal, Matsumura, and Narita

Petitioner contends that claim 34 would have been obvious in view of the etching process disclosed by Nakamura as modified by the chamber, substrate holder, and electronically controlled heat transfer device of Tegal, Matsumura, and Narita. Pet. 30–32. After identifying in the prior art the limitations of claim 34, Petitioner provides a reason for combining the references. *Id.* at 33–35. We begin with a summary of the Nakamura etching process.

1. Nakamura

Nakamura "relates to dry etching a material such as polycrystalline silicon and silicides with hydrogen bromide or bromine." Ex. 1006, 1:12–15. For Sample A, a silicon wafer (substrate) with a layer (film) of arsenic–doped polycrystalline silicon was prepared and coated with a patterned photoresist layer. *Id.* at 12:22–30. Sample B was similar except that arsenic "was not ion implanted and phosphorus was thermally diffused into the polycrystalline silicon." *Id.* at 12:31–34. Each sample was etched at 100°C in an apparatus similar to the Figure 6 apparatus shown below. *Id.* at 13:1–4, 12:49–55.

Fig. 6

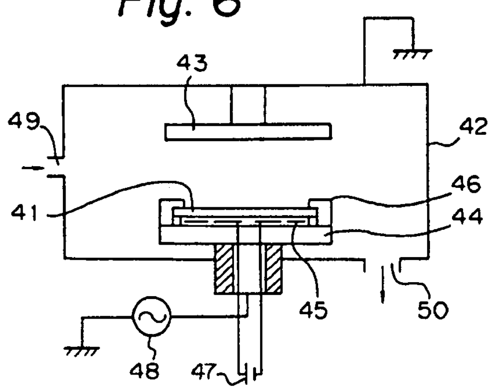


Figure 6 depicts a substrate (wafer 41) on a substrate holder (electrostatic chuck 45 and holder 46) in a chamber (etching chamber 42). Each sample was transferred to a second chamber shown in Figure 8, below, and etched at 60°C. *Id.* at 13:16–31.

Fig. 8

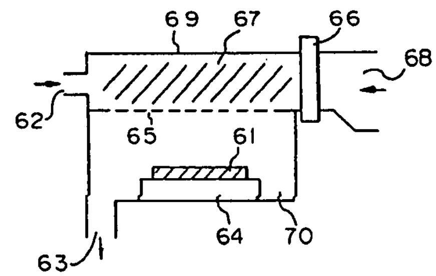


Figure 8 depicts a substrate (wafer 61) on a substrate holder (stage 64) in a chamber (sample chamber 70).

2. Analysis

Based on our review of Petitioner's analysis and supporting evidence, in light of the arguments presented by Patent Owner, we are not persuaded that Petitioner has shown that there is a reasonable likelihood that it would prevail in its obviousness challenge to claim 34 based on Nakamura, Tegal, Matsumura, and Narita.

Petitioner asserts that Nakamura discloses all of the limitations recited in claim 34 because Nakamura teaches etching a polycrystalline silicon layer at 100°C, then etching a photoresist layer at a wafer temperature of 60°C, and therefore "the second portion of the film comprises a material composition that is different from the material composition of the first portion of the film" as recited in the claim. Pet. 30. Claim 34, however, depends from claim 27 and, therefore, includes all of the limitations of claim 27. According to Petitioner, all of the requirements of claim 27 are also met because "the process taught by Nakamura can be performed in the chamber taught by the combination of Tegal, Matsumura, and Narita." *Id.* at 31. Petitioner incorporates its reasons for combining Tegal, Matsumura, and

Narita provided in the context of its combination of Tegal, Matsumura, and Narita with Hwang, discussed above, and further asserts that one of ordinary skill in the art "would have had reasons to use the system taught by Tegal, Matsumura, and Narita to perform the Nakamura process in a single chamber to increase throughput." *Id.* at 33 (citing Ex. 1008 ¶ 96). Petitioner, however, does not explain sufficiently how the process of Nakamura in combination with Tegal, Matsumura, and Narita, meets the limitations of claim 27.

Petitioner's obviousness analysis regarding claim 27 is set forth in the claim chart provided on pages 31–32 of the Petition. In the claim chart, Petitioner provides citations to Nakamura, Tegal, Matsumura, and Narita. *Id.* at 31–32. Providing a road map to where each of the limitations recited in claim 27 may be found in one or more of the cited prior art references is not sufficient to demonstrate a reasonable likelihood of success in showing claim 27 would have been obvious over the combination of Nakamura, Tegal, Matsumura, and Narita. It is Petitioner's responsibility "to explain specific evidence that support its arguments, not the Board's responsibility to search the record and piece together what may support Petitioner's arguments." *Dominion Dealer Solutions, LLC v. Autoalert, Inc.*, Case IPR2013-00225, slip op. at 4 (PTAB Oct. 10, 2013) (Paper 15); *see DeSilva v. DiLeonardi*, 181 F.3d 865, 866-67 (7th Cir. 1999)("A brief must make all arguments accessible to the judges, rather than ask them to play archeologist with the record."). We find that Petitioner has not met its burden.

For at least this reason, we conclude that Petitioner has not shown a reasonable likelihood of prevailing in its obviousness challenge to claim 34 of the '264 patent based on Nakamura, Tegal, Matsumura, and Narita.

D. Obviousness over Wang, Tegal, Matsumura, and Narita

Petitioner contends that claim 37 would have been obvious in view of the chemical vapor deposition process disclosed by Wang as modified by the chamber, substrate holder, and electronically controlled heat transfer device of Tegal, Matsumura, and Narita. Pet. 35–50. Petitioner also contends that claims 40, 41, 44, 47, 48, and 50 would have been obvious in further view of the disclosures in Wang, Tegal, Matsumura, and Narita. *Id.* at 50–56. After identifying in the prior art the limitations of claims 37, 40, 41, 44, 47, 48, and 50, Petitioner provides a reason for combining the references. *Id.* at 56–60. We begin with a summary of the Wang process.

1. Wang

Wang discloses a "high pressure, high throughput, single wafer, semiconductor processing reactor (10) . . . capable of thermal CVD, plasma-enhanced CVD, plasma-assisted etchback, plasma self-cleaning, and deposition topography modification by sputtering, either separately or as part of in-situ multiple step processing." Ex. 1007, Abstract. Figure 2, below, depicts reactor (10). *Id.* at 7:28–34.

FIG. 2

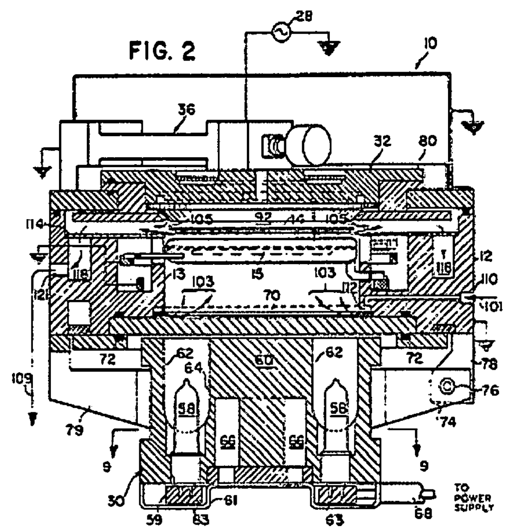


Figure 2 shows a substrate (wafer 15) on a substrate holder (wafer-holding susceptor 16) in a chamber (inner vacuum chamber 13).

Wang further teaches that "[a] preferred in-situ multiple-step process for forming a planarized silicon dioxide layer uses (1) high rate silicon dioxide deposition at a low temperature and high pressure followed by (2) the deposition of the conformal silicon dioxide layer also at high pressure and low temperature, followed by (3) a high rate isotropic etch, preferably at low temperature and high pressure in the same reactor used for the two oxide deposition steps." *Id.* at Abstract. Step (1) "heat[s] the wafer surface to a temperature of 300 to 500°C" (*id.* at 30:35–36), and, preferably 375°C ± 20°C (*id.* at 30:48–49). Step (2) is run "at temperatures of about 200 to 400°C." *Id.* at 31:26–27. Step (3) is run "at a temperature in the range of about 100°C to 500°C and preferably 200°C to 400°C." *Id.* at 32:17–18.

2. Analysis

Based on our review of Petitioner's analysis and supporting evidence, in light of the arguments presented by Patent Owner, we are not persuaded that Petitioner has shown that there is a reasonable likelihood that it would prevail in its obviousness challenge to claims 37, 40, 41, 44, 47, 48, and 50 based on Wang, Tegal, Matsumura, and Narita.

Petitioner asserts that a person of ordinary skill in the art "would have understood that in addition to performing etching processes, CVD and PECVD processes also could be performed in the Tegal chamber just as all these processes can be performed in the Wang chamber." Pet. 36. In support of its position, Petitioner cites to both Wang and Tegal disclosing a diode reactor for its chamber. *Id.* (citing Ex. 1007, 6:24–26, 8:51–56; Ex. 1002, 2:38–43). Petitioner does not explain sufficiently why one of ordinary skill in the art would modify Wang with the disclosures in Tegal, other than to state that "CVD and PECVD processes also *could* be performed in the Tegal chamber just as all these processes can be performed in the Wang chamber." *Id.* (emphasis added); *see also id.* at 58. This is not an explanation why a person of ordinary skill in the art *would have* altered the Wang chamber. For example, Petitioner does not explain sufficiently why one of ordinary skill in the art would modify Wang to include the substrate holder of Tegal. *See id.* at 36–37. Without such articulated reasoning, Petitioner's contentions are insufficient to establish that claim 37 of the '264 patent would have been obvious based on the combination of Wang, Tegal, Matsumura, and Narita. *KSR*, 550 U.S. at 418.

For at least this reason, we conclude that Petitioner has not shown a reasonable likelihood of prevailing in its obviousness challenge to claim 37 of the '264 patent based on Wang, Tegal, Matsumura, and Narita. Because claims 40, 41, 44, 47, 48, and 50 each depend from claim 37, we find Petitioner has not shown a reasonable likelihood of prevailing in it obviousness challenge to these claims based on Wang, Tegal, Matsumura, and Narita for the same reason.

III. CONCLUSION

For the foregoing reasons, we do not institute an *inter partes* review of any of the challenged claims of the '264 patent on any of the asserted grounds.

IV. ORDER

Accordingly, it is:

ORDERED that the Petition is DENIED.

PETITIONER:

Michael R. Fleming
Samuel K. Lu
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mfleming@irell.com
LamFlamIPR@irell.com

PATENT OWNER:

Christopher Frerking
chris@ntknet.com

✎ AO 120 (Rev. 2/99)

TO: **Mail Stop 8** **Director of the U.S. Patent & Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Northern District of California on the following ✔ Patents or ☐ Trademarks:

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
CV 15-01277 JSC	3/18/15	450 Golden Gate Avenue, Box 36060, San Francisco, CA 94102

PLAINTIFF	DEFENDANT
LAM RESEARCH CORP	DANIEL L FLAMM

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 see Complaint		
2 5,711,849		
3 6,017,221		
4 RE40,264		
5		

In the above—entitled case, the following patent(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	**DATE OF PATENT OR TRADEMARK**	**HOLDER OF PATENT OR TRADEMARK**
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Richard W. Wieking	Sheila Rash	March 19, 2015

Copy 1—Upon initiation of action, mail this copy to Commissioner **Copy 3—Upon termination of action, mail this copy to Commissioner**
Copy 2—Upon filing document adding patent(s), mail this copy to Commissioner **Copy 4—Case file copy**

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Daniel L. Flamm
476 Green View Drive
Walnut Creek CA 94596

MAILED

FEB 2 2 2010

OFFICE OF PETITIONS

In re Patent No. RE40,264 :
Issue Date: April 29, 2008 :
Application No. 10/439,245 : DECISION ON PETITION
Filed: May 14, 2003 :
Attorney Docket No. :

This is a decision on the petition, filed December 22, 2009, under 37 CFR § 1.378(c) to accept the unintentionally delayed payment of a maintenance fee for the above-identified patent. A copy of the petition was subsequently filed on January 15, 2010.

The petition is **GRANTED**.

The patent expired on May 15, 2009 for failure to pay the seven and one-half year maintenance fee. Since this petition was submitted within twenty-four months after the six-month grace period provided in 37 CFR § 1.362(e), the petition was timely filed under the provisions of 37 CFR § 1.378(c).

The maintenance fee and surcharge payment of $3540.00 to cover the requisite (1) $1240.00 seven and a half year maintenance fee (Fee Code 2552) and (2) $1640.00 surcharge (Fee Code 1558) included a $660.00 overpayment. Accordingly, $660.00 will be refunded as a credit to Petitioner's credit card.

The maintenance fee is hereby accepted and the above-identified patent is hereby reinstated as of the mail date of this decision.

Telephone inquiries concerning this matter should be directed to Brian W. Brown at (571) 272-5338.

Brian W. Brown
Petitions Examiner
Office of Petitions

IFW

PTO/SB/66 (03-09)
Approved for use through 03/31/2012. OMB 0651-0016
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

PETITION TO ACCEPT UNINTENTIONALLY DELAYED PAYMENT OF MAINTENANCE FEE IN AN EXPIRED PATENT (37 CFR 1.378 (c))	Docket Number (Optional) PATDLF-RE40264

RECEIVED

DEC 2 2 2009

OFFICE OF PETITIONS

Mail to: Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Fax: (571) 273-8300

NOTE: If information or assistance is needed in completing this form, please contact Petitions Information at (571) 272-3282.

Patent No. RE40264 Application Number 10/439245

Issue Date 4/29/2008 Filing Date 5/14/2003

CAUTION: Maintenance fee (and surcharge, if any) payment must correctly identify: (1) the patent number (or reissue patent number, if a reissue) and (2) the application number of the actual U.S. application (or reissue application) leading to issuance of that patent to ensure the fee(s) is/are associated with the correct patent. 37 CFR 1.366(c) and (d).

02/22/2010 CKHLOK 00000009 RE40264

01 FC:2552 1240.00 OP
02 FC:1558 1640.00 OP

Also complete the following information, if applicable

The above – identified patent

☑ is a reissue of original Patent No. 6231776 original issue date 5/15/2001

original application number 09/151163

original filing date 9/10/1998

Refund Ref: 02/22/2010 0030080198

Credit Card Refund Total: $660.00

☐ resulted from the entry into the U.S. under 35 U.S.C. 371 of international application

filed on ____________

HU Exp: XXXXXXXXXXX3887

CERTIFICATE OF MAILING (37 CFR 1.8(a))

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

July 8, 2008
Date

Signature

Daniel L. Flamm
Typed or Printed Name of Person Signing Certificate

[page 1 of 3]

This collection of information is required by 37 CFR 1.378(c). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Adjustment date: 02/22/2010 CKHLOK
07/14/2009 SDIRETA1 00000008 RE40264
01 FC:1599 -3540.00 OP

PTO/SB/66 (03-09)
Approved for use through 03/31/2012. OMB 0651-0016
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

1. SMALL ENTITY

☑ Patentee claims, or has previously claimed, small entity status. See 37 CFR 1.27.

2. LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS

☐ Patentee is no longer entitled to small entity status. See 37 CFR 1.27(g)

3. MAINTENANCE FEE (37 CFR 1.20(e)-(g))

The appropriate maintenance fee must be submitted with this petition, unless it was paid earlier.

NOT Small Entity			Small Entity		
Amount	Fee	(Code)	Amount	Fee	(Code)
☐ $ ______	3 ½ yr fee	(1551)	☐ $ ______	3 ½ yr fee	(2551)
☐ $ ______	7 ½ yr fee	(1552)	☐ $ ______	7 ½ yr fee	(2552)
☐ $ ______	11 ½ yr fee	(1553)	☑ $ 1900.00	11 ½ yr fee	(2553)

MAINTENANCE FEE BEING SUBMITTED $ 1900.00

4. SURCHARGE

The surcharge required by 37 CFR 1.20(i)(2) of $ 1640.00 (Fee Code 1558) must be paid as a condition of accepting unintentionally delayed payment of a maintenance fee.

SURCHARGE FEE BEING SUBMITTED $ 1640.00

5. MANNER OF PAYMENT

☐ Enclosed is a check for the sum of $ ______

☐ Please charge Deposit Account No. ______ the sum of $ ______

☑ Payment by credit card. Form PTO-2038 is attached.

6. AUTHORIZATION TO CHARGE ANY FEE DEFICIENCY

☐ The Director is hereby authorized to charge any maintenance fee, surcharge or petition deficiency to Deposit Account No. ______

Best Available Copy

7. OVERPAYMENT

As to any overpayment made please

☐ Credit to Deposit Account No. ____________________.

OR

☑ Send refund check

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

8. STATEMENT

The delay in payment of the maintenance fee to this patent was unintentional.

9. PETITIONER(S) REQUEST THAT THE DELAYED PAYMENT OF THE MAINTENANCE FEE BE ACCEPTED AND THE PATENT REINSTATED

Signature(s) of Petitioner(s)	July 8, 2009 Date
Daniel L. Flamm Typed or printed name(s)	54100 Registration Number, if applicable
925-947-1909 Telephone Number	

476 Green View Drive, Walnut Creek, CA 94596
Address

Address

37 CFR 1.378(d) states: "Any petition under this section must be signed by an attorney or agent registered to practice before the Patent and Trademark Office, or by the patentee, the assignee, or other party in interest."

ENCLOSURES

☑ Maintenance Fee Payment

☑ Surcharge under 37 CFR 1.20(i)(2) (fee for filing the maintenance fee petition)

☐ ____________________

UNITED STATES PATENT & TRADEMARK OFFICE
Washington, D.C. 20231

REQUEST FOR **PATENT** FEE REFUND RE 40264

1 Date of Request: 02/22/10 2 Serial/Patent # 10/439,245

	3 Please refund the following fee(s):	4 PAPER NUMBER	5 DATE FILED	6 AMOUNT
	Filing			$
	Amendment			$
	Extension of Time			$
	Notice of Appeal/Appeal			$
	Petition			$
	Issue			$
	Cert of Correction/Terminal Disc.			$
	Maintenance			$
	Assignment			$
X	Other Fee Code 1599			$ 660.00

7 TOTAL AMOUNT OF REFUND $ 660.00

8 TO BE REFUNDED BY:

	Treasury Check
	Credit Deposit A/C #:

9 [ ][ ]--[ ][ ][ ][ ]

10 REASON: SEE BELOW

X	Overpayment
	Duplicate Payment
	No Fee Due (Explanation):

11 REFUND REQUESTED BY:

TYPED/PRINTED NAME: Brian W. Brown TITLE: Petitions Examiner

SIGNATURE: [signature] PHONE: 272-5338

OFFICE: Office of Petitions

****

THIS SPACE RESERVED FOR FINANCE USE ONLY:

APPROVED: CKILOK DATE: 2/22/10

Instructions for completion of this form appear on the back. After completion, attach white and yellow copies to the official file and mail or hand-carry to:

Office of Finance
Refund Branch
Crystal Park One, Room 802B

FORM PTO 1577
(01/90)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Daniel L. Flamm U.S. Patent No.: RE40264

Application Nos.: 10/439245, 12/029,469

Title: Multi-Temperature Processing

REQUEST TO EFFECTUATE PETITION TO REINSTATE PATENT RE40264, TO WITHDRAW AN OFFICE ACTION FOR RELATED APPLICATION SERIAL NO. 12/209,469 MAILED ON OCTOBER 16, 2009, AND TO REFUND THE PETITION FEE FOR CORRECTING THE FILING DATE OF APPLICATION SERIAL NO. 12/209,469.

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

1. In June of 2009, applicant received notice that U.S. Reissue Patent RE40264 was expired. Applicant's immediate attempts to file a Petition to Accept Unintentionally Delayed Payment of Maintenance Fee in an Expired Patent by way of EFS through the internet were unsuccessful. PTO EFS technical support subsequently determined and informed Applicant that it was necessary to file the Petition using the U.S. Postal Service because it was for a reissued patent. Applicant did then file the Petition by US mail. The Petition on Form SB-66 and a Form PTO-2038 for payment were deposited with the U.S. Postal Service in Walnut Creek, California on July 8, 2009. Copies of the sent Petition and payment forms are attached herewith.

2. On December 15, 2009, Applicant determined that the PTO web site listed that RE40264 was expired, despite the Petition and payment having been received by the PTO. On December 16, 2009, Applicant telephoned the PTO Petitions Office to inquire as to the reasons the status of RE40264 was maintained as being expired, despite entry of the Petition. Applicant reached Ms. Liana Walsh of the Petitions Office. Ms. Walsh investigated the matter, and confirmed that the PTO had lost Applicant's petition by error, at least in view of the fact that the accompanying payment had been received and

deposited.

Applicant sent Ms. Walsh one copy of the sent Petition and payment form by email, and a second copy of the email and documents were addressed to Ms. Walsh and deposited with the US Postal on December 16, 2009. A copy of that email and an electronic delivery confirmation receipt from Ms. Walsh are attached herewith.

3. The PTO sent an Office Action on October 16, 2009 concerning related AN 12/029,469. The Office action rejected all claims in that Application based at least upon the Application being defective because RE40264 was expired and by statute a reissue application can only be granted for the unexpired portion of the term of the original. However Applicant submits that RE40264 would have been reinstated before that date but for PTO error in losing the Petition for reinstatement.

4. On January 14, 2010, Applicant had a telephonic conversation with Supervisory Examiner Parviz Hassanzadeh concerning AN 12/029,469. Applicant requested that Examiner extend the date for response to the Office Action without additional cost, in view of the lost Petition. Examiner Hassanzadeh responded that the Office Action was sent in error at least because it should have been withheld during the time when the Petition was being considered. Examiner Hassanzadeh also stated that he had no authority to extend any dates under the instant circumstances, and that an extension of time must be granted by the Petitions Office.

5. On January 14, 2010, Applicant had a telephonic discussion concerning the above events with Paralegal Olisa Anwa of the Petitions Office. Applicant was informed that there was no record of his email and/or documents sent to Ms. Walsh. Applicant sent a copy of the documents to Paralegal Anwa during the telephone conversation. Paralegal Anwa confirmed that the Petition had been received and lost, and told Applicant that he must nevertheless enter a copy of the Petition and explanation via EFS and/or send same to the PTO Office of Petitions via facsimile.

6. Pursuant to the above, Applicant respectfully requests: 1) the Petition for Reinstatement be entered and granted, and 2) that the Office Action concerning AN 12/029,469, dated

October 16, 2009, and the deadline for responding to said Office Action be withdrawn.

7. The following facts are further noted. AN 12/029,469 was filed on February 11, 2008 and was believed to be complete apart from payment of the filing fee. However the PTO first accorded AN 12/029,469 a filing date of April 28, 2008. Applicant then entered a petition to instate February 11, 2008 as the filing date for AN 12/029,469 and that petition was granted.

   A petition fee of $130.00 accompanied that petition. The petition stated that " ... in view of the facts and that this petition is for a filing date, it is respectfully submitted that the filing date should have been corrected without the requirement of a Petition and accordingly no fees should be due for filing this petition." However the patent office has not yet returned the fee.

8. It is respectfully requested that the fee of $130 now be refunded to the Applicant. If the Commissioner has any questions concerning this matter, please contact the undersigned at the number set forth below.

Respectfully submitted,

Daniel L. Flamm

Tel: 925-826-3113
Fax: 925-937-2754
Email: dlf@mtag.com

PETITION TO ACCEPT UNINTENTIONALLY DELAYED PAYMENT OF MAINTENANCE FEE IN AN EXPIRED PATENT (37 CFR 1.378 (c))	Docket Number (Optional) PATDLF-RE40264

Mail to: Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Fax: (571) 273-8300

NOTE: If information or assistance is needed in completing this form, please contact Petitions Information at (571) 272-3282.

Patent No. RE40264 Application Number 10/439245

Issue Date 4/29/2008 Filing Date 5/14/2003

CAUTION: Maintenance fee (and surcharge, if any) payment must correctly identify: (1) the patent number (or reissue patent number, if a reissue) and (2) the application number of the actual U.S. application (or reissue application) leading to issuance of that patent to ensure the fee(s) is/are associated with the correct patent. 37 CFR 1.366(c) and (d)

Also complete the following information, if applicable

The above – identified patent

☑ Is a reissue of original Patent No. 6231776 original issue date 5/15/2001
original application number 09/151163
original filing date 9/10/1998

☐ resulted from the entry into the U.S. under 35 U.S.C. 371 of international application ______
filed on ______

CERTIFICATE OF MAILING (37 CFR 1.89(a))

I hereby certify that this paper (*along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class main in an envelope addressed to Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

July 8, 2008
Date

[signature]
Signature

Daniel L. Flamm
Typed or Printed Name of Person Signing Certificate

[page 1 of 3]

This collection of information is required by 37 CFR 1.378(c) The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2

1. SMALL ENTITY

☑ Patentee claims, or has previously claimed, small entity status. See 37 CFR 1.27.

2. LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS

☐ Patentee is no longer entitled to small entity status. See 37 CFR 1.27(g)

3. MAINTENANCE FEE (37 CFR 1.20(e)-(g))

The appropriate maintenance fee must be submitted with this petition, unless it was paid earlier.

NOT Small Entity				Small Entity			
	Amount	Fee	(Code)		Amount	Fee	(Code)
☐	$ ______	3 ½ yr fee	(1551)	☐	$ ______	3 ½ yr fee	(2551)
☐	$ ______	7 ½ yr fee	(1552)	☐	$ ______	7 ½ yr fee	(2552)
☐	$ ______	11 ½ yr fee	(1553)	☑	$ 1900.00	11 ½ yr fee	(2553)

MAINTENANCE FEE BEING SUBMITTED $ 1900.00

4. SURCHARGE

The surcharge required by 37 CFR 1.20(i)(2) of $ 1640.00 (Fee Code 1558) must be paid as a condition of accepting unintentionally delayed payment of a maintenance fee.

SURCHARGE FEE BEING SUBMITTED $ 1640.00

5. MANNER OF PAYMENT

☐ Enclosed is a check for the sum of $ ______

☐ Please charge Deposit Account No. ______ the sum of $ ______

☑ Payment by credit card. Form PTO-2038 is attached.

6. AUTHORIZATION TO CHARGE ANY FEE DEFICIENCY

☐ The Director is hereby authorized to charge any maintenance fee, surcharge or petition deficiency to Deposit Account No. ______

7. OVERPAYMENT

As to any overpayment made please

☐ Credit to Deposit Account No. ____________________.

OR

☑ Send refund check

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

8. STATEMENT

The delay in payment of the maintenance fee to this patent was unintentional.

9. PETITIONER(S) REQUEST THAT THE DELAYED PAYMENT OF THE MAINTENANCE FEE BE ACCEPTED AND THE PATENT REINSTATED

Daniel L. Flamm

Signature(s) of Petitioner(s)

July 8, 2009

Date

Daniel L. Flamm

Typed or printed name(s)

54100

Registration Number, if applicable

925-947-1909

Telephone Number

476 Green View Drive, Walnut Creek, CA 94596

Address

____

Address

37 CFR 1.378(d) states: "Any petition under this section must be signed by an attorney or agent registered to practice before the Patent and Trademark Office, or by the patentee, the assignee, or other party in interest."

ENCLOSURES

☑ Maintenance Fee Payment

☑ Surcharge under 37 CFR 1.20(i)(2) (fee for filing the maintenance fee petition)

☐ ____________________

Daniel L. Flamm

From:	Daniel L. Flamm [dlf@mtag.com]
Sent:	Wednesday, December 16, 2009 10:23 PM
To:	liana.walsh@uspto.gov
Subject:	PETITION TO ACCEPT UNINTENTIONALLY DELAYED... RE40264... as mailed (pdf attachment)
Attachments:	2009_07_08_As Mailed.pdf

Dear Liana,

Thank you so much for your courteous assistance today. The petition was sent on July 8, 2009 as confirmed by the certificate of mailing. I believe it was sent with USPS delivery confirmation, however there should be no issue in this regard since the USPTO charged the petition using the included paper Form 2038.

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Office of Petitions, PO Box 1450, Alexandria, VA 22313-1450
Please accept this as an official communication.

Best regards,

(dan f.) Electronic signature: /Daniel L. Flamm Reg. #54100/

--
Dr. Daniel L. Flamm, Esq.
476 Green View Dr.
Walnut Creek, CA 94596
Tel: (925) 947-1909
Fax: (925) 937-2754
dlf@mtag.com

Daniel L. Flamm

From: Walsh, Liana [Liana.Walsh@USPTO.GOV]
To: Daniel L. Flamm
Sent: Thursday, December 17, 2009 4:13 AM
Subject: Read: PETITION TO ACCEPT UNINTENTIONALLY DELAYED... RE40264... as mailed (pdf attachment)

Your message was read on Thursday, December 17, 2009 7:12:54 AM (GMT-05:00) Eastern Time (US & Canada).

Electronic Acknowledgement Receipt

EFS ID:	6816079
Application Number:	10439245
International Application Number:	
Confirmation Number:	5963
Title of Invention:	MULTI-TEMPERATURE PROCESSING
First Named Inventor/Applicant Name:	Daniel L. Flamm
Correspondence Address:	Daniel L. Flamm - 476 Green View Drive - Walnut Creek CA 94596 US 925-947-1909 -
Filer:	Daniel Lawrence Flamm
Filer Authorized By:	
Attorney Docket Number:	
Receipt Date:	15-JAN-2010
Filing Date:	14-MAY-2003
Time Stamp:	03:45:26
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition for review by the Office of Petitions.	Request_Reinstate.pdf	607850 2d591ef5b9ef85f601ee1570541a40ee38d439f1	no	9
Warnings:					
Information:					
		Total Files Size (in bytes):	607850		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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JAN 15 2010

USPTO
2010 JAN 20 PM 4:21

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Daniel L. Flamm

U.S. Patent No.: RE40264

Application Nos.: 10,439245, 12/029,469

Title: Multi-Temperature Processing

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JAN 28 2010
OFFICE OF PETITIONS

REQUEST TO EFFECTUATE PETITION TO REINSTATE PATENT RE40264, TO WITHDRAW AN OFFICE ACTION FOR RELATED APPLICATION SERIAL NO. 12/209,469 MAILED ON OCTOBER 16, 2009, AND TO REFUND THE PETITION FEE FOR CORRECTING THE FILING DATE OF APPLICATION SERIAL NO. 12/209,469.

Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

1. In June of 2009, applicant received notice that U.S. Reissue Patent RE40264 was expired. Applicant's immediate attempts to file a Petition to Accept Unintentionally Delayed Payment of Maintenance Fee in an Expired Patent by way of EFS through the internet were unsuccessful. PTO EFS technical support subsequently determined and informed Applicant that it was necessary to file the Petition using the U.S. Postal Service because it was for a reissued patent. Applicant did then file the Petition by US mail. The Petition on Form SB-66 and a Form PTO-2038 for payment were deposited with the U.S. Postal Service in Walnut Creek, California on July 8, 2009. Copies of the sent Petition and payment forms are attached herewith.

2. On December 15, 2009, Applicant determined that the PTO web site listed that RE40264 was expired, despite the Petition and payment having been received by the PTO. On December 16, 2009, Applicant telephoned the PTO Petitions Office to inquire as to the reasons the status of RE40264 was maintained as being expired, despite entry of the Petition. Applicant reached Ms. Liana Walsh of the Petitions Office. Ms. Walsh investigated the matter, and confirmed that the PTO had lost Applicant's petition by error, at least in view of the fact that the accompanying payment had been received and

PAGE 2/10 * RCVD AT 1/15/2010 3:54:53 AM [Eastern Standard Time] * SVR:USPTO-EFXRF-5/45 * DNIS:2738300 * CSID: * DURATION (mm-ss):02-32

deposited.

Applicant sent Ms. Walsh one copy of the sent Petition and payment form by email, and a second copy of the email and documents were addressed to Ms. Walsh and deposited with the US Postal on December 16, 2009. A copy of that email and an electronic delivery confirmation receipt from Ms. Walsh are attached herewith.

3. The PTO sent an Office Action on October 16, 2009 concerning related AN 12/029,469. The Office action rejected all claims in that Application based at least upon the Application being defective because RE40264 was expired and by statute a reissue application can only be granted for the unexpired portion of the term of the original. However Applicant submits that RE40264 would have been reinstated before that date but for PTO error in losing the Petition for reinstatement.

4. On January 14, 2010, Applicant had a telephonic conversation with Supervisory Examiner Parviz Hassanzadeh concerning AN 12/029,469. Applicant requested that Examiner extend the date for response to the Office Action without additional cost, in view of the lost Petition. Examiner Hassanzadeh responded that the Office Action was sent in error at least because it should have been withheld during the time when the Petition was being considered. Examiner Hassanzadeh also stated that he had no authority to extend any dates under the instant circumstances, and that an extension of time must be granted by the Petitions Office.

5. On January 14, 2010, Applicant had a telephonic discussion concerning the above events with Paralegal Olisa Anwa of the Petitions Office. Applicant was informed that there was no record of his email and/or documents sent to Ms. Walsh. Applicant sent a copy of the documents to Paralegal Anwa during the telephone conversation. Paralegal Anwa confirmed that the Petition had been received and lost, and told Applicant that he must nevertheless enter a copy of the Petition and explanation via EFS and/or send same to the PTO Office of Petitions via facsimile.

6. Pursuant to the above, Applicant respectfully requests: 1) the Petition for Reinstatement be entered and granted, and 2) that the Office Action concerning AN 12/029,469, dated

October 16, 2009, and the deadline for responding to said Office Action be withdrawn.

7. The following facts are further noted. AN 12/029,469 was filed on February 11, 2008 and was believed to be complete apart from payment of the filing fee. However the PTO first accorded AN 12/029,469 a filing date of April 28, 2008. Applicant then entered a petition to instate February 11, 2008 as the filing date for AN 12/029,469 and that petition was granted.

   A petition fee of $130.00 accompanied that petition. The petition stated that " ... in view of the facts and that this petition is for a filing date, it is respectfully submitted that the filing date should have been corrected without the requirement of a Petition and accordingly no fees should be due for filing this petition." However the patent office has not yet returned the fee.

8. It is respectfully requested that the fee of $130 now be refunded to the Applicant. If the Commissioner has any questions concerning this matter, please contact the undersigned at the number set forth below.

Respectfully submitted,

Daniel L. Flamm

Tel: 925-826-3113
Fax: 925-937-2754
Email: dlf@mtag.com

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JAN 15 2010

PTO/SB/66 (03-09)
Approved for use through 03/31/2012. OMB 0651-0016
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

PETITION TO ACCEPT UNINTENTIONALLY DELAYED PAYMENT OF MAINTENANCE FEE IN AN EXPIRED PATENT (37 CFR 1.378 (c))	Docket Number (Optional) PATDLF-RE40264

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JAN 28 2010

OFFICE OF PETITIONS

Mail to: Mail Stop Petition
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450
Fax: (571) 273-8300

NOTE: If information or assistance is needed in completing this form, please contact Petitions Information at (571) 272-3282.

Patent No. RE40264 Application Number 10/439245

Issue Date 4/29/2008 Filing Date 5/14/2003

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Also complete the following information, if applicable

The above – identified patent

☑ is a reissue of original Patent No. 6231776 original issue date 5/15/2001

original application number 09/151163

original filing date 9/10/1998

☐ resulted from the entry into the U.S. under 35 U.S.C. 371 of international application ______

filed on ______

CERTIFICATE OF MAILING (37 CFR 1.89(a))

I hereby certify that this paper (*along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class main in an envelope addressed to Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

July 8, 2008
Date

Signature

Daniel L. Flamm
Typed or Printed Name of Person Signing Certificate

[page 1 of 3]

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JAN 15 2010

PTO/SB/66 (03-09)
Approved for use through 03/31/2012. OMB 0651-0016
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

1. SMALL ENTITY

☑ Patentee claims, or has previously claimed, small entity status. See 37 CFR 1.27.

2. LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS

☐ Patentee is no longer entitled to small entity status. See 37 CFR 1.27(g)

3. MAINTENANCE FEE (37 CFR 1.20(e)-(g))

The appropriate maintenance fee must be submitted with this petition, unless it was paid earlier.

NOT Small Entity			Small Entity		
Amount	Fee	(Code)	Amount	Fee	(Code)
☐ $ ____	3 ½ yr fee	(1551)	☐ $ ____	3 ½ yr fee	(2551)
☐ $ ____	7 ½ yr fee	(1552)	☐ $ ____	7 ½ yr fee	(2552)
☐ $ ____	11 ½ yr fee	(1553)	☑ $ 1900.00	11 ½ yr fee	(2553)

MAINTENANCE FEE BEING SUBMITTED $ 1900.00

4. SURCHARGE

The surcharge required by 37 CFR 1.20(i)(2) of $ 1640.00 (Fee Code 1558) must be paid as a condition of accepting unintentionally delayed payment of a maintenance fee.

SURCHARGE FEE BEING SUBMITTED $ 1640.00

5. MANNER OF PAYMENT

☐ Enclosed is a check for the sum of $ ____

☐ Please charge Deposit Account No. ____ the sum of $ ____

☑ Payment by credit card. Form PTO-2038 is attached.

6. AUTHORIZATION TO CHARGE ANY FEE DEFICIENCY

☐ The Director is hereby authorized to charge any maintenance fee, surcharge or petition deficiency to Deposit Account No. ____

PTO/SB/66 (03-09)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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7. OVERPAYMENT

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OR

☑ Send refund check

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8. STATEMENT

The delay in payment of the maintenance fee to this patent was unintentional.

9. PETITIONER(S) REQUEST THAT THE DELAYED PAYMENT OF THE MAINTENANCE FEE BE ACCEPTED AND THE PATENT REINSTATED

Daniel L. Flamm — July 8, 2009

Signature(s) of Petitioner(s) — Date

Daniel L. Flamm — 54100

Typed or printed name(s) — Registration Number, if applicable

925-947-1909

Telephone Number

476 Green View Drive, Walnut Creek, CA 94596

Address

Address

37 CFR 1.378(d) states: "Any petition under this section must be signed by an attorney or agent registered to practice before the Patent and Trademark Office, or by the patentee, the assignee, or other party in interest."

ENCLOSURES

☑ Maintenance Fee Payment

☑ Surcharge under 37 CFR 1.20(i)(2) (fee for filing the maintenance fee petition)

☐ ____________________

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JAN 15 2010

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Daniel L. Flamm

From:	Daniel L. Flamm [dlf@mtag.com]
Sent:	Wednesday, December 16, 2009 10:23 PM
To:	liana.walsh@uspto.gov
Subject:	PETITION TO ACCEPT UNINTENTIONALLY DELAYED... RE40264... as mailed (pdf attachment)
Attachments:	2009_07_08_As Mailed.pdf

Dear Liana,

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Please accept this as an official communication.

Best regards,

(dan f.) Electronic signature: /Daniel L. Flamm Reg. #54100/

--
Dr. Daniel L. Flamm, Esq.
476 Green View Dr.
Walnut Creek, CA 94596
Tel: (925) 947-1909
Fax: (925) 937-2754
dlf@mtag.com

Daniel L. Flamm

From:	Walsh, Liana [Liana.Walsh@USPTO.GOV]
To:	Daniel L. Flamm
Sent:	Thursday, December 17, 2009 4:13 AM
Subject:	Read: PETITION TO ACCEPT UNINTENTIONALLY DELAYED... RE40264... as mailed (pdf attachment)

Your message was read on Thursday, December 17, 2009 7:12:54 AM (GMT-05:00) Eastern Time (US & Canada).

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OFFICE OF PETITIONS

To: Office of Petitions
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571-273-8300

From: D.L. Flamm
Reg # 52100
tel 925-947-1909
FAX 925-937-2754

Pages: 9 pages + this cover
Date: 1/15/2010

GMail by Google

Daniel Flamm <dlf@mtag.com>

PETITION TO ACCEPT UNINTENTIONALLY DELAYED... RE40264... as mailed (pdf attachment)

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DEC 2 2 2009

OFFICE OF PETITIONS

Daniel L. Flamm <dlf@mtag.com>
Reply-To: dlf@mtag.com
To: liana.walsh@uspto.gov

Wed, Dec 16, 2009 at 10:23 PM

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Best regards,

(dan f.) Electronic signature: /Daniel L. Flamm Reg. #54100/

--
Dr. Daniel L. Flamm, Esq.
476 Green View Dr.
Walnut Creek, CA 94596
Tel: (925) 947-1909
Fax: (925) 937-2754
dlf@mtag.com

2009_07_08_As Mailed.pdf
1033K

IFW

PETITION TO ACCEPT UNINTENTIONALLY DELAYED PAYMENT OF MAINTENANCE FEE IN AN EXPIRED PATENT (37 CFR 1.378 (c))

Docket Number (Optional)
PATDLF-RE40264

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Alexandria, VA 22313-1450
Fax: (571) 273-8300

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Patent No. RE40264 Application Number 10/439245

Issue Date 4/29/2008 Filing Date 5/14/2003

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Also complete the following information, if applicable

The above – identified patent

- [x] is a reissue of original Patent No. 6231776 original issue date 5/15/2001
original application number 09/151163
original filing date 9/10/1998

- [ ] resulted from the entry into the U.S. under 35 U.S.C. 371 of international application ________
filed on ________

CERTIFICATE OF MAILING (37 CFR 1.8(a))

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class main in an envelope addressed to Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

July 8, 2008
Date

Signature

Daniel L. Flamm
Typed or Printed Name of Person Signing Certificate

[page 1 of 3]

This collection of information is required by 37 CFR 1.378(c). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

1. SMALL ENTITY

☑ Patentee claims, or has previously claimed, small entity status. See 37 CFR 1.27.

2. LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS

☐ Patentee is no longer entitled to small entity status. See 37 CFR 1.27(g)

3. MAINTENANCE FEE (37 CFR 1.20(e)-(g))

The appropriate maintenance fee must be submitted with this petition, unless it was paid earlier.

NOT Small Entity				**Small Entity**			
	Amount	Fee	(Code)		Amount	Fee	(Code)
☐	$ ______	3 ½ yr fee	(1551)	☐	$ ______	3 ½ yr fee	(2551)
☐	$ ______	7 ½ yr fee	(1552)	☐	$ ______	7 ½ yr fee	(2552)
☐	$ ______	11 ½ yr fee	(1553)	☑	$ 1900.00	11 ½ yr fee	(2553)

MAINTENANCE FEE BEING SUBMITTED $ 1900.00

4. SURCHARGE

The surcharge required by 37 CFR 1.20(i)(2) of $ 1640.00 (Fee Code 1558) must be paid as a condition of accepting unintentionally delayed payment of a maintenance fee.

SURCHARGE FEE BEING SUBMITTED $ 1640.00

5. MANNER OF PAYMENT

☐ Enclosed is a check for the sum of $ ______

☐ Please charge Deposit Account No. ______ the sum of $ ______

☑ Payment by credit card. Form PTO-2038 is attached.

6. AUTHORIZATION TO CHARGE ANY FEE DEFICIENCY

☐ The Director is hereby authorized to charge any maintenance fee, surcharge or petition deficiency to Deposit Account No. ______

7. OVERPAYMENT

As to any overpayment made please

☐ Credit to Deposit Account No. ____________________.

OR

☑ Send refund check

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

8. STATEMENT

The delay in payment of the maintenance fee to this patent was unintentional.

9. PETITIONER(S) REQUEST THAT THE DELAYED PAYMENT OF THE MAINTENANCE FEE BE ACCEPTED AND THE PATENT REINSTATED

Signature(s) of Petitioner(s) — July 8, 2009 (Date)

Daniel L. Flamm
Typed or printed name(s)

54100
Registration Number, if applicable

925-947-1909
Telephone Number

476 Green View Drive, Walnut Creek, CA 94596
Address

____
Address

37 CFR 1.378(d) states: "Any petition under this section must be signed by an attorney or agent registered to practice before the Patent and Trademark Office, or by the patentee, the assignee, or other party in interest."

ENCLOSURES

☑ Maintenance Fee Payment

☑ Surcharge under 37 CFR 1.20(i)(2) (fee for filing the maintenance fee petition)

☐ ______________________________

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	04/29/2008	RE40264		5963

7590 04/09/2008

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Extension or Adjustment under 35 U.S.C. 154 (b)

A reissue patent is for "the unexpired part of the term of the original patent." See 35 U.S.C. 251. Accordingly, the above-identified reissue application is not eligible for Patent Term Extension or Adjustment under 35 U.S.C. 154(b).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Daniel L. Flamm, Walnut Creek, CA;

IR103 (Rev. 11/05)

Application Number	Application No. 10/439,245	Applicant(s) Flamm
	Notice of Reissue Published in OG on 04/13/04	

Original Patent Number of Patent To Be Reissued is 6,231,776	**The Maintenance fee status is:** ☒ up to date. ☐ not required.

This reissue patent is subject to A Terminal Disclaimer that:

☐ was filed during the prosecution of the reissue application.
☐ was of record prior to the filing of the reissue application.

Physical surrender of the letters patent

☐ was made.
☐ was not made, but a statement of loss/inaccessibility was provided.
☒ is not required

Final SPRE Review

LQ
(INITIALS)

3/12/08
(DATE)

U.S. Patent and Trademark Office

OIPE JAN 3 0 2008

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax **(571) 273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Daniel L. Flamm (Depositor's name)
[signature] (Signature)
January 30, 2008 (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	5/14/2003	Daniel L. Flamm		5693

TITLE OF INVENTION:

01/31/2008 NNGUYEN2 00000031 10439245

01 FC:2501 720.00 OP

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	Yes	720		$720	1/31/2008

EXAMINER	ART UNIT	CLASS-SUBCLASS

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 Daniel L. Flamm
2 ______
3 ______

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:
☑ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies ______

4b. Payment of Fee(s):
☐ A check in the amount of the fee(s) is enclosed.
☑ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number ______ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)
☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature [signature] Date January 30, 2008

Typed or printed name Daniel L. Flamm Registration No. 54,100

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

OIPE JAN 3 0 2008 PATENT & TRADEMARK OFFICE

NOTICE OF ALLOWANCE AND FEE(S) DUE

10/31/2007

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

EXAMINER	
ALANKO, ANITA KAREN	
ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 10/31/2007

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

TITLE OF INVENTION: MULTI-TEMPERATURE PROCESSING

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$720	$0	$0	$720	01/31/2008

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 10/31/2007

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

EXAMINER	
ALANKO, ANITA KAREN	
ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 10/31/2007

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

TITLE OF INVENTION: MULTI-TEMPERATURE PROCESSING

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$720	$0	$0	$720	01/31/2008

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

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If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

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IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 10/31/2007

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

TITLE OF INVENTION: MULTI-TEMPERATURE PROCESSING

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$720	$0	$0	$720	01/31/2008

EXAMINER	ART UNIT	CLASS-SUBCLASS
ALANKO, ANITA KAREN	1765	216-059000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 ____________
   2 ____________
   3 ____________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number ________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature ____________________ Date ____________________

Typed or printed name ____________________ Registration No. ____________________

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 10/31/2007

EXAMINER	
ALANKO, ANITA KAREN	
ART UNIT	PAPER NUMBER
1765	

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

DATE MAILED: 10/31/2007

Determination of Patent Term Extension or Adjustment under 35 U.S.C. 154 (b)

A reissue patent is for "the unexpired part of the term of the original patent." See 35 U.S.C. 251. Accordingly, the above-identified reissue application is not eligible for Patent Term Extension or Adjustment under 35 U.S.C. 154(b).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

Notice of Allowability	Application No. 10/439,245	Applicant(s) FLAMM, DANIEL L.	
	Examiner Anita K. Alanko	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 7/30/07
2. ☒ The allowed claim(s) is/are 56-98,100-104,106-108 and 110-117.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL. .

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 20070819
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

Anita K. Alanko

Anita K Alanko
Primary Examiner
Art Unit: 1765

Examiner-Initiated Interview Summary	**Application No.** 10/439,245	**Applicant(s)** FLAMM, DANIEL L.	
	Examiner Anita K. Alanko	**Art Unit** 1765	

All Participants:

(1) Anita K. Alanko.

(2) Daniel L. Flamm.

Status of Application: _____

(3) _____.

(4) _____.

Date of Interview: 17 August 2007

Time: _____

Type of Interview:

☒ ~~Telephonic~~ electronic mail, attached declaration

☐ Video Conference

☐ Personal (Copy given to: ☐ Applicant ☐ Applicant's representative)

Exhibit Shown or Demonstrated: ☐ Yes ☐ No

If Yes, provide a brief description:

Part I.

Rejection(s) discussed:

Claims discussed:

Prior art documents discussed:

Part II.

SUBSTANCE OF INTERVIEW DESCRIBING THE GENERAL NATURE OF WHAT WAS DISCUSSED:

Examiner requested clarification on the assignment. Applicant responded by submitting a declaration.

Part III.

☒ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview directly resulted in the allowance of the application. The examiner will provide a written summary of the substance of the interview in the Notice of Allowability.

☐ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview did not result in resolution of all issues. A brief summary by the examiner appears in Part II above.

Anita K. Alanko
Anita K. Alanko
Primary Examiner
(Examiner/SPE Signature)
Art Unit 1765

(Applicant/Applicant's Representative Signature – if appropriate)

7/30/07

OK to enter
/AH/
8/6/07

AMENDMENTS TO THE SPECIFICATION

This listing of amendments to the specification will replace all prior listings of amendments to the specification made during prosecution of this application. Please amend the specification as follows:

At Col. 2 Par. 5 continuing to before Col. 3 Par. 1, (in the BRIEF DESCRIPTION OF THE DRAWINGS):

FIG. 1 is a simplified diagram of a plasma etching apparatus according to the present invention;

FIGS. 2A-2E are simplified configurations using wave adjustment circuits according to the present invention;

FIG. 3 is a simplified diagram of a chemical vapor deposition apparatus according to the present invention;

FIG. 4 is a simplified diagram of a stripper according to the present invention;

FIGS. 5A-5C are more detailed simplified diagrams of a helical resonator according to the present invention;

FIG. 6 is a simplified block diagram of a substrate holder according to the present invention;

FIG. 7 is a simplified diagram of a temperature control system according to an embodiment of the present invention;

FIG. 8 is a simplified diagram of a fluid reservoir system according to an embodiment of the present invention;

7/30/07

OK to enter /AG/ 8/6/07

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1-55. (*canceled*)

56. (*previously presented*) A method of etching a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a chamber, the substrate holder having a selected thermal mass;

setting the substrate holder to a selected first substrate holder temperature with a heat transfer device;

etching a first portion of the film while the substrate holder is at the selected first substrate holder temperature;

with the heat transfer device, changing the substrate holder temperature from the selected first substrate holder temperature to a selected second substrate holder temperature; and

etching a second portion of the film while the substrate holder is at the selected second substrate holder temperature;

wherein the thermal mass of the substrate holder is selected for a predetermined temperature change within a specified interval of time during processing; the predetermined temperature change comprises the change from the selected first substrate holder temperature to

Issue Classification	Application/Control No. 10/439,245	Applicant(s)/Patent under Reexamination FLAMM, DANIEL L.
	Examiner Anita K. Alanko	Art Unit 1765

ISSUE CLASSIFICATION

ORIGINAL	
CLASS	SUBCLASS
216	59

INTERNATIONAL CLASSIFICATION					
CLAIMED					NON-CLAIMED
H	5	H	1	/00	/
H	1	L	21	/302	/
				/	/
				/	/
				/	/
				/	/
				/	/

CROSS REFERENCES

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)			
216	67	68	74	
438	714	715		
204	192.32			
156	345.52	345.53		

(Assistant Examiner) (Date)

(Legal Instruments Examiner) (Date)

Anita Alanko
Anita Alanko ~~7/07~~ 8/6/07
(Primary Examiner) (Date)

Total Claims Allowed: ~~71~~ 59 AKA

O.G. Print Claim(s)	O.G. Print Fig.
~~1~~ 13	none

AKA 8/6/07

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		31	18	61	48	91		121		151		181
2	2		32	19	62	49	92		122		152		182
3	3		33	20	63	50	93		123		153		183
4	4		34	21	64	51	94		124		154		184
5	5		35	22	65	52	95		125		155		185
6	6		36	23	66	53	96		126		156		186
7	7		37	24	67	54	97		127		157		187
8	8		38	25	68	55	98		128		158		188
9	9		39	26	69		99		129		159		189
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	26	13	56	43	86	70	116		146		176		206
	27	14	57	44	87	71	117		147		177		207
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	29	16	59	46	89		119		149		179		209
	30	17	60	47	90		120		150		180		210

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/439,245	FLAMM, DANIEL L.
Examiner	**Art Unit**
Anita K. Alanko	1765

√ Rejected	– (Through numeral) Cancelled	N Non-Elected	A Appeal
= Allowed	÷ Restricted	I Interference	O Objected

Claim Final	Claim Original	Date 8/6/07
1	1	-
2	2	-
3	3	-
4	4	-
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Claim Final	Claim Original	Date ~~7/7/07~~	8/6/07
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	52	-	
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13	56	=	
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54	97	=	
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56	100	=	

Claim Final	Claim Original	Date ~~7/7/07~~	8/6/07
57	101	=	
58	102	=	
59	103	=	
60	104	=	
	105	-	
61	106	=	
62	107	=	
63	108	=	
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64	110	=	
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Search Notes	Application/Control No. 10/439,245	Applicant(s)/Patent under Reexamination FLAMM, DANIEL L.	
	Examiner Anita K. Alanko	Art Unit 1765	

SEARCHED			
Class	Subclass	Date	Examiner

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
PGPubs, see search history printout		6/28/2007	AKA

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
inventor name search	6/28/2007	AKA

Application Number	Application No. 10/439,245	Applicant(s) Flamm
	Notice of Reissue Published in OG on 04/13/04	

Original Patent Number of Patent To Be Reissued is 6,231,776	**The Maintenance fee status is:** ☒ up to date. ☐ not required.

This reissue patent is subject to A Terminal Disclaimer that:

☐ was filed during the prosecution of the reissue application.
☐ was of record prior to the filing of the reissue application.

Physical surrender of the letters patent

☐ was made.
☐ was not made, but a statement of loss/inaccessibility was provided.
☒ is not required

Final SPRE Review

tQ
(INITIALS)

10/30/07
(DATE)

U.S. Patent and Trademark Office

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Daniel L. Flamm — Attorney Docket No.: 0A0301

Appl. No.: 10/439,245

Filed: May 14, 2003

Title: MULTI-TEMPERATURE PROCESSING

DECLARATION UNDER 37 CFR 3.73(b) BY INVENTOR IN REISSUE APPLICATION

As the-named inventor, I hereby declare that:

1. My residence and citizenship are stated below next to my name.

2. I have reviewed and understand the contents of the specification and claims of the above-identified reissue application, and believe myself to be the original and first inventor of the invention described and claimed in the aforesaid reissue application and in U.S. Letters Patent No. 6,231,776 B1 on which said reissue application is based.

3. I have never assigned any right, title or interest to the above identified U.S. Letters Patent No. 6,231,776 B1 or to Application No. 10/439,245, and therefore I presently hold all rights, title and interest thereto.

4. Any statement in the transmittal that indicates any assignment of the above identified patent or reissue application was in error.

5. I acknowledge a duty to disclose information I am aware of which is material to patentability as defined in 37 C.F.R. § 1.56.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States

Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: August 17, 2007

Daniel L. Flamm

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U.S.A.
Citizenship and Country of Residence

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July 25, 2007

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	Docket No: OA0301
Daniel L. Flamm	
Appln. No.: 10/439,245	Group Art Unit: 1765
Filed: 5/14/2003	Examiner: A. Alanko

AMENDMENT UNDER 37 C.F.R. § 1.116

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated, May 30, 2007, please amend the above-identified application as follows on the accompanying pages.

TABLE OF CONTENTS

AMENDMENTS TO THE SPECIFICATION

This listing of amendments to the specification will replace all prior listings of amendments to the specification made during prosecution of this application. Please amend the specification as follows:

At Col. 2 Par. 5 continuing to before Col. 3 Par. 1, (in the BRIEF DESCRIPTION OF THE DRAWINGS):

FIG. 1 is a simplified diagram of a plasma etching apparatus according to the present invention;

FIGS. 2A-2E are simplified configurations using wave adjustment circuits according to the present invention;

FIG. 3 is a simplified diagram of a chemical vapor deposition apparatus according to the present invention;

FIG. 4 is a simplified diagram of a stripper according to the present invention;

FIGS. 5A-5C are more detailed simplified diagrams of a helical resonator according to the present invention;

FIG. 6 is a simplified block diagram of a substrate holder according to the present invention;

FIG. 7 is a simplified diagram of a temperature control system according to an embodiment of the present invention;

FIG. 8 is a simplified diagram of a fluid reservoir system according to an embodiment of the present invention;

FIG. 9 is a [simplified diagram of a] simplified diagram of a semiconductor substrate according to an embodiment of the present invention; and

Fig. 10 is a simplified [flow diagram of a heating] process according to the present invention.

At Col. 3, Par. 2 (in the DETAILED DESCRIPTION):

The etch apparatus includes a chamber 12, a feed source 14, an exhaust 16, a product support check or pedestal 18, an inductive applicator 20, a radio frequency ("rf") power source 22 to the inductive applicator 20, wave adjustment circuits 24, 29 (WACs), a radio frequency power source 35 to the pedestal 18, a controller 36, an agile temperature control means [19], and other elements. Optionally, the etch apparatus includes a gas distributor 17.

At Col. 11, Par. 3:

Fig. 4 is a simplified diagram of a resist stripper according to the present invention. The present stripping apparatus includes similar elements as the previous described CVD apparatus. The present stripping apparatus includes a chamber 112, a feed source 114, an exhaust 116, a pedestal 118, which can be an agile temperature controlled chuck, an rf power source 122, a ground 124, a helical resonator 126, and other elements. The helical resonator 126 includes a coil 132, an outer shield 133, a wave adjustment circuit 400, and other elements. The chamber can be any suitable chamber capable of housing a product 119 such as a photoresist coated wafer for stripping, and for providing a plasma discharge therein. The plasma discharge is derived from a plasma source, which is preferably a helical resonator discharge or other inductive discharge using a wave adjustment circuit or other techniques to selectively adjust phase/anti-phase potentials. Of course, in some applications other configurations such as parallel plate capacitive discharges and microwave powered discharges such as electron cyclotron resonance machines, resonant cavities and slow [waver] wave applicator structures may also be suitable. The present stripping apparatus provides for stripping or ashing photoresist, e.g., implant hardened, etc. Further examples of such a stripping apparatus are described in the experiments section below.

At Col. 14, Par. 2:

Fig. 6 is a simplified block diagram of a substrate holder 600 according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. The substrate holder 600 or [suceptor] susceptor includes, among others, a lower or backside surface 608, which includes a plurality of concentric zones 608A, 608B, 608C, and 608D. In a specific embodiment, each of the zones can be in fluidic communication with each other and can be partly separated from each other. Each of the zones can have an inlet 613 and an outlet 611. Fluid enters the inlet, traverses in an annular manner in the zone, and leaves the outlet. A baffle can separate the inlet from the outlet. Each of the zones can have an inlet and outlet, which are independent from the other inlets and outlets. Alternatively, the inlet and outlets can be in fluid communication with each other.

At Col. 14, Par. 4:

The fluid can be used to heat or cool the upper surface of the substrate holder. In a specific embodiment, the fluid generally should have a relatively high thermal conductivity and large heat capacity. The fluid should also be substantially non-corrosive, easy to transport, and can withstand a relatively large temperature range and still maintain its fluid characteristics. Additionally, the fluid should be able to be pumped and <u>be</u> substantially non-reactive with the substrate holder material itself. The fluid can be any commercial heat transfer fluid selected for the desirable temperature range. As noted, the substrate holder and upper surface cools down or is heated up by way of the fluid. The fluid can traverse through the zones and can absorb thermal energy or release thermal energy by an external heat transfer device such as the one described below, but can be others.

At Col. 15, Par. 3:

The substrate <u>holder</u> has an upper surface, which holds an object in a secure manner during processing. The upper surface is generally made of a suitable material that has desirable heat transfer characteristics. In a specific embodiment, the upper surface is made using a low thermal mass, high conductivity material. As merely an example, the upper surface can be a diamond-like or diamond film overlying a copper or copper-like substrate. Of course, the type of surface used depends upon the application.

At Col. 15, Par. 4:

In a specific embodiment, the substrate holder also has temperature sensing units 615 such as the one shown in "SIDE-VIEW C." The temperature sensing unit can be any suitable unit that is capable of being adapted to the upper surface of the substrate holder. Alternatively, the temperature sensing unit can measure the temperature of the fluid or lower surface of the substrate holder. As merely an example, the temperature sensing unit is a ["fluro-optic"] "fluoroptic" sensor unit made by a company called Luxtron in Santa Clara, California. Alternatively, the sensing unit can be [an] a [edge band] band edge IR sensor or the like. The sensing unit is capable of measuring a variety of spatial locations along the upper or lower surface of the substrate holder. The substrate holder can be implemented using a variety of systems for heating and/or cooling applications such as the one described below, but can be others.

At Col. 16, Par. 3:

In a specific embodiment, system 700 operates in a manner to program a process temperature of the substrate holder. In this process, the reservoir with a suitable heat transfer fluid is maintained at a temperature below the desired process temperature. The fluid is circulated through the substrate holder or wafer chuck by the pump. The fluid line downstream of the pump is equipped with [the] an electrical heater which is capable of heating the fluid to a desired temperature. The desired fluid temperature is determined by comparing the desired wafer or wafer chuck set point temperature to a measured wafer or wafer chuck temperature (this measurement can performed with a thermocouple, thermistor, pyrometer, [fluor optic] fluoroptic sensor or other sensing means). If the measured temperature of the wafer [of chuck] or chuck is below the desired temperature, a suitable control algorithm such as a proportional controller or a proportional-integral-derivative (i.e., PID) controller algorithm increases the temperature by supplying more power to the heater.

At Col. 17, Par. 1:

In an alternative embodiment, FIG. 8 is a simplified diagram of a multiple fluid reservoir system 800 according to an embodiment of the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. As shown, system 800 depicts an automatic system for agile temperature control of the substrate holder or wafer chuck 809 using two reservoirs 801, 803, but is not limited to two and can be more than two, if desirable. The wafer chuck can be rapidly brought to temperature T1 by directing flow through proportional control valve [V1] 805 to the wafer chuck. Similarly, the chuck can be brought substantially to a temperature T2 by directing only a flow from the reservoir T2 to the wafer chuck. Temperature sensor TC1 measures the temperature of the heat transfer fluid entering the wafer chuck and sensor TC2 monitors temperature of fluid exiting the wafer chuck. Valves [V1 and V2] 805 and 807 are controlled by a control system which adjusts the total volumetric flow rate of fluid flowing into the wafer chuck as well as the ratio of fluid flowing through [V1 and V2] 805 and 807. The ratio is set so that the temperature monitored by TC1 is at a predetermined value selected to achieve a desired wafer chuck temperature. The flow rate of a fluid flowing from both reservoir [1 and 2] 801 and 803 is metered by conventional means and set to fix the temperature difference measured between [TC2 and TC2] TC1 and TC2 at a pre-specified difference. This difference is selected to meet a temperature uniformity specification. The temperature difference allowed is chosen so that etching nonuniformities caused by temperature gradients are below a predetermined permissible level which includes an allowance for normal variability in measurements, sensor, the control system etc. The flows can be digitally controlled with proportional metering values as illustrated or alternately they can be controlled by computer-controlled variable speed pumps, as will be well known to those skilled in the art. In addition to the sensors TC1 and TC2, it is convenient to monitor the top surface chuck temperature and the wafer temperature so that TC1 can be selected to maintain the wafer temperature within a specific amount of a wafer etching or CVD temperature (when the chuck and etching temperature are greater than the temperature of the chamber walls, the wafer temperature will generally be slightly less than the chuck temperature owing to heat transfer resistance between the chuck and wafer and thermal coupling between the wafer and surrounding chamber walls).

At Col. 17, Par. 2 continuing to top of Col. 18:

FIG. 9 is a simplified diagram of [a simplified diagram of] a semiconductor substrate 900 according to an embodiment of the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. As shown, the substrate is a stack of layers that is to be patterned. The stack includes a dielectric layer such as a thin 100Å gate oxide layer 903 on a substrate (e.g., silicon wafer) 901 on which 2000 Å of tungsten silicide 907 or other material is deposited on the conductive layer, which can be polysilicon 905. A masking layer such as 2 microns of photoresist 909 is spin coated over the tungsten silicide and patterned by conventional photolithography techniques. The patterned layer includes an opening 911, which exposes the underlying tungsten silicide layer. It is desired to anisotropically etch the stack down to the silicon dioxide layer in order to define a patterned structure which can be an EEPROM device or other integrated circuit element. Although this can be accomplished by etching in a conventional parallel plate reactor using a chlorine bearing plasma, it can be difficult to avoid removing excessive polysilicon during the overetching period, which is required to assure that the polysilicon is completely removed from within the unmasked regions. Furthermore, the resist mask must generally be removed after etching this stack. Since the temperature for the stack etch (i.e., often 50° C. to [100° C.] <u>100° C.)</u> is too low to achieve an adequate resist stripping rate (generally a rate of a few microns per minute is desirable), stripping is often done in a separate chamber [of] <u>or</u> in separate resist stripping equipment.

At Col. 18, Par. 1:

The temperature is programmed by use of this invention to achieve better control of the etching process as well as to permit stripping the resist in the same chamber and [controlled] control by the same process program which is used for stack etching.

At Col. 18, Par. 2

A process according to the present invention can be briefly outlined as follows:

(1) Provide patterned stack in chamber;

(2) Perform native oxide breakthrough using sulfur hexafluoride bearing plasma;

(3) Ignite chlorine bearing plasma;

(4) Etch tungsten silicide layer at a first substrate temperature;

(5) Detect polysilicon layer;

(6) Perform over etch to clear tungsten;

(7) Expose polysilicon;

(8) Etch polysilicon;

(9) Clear polysilicon to oxide;

(10) Stop chlorine bearing plasma;

(11) Feed oxygen;

(12) Ignite oxygen plasma;

(13) Strip photoresist at a second substrate temperature; and

(14) Extinguish oxygen plasma

The above sequence of steps are merely examples to show an etching process that uses more than one temperature. Here, the etching process for tungsten silicide and polysilicon occurs at a first temperature and an ashing process occurs at a second temperature, where the first temperature is lower than the second temperature. By way of the present invention, multiple temperatures can be used in a single chamber to perform multiple processes. Details of the present invention are shown by way of FIG. 10, for example.

At Col. 18, Par. 3:

Fig. 10 [is] shows a simplified [flow diagram of a heating] process according to the present invention. This [diagram] process is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. As shown, there is an isotropic breakthrough step during which an SF_6 plasma is [sued] used to remove very thin native oxide can be conducted at a low temperature such as room temperature. Ordinarily the breakthrough step is conducted at a high temperature. High temperatures have a serious disadvantage in that the etching rate of both oxide and tungsten silicide by SF_6 may be isotropic. Therefore the duration of the breakthrough step, especially if the native oxide layer is thin, must often be limited to a few seconds to avoid undesired undercut. At low temperature the etching rate is slower and therefore the extent to which materials under the native oxide are etched is easier to control.

At Col. 19, Par. 1:

At the end of the breakthrough [step] step, at time BB, the control program increases within several seconds to a higher steady state value at time [C] B. The tungsten silicide is etched at this temperature until this layer is breached at random locations on the wafer. This endpoint is conveniently observed by a change in the slope of intensity of an optical light emission from the plasma such as optical emission at 530 nm (point C in FIG. 10). The complete removal of the unmasked tungsten silicide areas is similarly signaled by a change in light emission such as that shown at point D (at time D all "patches" of the tungsten silicide are "cleared" from unmasked polysilicon areas; the signal begins to rapidly decease at time D because at constant temperature, polysilicon consumes chlorine more rapidly than tungsten silicide (e.g. a faster etch rate) and optical emission at this wavelength originates from a chlorine species.

At Col. 19, Par. 2:

Since it is not practical to change chuck temperature, at this point the etch rate would increase rapidly. As a consequence it can often be difficult to detect and terminate the polysilicon etching step when the thin oxide layer is reached. Another problem associated with the use of a single temperature for both silicide and polysilicon layers is that chlorine etching processes often undercut (etch along the mask direction, sideways- e.g. the etch is partly isotropic) silicon at the elevated temperatures suitable for a low residue tungsten silicide etch. Therefore it is highly desirable and advantageous to reduce the etching temperature during the polysilicon etch. The wafer temperature is gradually reduced at point [DD] D in order to achieve a slower and more anisotropic polysilicon etching step. The temperature necessary to etch tungsten silicide and polysilicon during this temperature programmed sequence are schematically compared in [the FIG] FIG. 10. As shown, the [The] emission signal intensity increases when the temperature is lowered because the rate of consumption of chlorine species by the etching process is slowed (the rate decreases with decreasing temperature). Stopping the etch process [at endpoint] beyond the endpoint where all of the silicon has "cleared," denoted by E is also easier and less critical because attack on the oxide has also slowed. Fig. 10 shows temperature changes between BB and B and between points D and E occurring over intervals which subtend less than about 5 percent of the tungsten silicide/polysilicon stack etching time.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1-55. (*canceled*)

56. (*previously presented*) A method of etching a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a chamber, the substrate holder having a selected thermal mass;

setting the substrate holder to a selected first substrate holder temperature with a heat transfer device;

etching a first portion of the film while the substrate holder is at the selected first substrate holder temperature;

with the heat transfer device, changing the substrate holder temperature from the selected first substrate holder temperature to a selected second substrate holder temperature; and

etching a second portion of the film while the substrate holder is at the selected second substrate holder temperature;

wherein the thermal mass of the substrate holder is selected for a predetermined temperature change within a specified interval of time during processing; the predetermined temperature change comprises the change from the selected first substrate holder temperature to the selected second substrate holder temperature, and the specified time interval comprises the time for changing from the selected first substrate holder temperature to the selected second substrate holder temperature.

57. (*previously presented*) The method of claim 56 wherein the second portion of the film comprises a material composition that is different from the material composition of the first portion of the film.

58. (*previously presented*) The method of claim 56 wherein the change from the first substrate holder temperature to the second substrate holder temperature is an in–situ process during the first portion etching and the second portion etching.

59. (*previously presented*) The method of claim 56 wherein the etching of the first portion of the film and the etching of the second portion of the film are conducted in a substantially constant plasma environment.

60. (*previously presented*) The method of claim 56 wherein etching at least one of the portions of the film comprises radiation.

61. (*previously presented*) The method of claim 56 wherein etching at least one of the portions of the film is an ion bombardment aided process.

62. (*previously presented*) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature; and

the first and the second substrate etching temperatures are in a known relationship to the first and the second substrate holder temperatures.

63. (*currently amended*) The method of claim 62 wherein the first etching temperature is within approximately one degree centigrade of the first substrate holder temperature and the second etching temperature is within approximately one degree centigrade of the second substrate holder temperature.

64. (*previously presented*) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is higher than the second substrate etching temperature; and

the first portion of the film is etched before the second portion of the film.

65. (*previously presented*) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is lower than the second substrate etching temperature; and

the first portion of the film is etched before the second portion of the film.

66. (*previously presented*) The method of claim 56 wherein the substrate holder comprises an electrostatic support chuck having a surface for supporting a substrate in a reaction chamber, the electrostatic support chuck overlays a heat exchange region, and the heat exchange region includes at least one fluid passage through which a fluid can be circulated to heat and/or cool the substrate holder.

67. (*previously presented*) The method of claim 66 wherein the heat exchange region includes at least two separate fluid passages, each fluid passage being configured to have an independent inlet and an independent outlet.

68. (*previously presented*) The method of claim 56 wherein the substrate holder heat transfer device includes a plurality of heating elements.

69. (*previously presented*) The method of claim 68 wherein the heating elements are configured to selectively heat one or more zones of the substrate holder.

70. (*currently amended*) A method of etching a substrate in the manufacture of a device, the method comprising:

heating a substrate holder to a first substrate holder temperature with a heat transfer device, the substrate holder having at least one temperature sensing unit,

placing a substrate having a film thereon on the substrate holder in a chamber;

etching a first portion of the film at a selected first substrate temperature; and

etching a second portion of the film at a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature;

wherein substrate temperature is changed from the selected first substrate temperature to the selected second substrate temperature, using a measured substrate temperature, within a preselected time interval for processing, and at least the first substrate temperature or the second substrate temperature, in single or in combination, is above room temperature.

71. (*previously presented*) The method of claim 70 wherein a continuous etching process comprises etching the first portion of the film and etching the second portion of the film.

72. (*previously presented*) The method of claim 70 wherein the substrate temperature change is by at least heat transfer with the substrate using at least an electrostatic chuck.

73. (*previously presented*) The method of claim 70 wherein the substrate temperature change is by transferring heat energy using at least a pressure of gas behind said substrate.

74. (*previously presented*) The method of claim 70 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

75. (*previously presented*) The method of claim 70 wherein changing the substrate temperature comprises selectively transferring energy in the form of heat from a substrate temperature control system to the substrate holder.

76. (*previously presented*) The method of claim 70 wherein changing the selected first substrate temperature to the selected second substrate temperature is an in-situ process while etching the first film portion and etching the second film portion.

77. (*previously presented*) The method of claim 70 wherein the second portion of the film comprises a material composition that is different from the material composition of the first portion of the film.

78. (*previously presented*) The method of claim 70 wherein etching at least one portion of the film comprises radiation.

79. *(previously presented)* The method of claim 70 wherein etching at least one portion of the film comprises an ion bombardment aided process.

80. *(previously presented)* A method of processing a substrate during the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder within a chamber of a plasma discharge apparatus, the plasma discharge apparatus comprising: a substrate temperature control system comprising a substrate temperature sensor and a substrate temperature control circuit operable to adjust the substrate temperature to a predetermined substrate temperature value with a first heat transfer process; and a substrate holder temperature control system comprising a substrate holder temperature sensor and a substrate holder temperature control circuit operable to adjust the substrate holder temperature to a predetermined substrate holder temperature value with a second heat transfer process;

performing a first film treatment of a first portion of the film at a selected first substrate temperature;

with the substrate temperature control circuit, changing from the selected first substrate temperature to a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature; and

performing a second film treatment of a second portion of the film at the selected second substrate temperature;

wherein the substrate holder is heated above room temperature during at least one of the first or the second film treatments, and the substrate temperature control circuit is operable to change the substrate temperature from the selected first substrate temperature to the selected second substrate temperature within a preselected time period to process the film.

81. *(previously presented)* The method of claim 80 wherein the substrate temperature control circuit comprises the substrate holder temperature control circuit.

82. *(previously presented)* The method of claim 80 wherein the substrate holder temperature control circuit comprises the substrate temperature control circuit.

83. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises the substrate temperature being less than the substrate holder temperature.

84. *(previously presented)* The method of claim 80 wherein the second portion of the film comprises a material composition that is different from the material composition of the first portion of the film.

85. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate holder to the substrate.

86. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate to the substrate holder.

87. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises maintaining the temperature of the substrate holder above room temperature and selectively transferring heat energy from the substrate into the substrate holder.

88. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring energy in the form of heat to the substrate holder with the substrate temperature control circuit and maintaining the substrate holder temperature above room temperature with the substrate holder control circuit.

89. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises etching.

90. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises chemical vapor deposition.

91. (*previously presented*) The method of claim 80 wherein at least one film treatment comprises maintaining the substrate temperature at a selected value from about 300 to 500 degrees centigrade.

92. (*previously presented*) The method of claim 80 wherein the first temperature is changed to the second temperature by transferring heat using at least a pressure of gas behind the substrate.

93. (*previously presented*) The method of claim 80 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

94. (*previously presented*) A method of processing a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a processing chamber; the processing chamber comprising the substrate holder, a substrate control circuit operable to adjust the substrate temperature, a substrate holder temperature sensor, and a substrate holder control circuit operable to maintain the substrate holder temperature;

performing a first etching of a first portion of the film at a selected first substrate temperature;

performing a second etching of a second portion of the film at a selected second substrate temperature, the second temperature being different from the first temperature;

wherein at least one of the film portions is etched while heat is being transferred to the substrate holder with the substrate holder control circuit; and

the substrate temperature control circuit effectuates the change from the first substrate temperature to the second substrate temperature within a preselected time period.

95. (*previously presented*) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate holder into the substrate.

96. (*previously presented*) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate into the substrate holder.

97. (*previously presented*) The method of claim 94 wherein the etching of at least one of the film portions comprises maintaining the temperature of the substrate in the range of 50°C to 100°C.

98. (*previously presented*) The method of claim 94 wherein the preselected time period to change from the first substrate temperature to the second substrate temperature subtends less than about 5 percent of a total etching process time.

99. (*cancelled*).

100. (*previously presented*) A method for processing layers which are included in a stack of layers positioned on a substrate, the method comprising:

placing the substrate on a substrate holder;

sensing a substrate holder temperature,

etching at least a portion of a first silicon-containing layer in a chamber while the substrate is maintained at a selected first substrate temperature; and

etching at least a portion of a second silicon-containing layer in the chamber while the substrate is maintained at a selected second substrate temperature;

wherein the substrate holder is heated to a temperature operable to maintain at least one of the selected first and the selected second substrate temperatures above 49°C, and

the substrate temperature is changed from the first substrate temperature to the second substrate temperature with a control circuit operable to effectuate the changing within a preselected time period that is less than the overall process time associated with the etching the first silicon-containing layer and the second silicon-containing layer.

101. *(previously presented)* The method of claim 100 wherein the change from the first substrate temperature to the second substrate temperature occurs within less than about 5 percent of the total etching process time.

102. *(previously presented)* The method of claim 100 wherein at least one layer is etched in a chlorine-containing ambient.

103. *(previously presented)* The method of claim 100 wherein at least one silicon-containing layer is etched in a chlorine-containing ambient;

the first layer is a polysilicon layer, the second layer is a silicide layer and the stack includes an oxide layer;

the second substrate temperature is higher than the first substrate temperature; and

a portion of at least one layer is selectively etched relative to the oxide layer.

104. *(previously presented)* A method for manufacturing a device comprising an integrated circuit, the method comprising:

transferring a substrate comprising a stack of layers including a silicide layer into a chamber, the chamber comprising a substrate holder;

sensing the substrate holder temperature;

heating the substrate holder with a substrate holder control circuit and a heating device to maintain the substrate holder at a temperature that is operable to effectuate a substrate temperature above room temperature while processing the substrate;

processing the substrate on the substrate holder at a first substrate temperature; and

processing the substrate on the substrate holder at a second substrate temperature to etch at least a portion of the silicide layer;

wherein the first substrate temperature is different from the second substrate temperature and the first substrate temperature is changed to the second substrate temperature with a substrate temperature control circuit within a preselected time to etch the silicide layer.

105. *(cancelled.)*

106. *(previously presented)* The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature within a selected period of time by at least heat transfer to the substrate using at least an electrostatic chuck.

107. *(previously presented)* The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring heat using at least a pressure of gas behind the substrate.

108. *(previously presented)* The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

109. *(cancelled)*.

110. *(previously presented)* The method of claim 56 wherein the change from the first substrate holder temperature to the second substrate holder temperature is effectuated with a control circuit.

111. *(previously presented)* The method of claim 56 wherein the substrate holder reaches the second substrate holder temperature at approximately a selected time.

112. *(previously presented)* The method of claim 70 wherein the first substrate holder temperature is above room temperature.

113. *(previously presented)* The method of claim 80 wherein at least one film treatment comprises transferring energy from the substrate holder with a heat transfer device.

114. *(previously presented)* The method of claim 94 wherein the second portion of the film comprises a material composition different from the first portion of the film.

115. *(previously presented)* The method of claim 94 wherein the substrate temperature is the second substrate temperature at approximately a selected time.

116. *(previously presented)* The method of claim 104 comprising processing the substrate while maintaining the substrate temperature at a selected value within 180 to 220 degrees centigrade.

117. *(previously presented)* The method of claim 104 comprising processing the substrate while maintaining the substrate temperature at a selected value within 50 to 100 degrees centigrade.

REMARKS

Applicant thanks the Examiner for graciously granting an interview and for her helpful suggestions.

Prior to this amendment Claims 56-62, 64-98, 100-104, 106-108, and 110-117 were allowed. Claim 63 was rejected and Claim 109 was objected to. Claims 1-55, 99 and 105 were previously cancelled.

The Amendment to the Specification presented herein comprises the specification amendments in the Amendment after Allowance under 37 CRF 1.312(a) made in Application Serial No. 09/151,163 (issued as U.S. Patent No. 6,231,776 B1) and the previously presented Amendment to the Specification entered in this application Serial No. 10/439,245 on Feb. 21, 2006. As previously noted, the amended text of the Amendment after Allowance under 37 CRF 1.312(a) in Application Serial No. 09/151,163 was omitted from the printed U.S. Patent 6,231,776 B1 publication. This omission resulted in some discrepancies between the printed specification and certain printed figures. Furthermore, the Feb. 21, 2006 Amendment to the Specification was unintentionally entered using improper strikeout deletion pursuant to 37 CFR 1.121 rather than the prescribed bracket deletion under 37 CFR 1.530(d). Accordingly, the instant Amendment to the Specification is formated pursuant to 37 CFR 1.530(d).

In the Amendment to the Specification entered on Feb. 21, 2006, a full paragraph at Col. 18, Par. 3 was erroneously labelled as being at "Col. 18, Par. 2". The position of the amended paragraph at Col. 18, Par. 3 is correctly labelled herein.

In the specification, before Col. 3 Par. 1, in the BRIEF DESCRIPTION OF THE DRAWINGS, the line starting with "FIG. 9" is herein amended to correct a typographical error in which the phrase "a simplified diagram of" was twice repeated.

In the specification, at Col. 3, Par. 2 in the DETAILED DESCRIPTION there is an erroneous reference to a reference numeral 19. In the Amendment After Allowance under 37 CFR § 1.312(a) of the 09/151,163 application, by error only the digit "9" of the reference numeral was deleted, instead of deleting the entire numeral "19". By this amendment, the erroneous reference to reference numeral "19" is deleted.

In the specification, at Col. 17, Par. 2, the first line is herein amended to correct a typographical error in which the phrase "a simplified diagram of" was twice repeated.

Claim 63 is currently amended pursuant to examiner's guidance, and Claim 109 is cancelled.

Claim 70 is amended to correct a typographical error. The phrase "a measured wafer temperature" in the previously presented claim should have referenced "a measured substrate temperature." It will be apparent that other language throughout the claim consistently references a "substrate", a "substrate temperature", a film on a "substrate" and so forth.

Hence Claims 63 and 70 are pending in this application.

No new matter is added.

A supplemental declaration by the inventor under 37 CFR 1.175 is included herewith.

CONCLUSION

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,

Daniel L. Flamm
Reg. No. 54,100

Telephone: (925) 947-1909
Facsimile: (925) 937-2754
Date: July 25, 2007

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to:

Attn: Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

On July 25, 2007

By: Anne L. Hannon

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Daniel L. Flamm Attorney Docket No.: 0A0301

Patent No.: 6,231,776 B1

Issued: May 15, 2001

Title: MULTI-TEMPERATURE PROCESSING

Mail Stop Reissue
Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SUPPLEMENTAL DECLARATION BY INVENTOR IN REISSUE APPLICATION

As a below-named inventor, I hereby declare that:

1. My residence and citizenship are stated below next to my name.

2. I have reviewed and understand the contents of the specification and claims of the above-identified reissue application, including the claims and specification as amended by the amendment attached hereto, and believe myself to be the original and first inventor of the invention described and claimed in the aforesaid reissue application and in U.S. Letters Patent No. 6,231,776 B1 on which said reissue application is based.

3. I do not know and do not believe that said invention was ever known or used in the United States of America before the invention thereof by myself.

4. I acknowledge a duty to disclose information I am aware of which is material to patentability as defined in 37 C.F.R. § 1.56.

5. I believe the original patent, U.S. Patent No. 6,231,776 B1, to be wholly or partly inoperative as the patent claims less than I had the right to claim in the patent. This reissue is broadening to correct the erroneous scope of the claims.

6. An example of error is that the previous issued claims failed to claim an inventive method of performing a first film treatment at a first substrate temperature and a second film treatment at a second substrate temperature in a plasma discharge apparatus, using a substrate temperature sensor, a substrate holder temperature sensor, and a substrate temperature control circuit, without limitation of a selected thermal mass of the substrate holder. Another example of error is that the previously issued claims failed to include an inventive method of performing a first film treatment of a first portion of a film at a selected first substrate temperature, and a second film treatment of a second portion of the film at a selected second substrate temperature, wherein the substrate holder is heated above room temperature during at least one treatment, without a limitation that the first film treatment is etching a first portion of the film and the second film treatment is etching a second portion of the film.

7. All errors being corrected in this reissue arose without any deceptive intent on my part.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: July 25, 2007

Daniel L. Flamm

476 Green View Drive, Walnut Creek, CA 94596
Residence Address

U.S.A.
Citizenship and Country of Residence

PTO/SB/06 (08-03)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 10/439245

CLAIMS AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE (37 CFR 1.16(a))				$	OR		$
TOTAL CLAIMS (37 CFR 1.16(c))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	minus 3 =	*	X $ =		OR	X $ =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))			+ $ =		OR	+ $ =	
			TOTAL		OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

CLAIMS AS AMENDED – PART II

AMENDMENT A

10/6/06	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 60	Minus	** 63	= 0	X $ =		OR	X $ =	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	= 0	X $ =		OR	X $ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

11/00/??	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 60	Minus	** 63	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	=	X $ =		OR	X $ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT C

7/30/07	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 59	Minus	** 63	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	=	X $ =		OR	X $ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	4581	216/63-67.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/06/28 13:38
L2	272	216/72.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/06/28 13:38
L3	465	216/75.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/06/28 13:38
L4	1265	216/79.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/06/28 13:38
L5	5526	L1 L2 L3 L4	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/06/28 13:38
L6	573	(measur$4 sens$4 detect$4) near3 (substrate wafer workpiece) near1 (holder chuck support).clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/06/28 13:39
L7	1	5 and 6	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/06/28 13:39

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 05/30/2007

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EXAMINER	
ALANKO, ANITA KAREN	

ART UNIT	PAPER NUMBER
1765	

MAIL DATE	DELIVERY MODE
05/30/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

c

Office Action Summary	Application No.	Applicant(s)	
	10/439,245	FLAMM, DANIEL	
	Examiner	**Art Unit**	
	Anita K. Alanko	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 November 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *56-98,100-104 and 106-117* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *56-62,64-98,100-104,106-108 and 110-117* is/are allowed.

6)☒ Claim(s) *63* is/are rejected.

7)☒ Claim(s) *109* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Claim Objections

Claim 109 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 57. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 63 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term “substantially” in claim 63 is a relative term which renders the metes and bounds of the claim indefinite. The term "high" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is unclear which values of temperatures are within the range of being “substantially” equal.

Allowable Subject Matter

Claims 56-62, 64-98, 100-104, 106-108, 110-117 are allowed.

Claim 63 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Response to Amendment

The objection to the specification, rejection of claim 109 under 35 USC 251, and rejection of claim 109 under 35 USC 112, 1st paragraph are withdrawn since the "in a controlled manner" and "before" have been deleted from the claims.

The rejection of claims 57, 68 and 103 under 35 USC 112, 2nd paragraph is withdrawn since "heat transfer means" has been deleted, proper basis for "plurality of heating elements" has been added and "high" has been deleted.

The prior art rejections over JP 59-076876 are withdrawn. Applicant's point is well taken that JP 59-076876 does not teach selecting a thermal mass based on a predetermined temperature change and specified interval of time for processing, as in the context of claim 56. Although such a thermal mass may be inherent, there is no teaching to predetermine a temperature change and interval of time, and based on that, to select the thermal mass of the substrate holder. As to claim 70, JP 59-076876 does not teach changing the substrate temperature by using a measured wafer temperature. Rather, JP 59-076876 changes temperature based on the thickness that has been processed (page 6, lines 1-2). As to claim 94, JP 59-076876 fails to disclose a substrate holder temperature sensor. There is no motivation to provide one since the substrate holder temperature is not used to control the process.

The prior art rejections over Tsubone are withdrawn. Applicant's point is well taken that Tsubone does not teach heating, as in the context of claim 70. Rather, Tsubone has cooling. As to claims 80, 94, 100 and 104, Tsubone fails to disclose a substrate holder temperature sensor. Rather, Tsubone has a substrate temperature sensor 28. There is no motivation to add an extra sensor that Tsubone does not use for process control since the substrate holder is maintained at the same temperature during processing.

Response to Arguments

Applicant's arguments filed 11/20/06 have been fully considered but they are not persuasive to the extent they still apply.

Claim 63 remains rejected under 35 USC 112 because of the term "substantially." Applicant argues that a specific embodiment defines the term to "within one degree Celsius." In response, an example of what comprises "substantially" is not the same as a clear and distinct definition, and therefore the metes and bounds of the claim are unclear. The definition provided in the specification may be added to the claim to overcome the rejection.

Examiner notes that new claim text (new with respect to the issued patent) should be underlined. The text of claims 99 and 105 should not be presented. In addition, a supplemental oath should be submitted stating that all errors (i.e., amendments) occurred without deceptive intent.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anita K. Alanko whose telephone number is 571-272-1458. The examiner can normally be reached on Mon-Fri until 2:30 pm (Wed until 11:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Anita K. Alanko
Anita K Alanko
Primary Examiner
Art Unit 1765

Notice of References Cited	Application/Control No. 10/439,245	Applicant(s)/Patent Under Reexamination FLAMM, DANIEL	
	Examiner Anita K. Alanko	Art Unit 1765	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,965,034	10-1999	Vinogradov et al.	216/68
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes

	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/439,245	FLAMM, DANIEL	
	Examiner	**Art Unit**	
	Anita K. Alanko	1765	

SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST, see search history printout	1/21/2007	AKA

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
PGPubs, see search hisotry printout		1/21/2007	AKA

U.S. Patent and Trademark Office

Part of Paper No. 20070121

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3042	(measur$4 sens$4 detect$4) near3 (substrate wafer workpiece) near1 (holder chuck support)	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/01/20 23:50
L2	795338	(("156") or ("216") or ("438") or ("257") or ("118") or ("427") or ("204")).CLAS.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	OFF	2007/01/20 23:51
L3	655	1 and 2	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/01/20 23:51
L4	414	3 and etch$4	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/01/20 23:51
L5	545	1.clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/01/20 23:51
L6	94	4 and 5	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2007/01/20 23:51
L9	59	("3560252" | "3615931" | "3641974" | "3796099" | "3969943" | "4001586" | "4435092" | "4456919" | "4496609" | "4564416" | "4607591" | "4698486" | "4728389" | "4764026" | "4789771" | "4821674" | "4836138" | "4854727" | "4890245" | "4913790" | "4919542" | "4969748" | "4978567" | "4984902" | "4996942" | "5002630" | "5011789" | "5063031" | "5098198" | "5156461" | "5205871" | "5221412" | "5225245" | "5359693" | "5373806" | "5377126" | "5445675" | "5446825" | "5471947" | "5514439" | "5549756" | "5578521" | "5593608" | "5650082" | "5678989" | "5707146" | "5743644" | "5809211" | "5968587").PN. OR ("6121061").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2007/01/20 23:59

IFW 1765

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November 16, 2006

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	Docket No: OA0301
Daniel L. Flamm	
Appln. No.: 10/439,245	Group Art Unit: 1765
Filed: 5/14/2003	Examiner: A. Alanko

RESPONSE TO NOTICE OF NON-COMPLIANT AMENDMENT UNDER 37 C.F.R. § 1.121

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is responsive to the Notice of Non-Compliant Amendment mailed on Oct. 18, 2006. Please substitute the attached document which includes corrections believed to place the Amendment Under 37 C.F.R. § 1.111 into compliance.

Furthermore, applicant has carefully reviewed all of the claims and claim markings including the specific non-compliant marking cited in the Notice. Applicant confirmed that the identifier cited in the Notice was non-compliant and found additional formality errors. The errors comprised omitted struck out text, included struck out text that was not in the previously presented claims, and omitted underscores. Furthermore, applicant found a typographical error that the connective "from the" was repeated in the last paragraph of Claim 56 (e.g. "from the from the"). These non-compliant and typographical formalities were unintentional..

The aforementioned issues have been corrected in the accompanying revised copy of the Amendment Under 37 C.F.R. § 1.111. The instant revised Amendment is believed to be in compliance. This response is mailed within the 30 day statutory period of the Notice.

Respectfully submitted,

Daniel L. Flamm
Reg. No. 54,100

Telephone: (925) 947-1909
Facsimile: (925) 937-2754
Date: November 16, 2006

PATENT

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to:

Attn: Box Missing parts
Assistant Commissioner for Patents
U. S. Patent and Trademark Office
Washington, D.C. 20231

On November 16, 2006

By: ______

Daniel L. Flamm

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October 2, 2006

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	Docket No: OA0301
Daniel L. Flamm	
Appln. No.: 10/439,245	Group Art Unit: 1765
Filed: 5/14/2003	Examiner: A. Alanko

AMENDMENT UNDER 37 C.F.R. § 1.111

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated, June 1, 2006, please amend the above-identified application as follows on the accompanying pages.

TABLE OF CONTENTS

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1.-55 (*canceled*)

56. (*currently amended*) A method of etching a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a chamber, the substrate holder having a selected thermal mass;

setting the substrate holder to a selected first substrate holder temperature with a heat transfer device;

etching a first portion of the film while the substrate holder is at the selected first substrate holder temperature;

with the heat transfer device, changing the substrate holder temperature from the selected first substrate holder temperature to a selected second substrate holder temperature; and

etching a second portion of the film while the substrate holder is at the selected second substrate holder temperature;

~~wherein the thermal mass of the substrate holder is selected to allow changing the first substrate holder temperature to the second substrate holder temperature within a selected time period.~~

<u>wherein the thermal mass of the substrate holder is selected for a predetermined temperature change within a specified interval of time during processing; the predetermined temperature change comprises the change from the selected first substrate holder temperature to the selected second substrate holder temperature, and the specified time interval comprises the time for changing from the selected first substrate holder temperature to the selected second substrate holder temperature</u>.

57. (*currently amended*) The method of claim 56 wherein the ~~first substrate holder temperature is changed to the~~ second ~~substrate holder temperature by heat transfer means coupled to the substrate holder~~ <u>portion of the film comprises a material composition that is different from the material composition of the first portion of the film</u>.

58. (*currently amended*) The method of claim 56 wherein the change from the first substrate holder temperature to the second substrate holder temperature is an in–situ process during the first portion etching ~~step~~ and the second portion etching ~~step~~.

59. (*previously presented*) The method of claim 56 wherein the etching of the first portion of the film and the etching of the second portion of the film are conducted in a substantially constant plasma environment.

60. (*previously presented*) The method of claim 56 wherein etching at least one of the portions of the film comprises radiation.

61. (*previously presented*) The method of claim 56 wherein etching at least one of the portions of the film is an ion bombardment aided process.

62. (*previously presented*) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature; and

the first and the second substrate etching temperatures are in a known relationship to the first and the second substrate holder temperatures.

63. (*previously presented*) The method of claim 62 wherein the first etching temperature is substantially the first substrate holder temperature and the second etching temperature is substantially the second substrate holder temperature.

64. (*previously presented*) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is higher than the second substrate etching temperature; and

the first portion of the film is etched before the second portion of the film.

65. (*previously presented*) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is lower than the second substrate etching temperature; and

the first portion of the film is etched before the second portion of the film.

66. (*previously presented*) The method of claim 56 wherein the substrate holder comprises an electrostatic support chuck having a surface for supporting a substrate in a reaction chamber, the electrostatic support chuck overlays a heat exchange region, and the heat exchange region includes at least one fluid passage through which a fluid can be circulated to heat and/or cool the substrate holder.

67. (*previously presented*) The method of claim 66 wherein the heat exchange region includes at least two separate fluid passages, each fluid passage being configured to have an independent inlet and an independent outlet.

68. (*currently amended*) The method of claim 56 wherein the substrate holder heat transfer device includes a plurality of heating elements.

69. (*previously presented*) The method of claim 68 wherein the heating elements are configured to selectively heat one or more zones of the substrate holder.

70. (*currently amended*) A method of etching a substrate in the manufacture of a device, the method comprising:

heating ~~the~~ a substrate holder to a first substrate holder ~~operating~~ temperature with a heat transfer device, the substrate holder having at least one temperature sensing unit,

placing a substrate having a film thereon on ~~a~~ the substrate holder in a chamber;

etching a first portion of the film at a selected first substrate temperature; and

etching a second portion of the film at a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature;

wherein substrate temperature is changed from the selected first substrate temperature to the selected second substrate temperature, using a measured wafer temperature, within a preselected time interval for processing, and at least the first substrate temperature or the second substrate temperature, in single or in combination, is above room temperature. ~~operating the substrate holder at the first temperature enables the substrate temperature to be above room temperature while etching at least one of the portions of the film, and the selected first substrate~~

~~temperature is operable to be changed to the selected second substrate temperature within a selected time period to process the film.~~

71. (*previously presented*) The method of claim 70 wherein a continuous etching process comprises etching the first portion of the film and etching the second portion of the film.

72. (*currently amended*) The method of claim 70 wherein the ~~first substrate temperature is changed to the second substrate temperature within a selected period of time~~ substrate temperature change is by at least heat transfer with the substrate using at least an electrostatic chuck.

73. (*currently amended*) The method of claim 70 wherein the ~~first substrate temperature is changed to the second substrate temperature~~ substrate temperature change is by transferring heat energy using at least a pressure of gas behind said substrate.

74. (*currently amended*) The method of claim 70 wherein ~~said~~ the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

75. (*previously presented*) The method of claim 70 wherein changing the substrate temperature comprises selectively transferring energy in the form of heat from a substrate temperature control system to the substrate holder.

76. (*previously presented*) The method of claim 70 wherein changing the selected first substrate temperature to the selected second substrate temperature is an in-situ process while etching the first film portion and etching the second film portion.

77. (*currently amended*) The method of claim 70 wherein the ~~etching of the~~ ~~first portion of the film and the etching of~~ ~~the~~ second portion of the film ~~are conducted in a substantially constant plasma environment~~ comprises a material composition that is different from the material composition of the first portion of the film.

78. (*previously presented*) The method of claim 70 wherein etching at least one portion of the film comprises radiation.

79. (*previously presented*) The method of claim 70 wherein etching at least one portion of the film comprises an ion bombardment aided process.

80. (*currently amended*) A method of processing a substrate during the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder within a chamber of a plasma discharge apparatus, the plasma discharge apparatus comprising: ~~a substrate temperature sensor,~~ a substrate temperature control system ~~including~~ comprising a substrate temperature sensor and a substrate temperature control circuit operable to adjust the substrate temperature to a predetermined substrate temperature value with ~~execute~~ a first heat transfer process; and ~~the substrate holder having~~ a substrate holder temperature control system comprising a substrate holder temperature sensor and a substrate holder temperature control circuit operable to adjust the substrate holder temperature to a predetermined substrate holder temperature value with a second heat transfer process;

performing a first film treatment of a first portion of the film at a selected first substrate temperature;

with the substrate temperature control circuit, changing from the selected first substrate temperature to a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature; and

performing a second film treatment of a second portion of the film at the selected second substrate temperature;

~~maintaining the substrate holder temperature such that the substrate temperature remains above room temperature during at least one of the film treatments and the change from the first~~

~~substrate temperature to the second substrate temperature occurs within a predetermined time period to process the film.~~

wherein the substrate holder is heated above room temperature during at least one of the first or the second film treatments, and the substrate temperature control circuit is operable to change the substrate temperature from the selected first substrate temperature to the selected second substrate temperature within a preselected time period to process the film.

81. (*currently amended*) The method of claim 80 wherein the substrate temperature control circuit ~~system~~ comprises the substrate holder temperature control circuit ~~system~~.

82. (*currently amended*) The method of claim 80 wherein the substrate holder temperature control circuit ~~system~~ comprises the substrate temperature control circuit ~~system~~.

83. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises the substrate temperature being less than the substrate holder temperature.

84. (*currently amended*) The method of claim 80 wherein ~~at least one film treatment, selected from the first film treatment and the second film treatment, comprises the substrate~~

~~temperature being greater than the substrate holder temperature~~ the second portion of the film comprises a material composition that is different from the material composition of the first portion of the film.

85. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate holder to the substrate.

86. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate to the substrate holder.

87. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises maintaining the temperature of the substrate holder above room temperature and selectively transferring heat energy from the substrate into the substrate holder.

88. (*currently amended*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively

transferring energy in the form of heat ~~from the substrate temperature control system~~ to the substrate holder with the substrate temperature control circuit and maintaining the substrate holder temperature above room temperature with the substrate holder control circuit.

89. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises etching.

90. (*previously presented*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises chemical vapor deposition.

91. (*currently amended*) The method of claim 80 wherein at least one film treatment comprises maintaining the substrate temperature at a selected value from about 300 to 500 degrees centigrade~~, selected from the first film treatment and the second film treatment, is an ion assisted process~~.

92. (*previously presented*) The method of claim 80 wherein the first temperature is changed to the second temperature by transferring heat using at least a pressure of gas behind the substrate.

93. (*previously presented*) The method of claim 80 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

94. (*currently amended*) A method of processing a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a processing chamber~~,~~; the processing chamber comprising the substrate holder, a substrate control circuit operable to adjust the substrate temperature ~~control system to control the temperature of the substrate~~, a substrate holder temperature sensor, and a substrate holder control circuit operable to maintain the substrate holder temperature ~~control system to control the temperature of the substrate holder~~;

performing a first etching of a first portion of the film at a selected first substrate temperature;

performing a second etching of a second portion of the film at a selected second substrate temperature, the second temperature being different from the first temperature;

wherein at least one of the film portions is etched while heat is being transferred ~~from the substrate holder control system~~ to the substrate holder with the substrate holder control circuit ~~control system~~; and

~~effectuating a~~ the substrate temperature control circuit effectuates the change ~~in the substrate temperature~~ from the first substrate temperature to the second substrate temperature within a ~~specified~~ preselected time period. ~~to process the film.~~

95. (*previously presented*) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate holder into the substrate.

96. (*previously presented*) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate into the substrate holder.

97. (*previously presented*) The method of claim 94 wherein the etching of at least one of the film portions comprises maintaining the temperature of the substrate in the range of 50°C to 100°C.

98. (*currently amended*) The method of claim 94 wherein the preselected ~~characteristic~~ time period to change from the first substrate temperature to the second substrate temperature subtends less than about 5 percent of ~~the~~ a total etching process time.

99. (*cancelled*) The method of claim 94 wherein the characteristic time period to change from the first substrate temperature to the second substrate temperature subtends less than 15 percent of the total etching process time.

100. (*currently amended*) A method for processing layers which are included in a stack of layers positioned on a substrate, the method comprising:

placing the substrate on a substrate holder;

sensing a substrate holder temperature,

etching at least a portion of a first silicon-containing layer in a chamber while the substrate is maintained at a selected first substrate temperature; and

etching at least a portion of a second silicon-containing layer in the chamber while the substrate is maintained at a selected second substrate temperature;

wherein the substrate holder ~~temperature~~ is heated to ~~maintained above~~ a temperature ~~sufficient to~~ ~~allow~~ ~~controlling~~ operable to maintain at least one of the selected first and the selected second substrate temperatures above 49°C, and

~~the change~~ the substrate temperature is changed from the first substrate temperature to the second substrate temperature ~~occurs in a controlled manner,~~ with a control circuit operable to effectuate the changing within a preselected ~~selected~~ time period that is less than the overall process time associated with the etching the first silicon-containing layer and the second silicon-containing layer.

101. *(previously presented)* The method of claim 100 wherein the change from the first substrate temperature to the second substrate temperature occurs within less than about 5 percent of the total etching process time.

102. *(previously presented)* The method of claim 100 wherein at least one layer is etched in a chlorine-containing ambient.

103. *(currently amended)* The method of claim 100 wherein at least one silicon-containing layer is etched in a chlorine-containing ambient;

the first layer is a polysilicon layer, the second layer is a silicide layer and the stack includes an oxide layer;

the second substrate temperature is higher than the first substrate temperature; and

~~at least one of the etching steps has high selectivity to the oxide layer.~~

a portion of at least one layer is selectively etched relative to the oxide layer.

104. (*currently amended*) A method for manufacturing a device comprising an integrated circuit, the method comprising:

transferring a substrate comprising a stack of layers including a silicide layer into a chamber, the chamber comprising a substrate holder;

sensing the substrate holder temperature;

heating the substrate holder with a substrate holder control circuit and a heating device to maintain ~~a~~ the substrate holder at a temperature that is operable to ~~place~~ effectuate ~~the~~ a substrate temperature above room temperature while processing the substrate;

processing the substrate ~~in the chamber~~ on the substrate holder at a first substrate temperature; and

processing the substrate ~~in the chamber~~ on the substrate holder at a second substrate temperature to etch at least a portion of the silicide layer;

wherein the first substrate temperature is different from the second substrate temperature and the first substrate temperature is changed to the second substrate temperature with a substrate temperature control circuit within a preselected time to etch the silicide layer.

~~wherein the first temperature is different than the second temperature and the first substrate temperature is changed to the second substrate temperature within a selected time that is less than an overall time associated with processing the substrate at the first substrate temperature and processing the substrate at the second substrate temperature to etch the silicide layer.~~

105. (*cancelled*) The method of claim 104 where the first substrate temperature is less than about 90 degrees centigrade and the silicide layer is etched above about 99 degrees centigrade.

106. (*previously presented*) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature within a selected period of time by at least heat transfer to the substrate using at least an electrostatic chuck.

107. (*previously presented*) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring heat using at least a pressure of gas behind the substrate.

108. *(previously presented)* The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

109. *(currently amended)* The method of claim 56 wherein the ~~substrate holder is set to the selected first substrate temperature before the substrate is placed on the substrate holder~~ second portion of the film comprises a material composition different from the first portion of the film.

110. *(currently amended)* The method of claim 56 wherein the change from the first substrate holder temperature to the second substrate holder temperature is effectuated with a control circuit ~~occurs in a controlled manner~~.

111. *(previously presented)* The method of claim 56 wherein the substrate holder reaches the second substrate holder temperature at approximately a selected time.

112. *(currently amended)* The method of claim 70 wherein the first substrate holder ~~operating~~ temperature is above room temperature.

113. *(currently amended)* The method of claim 80 wherein ~~maintaining the substrate holder temperature comprises transferring heat into the substrate holder with a heat transfer device.~~ at least one film treatment comprises transferring energy from the substrate holder with a heat transfer device.

114. (*currently amended*) The method of claim 94 wherein the second portion of the film comprises a material composition different from the first portion of the film ~~change from the first substrate temperature to the second substrate temperature occurs in a controlled manner~~.

115. (*currently amended*) The method of claim 94 wherein the substrate ~~reaches~~ temperature is the second substrate temperature at approximately a selected time.

116. (*currently amended*) The method of claim 104 comprising processing the substrate while maintaining the substrate temperature at a selected value within 180 to 220 degrees centigrade. ~~wherein processing the substrate at the second substrate temperature comprises heating the substrate holder with a heating device and a substrate temperature above room temperature~~

117. (*currently amended*) The method of claim 104 comprising processing the substrate while maintaining the substrate temperature at a selected value within 50 to 100 degrees centigrade. ~~wherein the change from the first substrate temperature to the second substrate temperature occurs in a controlled manner.~~

REMARKS

Applicant thanks the Examiner for graciously granting an interview and taking the time to provide helpful explanations and suggestions.

Prior to this amendment Claims 56-98, 100-104, 106-117 were pending. Claims 1-55, 99 and 105 were previously cancelled.

Claims 56, 58, 68, 70, 72-74, 77, 80-82, 84, 88, 91, 94, 98-101, 103-105, 109, 110, and 112-117 are currently amended pursuant to examiner's guidance..

The Office Action objected to the specification as failing to provide antecedent basis for claims 100 and 109 and it rejected claim 109 under 35 U.S.C. 251. By this amendment these objections and the 35 U.S.C. 251 rejection are mooted.

Claims 99 and 105 are cancelled. The claim identifiers were in error and have been corrected.

Claims 57, 63, 68 and 103 were rejected under 35 U.S.C. 112.

Claims 56-62, 64, 70-71, 74-79, 109-112, and 114 were rejected under 35 U.S.C. 102(b) as being as being anticipated by JP 59-076876.

Claims 70-82, 84-96, 98 and 113-115 were rejected under 35 U.S.C. 102(b) as being anticipated by Tsubone et al (US 5,320,982).

Claims 97-98, 100-104, 106-108 and 116-117 were rejected under 25 U.S.C. 103(a) as being unpatentable over Tsubone et al. (US 5,230,982) in view of Shin et al. (US 6,087,264). Claims 83 and 112 were rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubone et al. (US 5,320,982) in view of Shin et al. (US 6,087,264) and Olson et al. (US 5,705,433).

Claims 63, 65, 66-69 and 72-73 were rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Rossman et al. (US 6,077,357).

Claims 80-89, 91, 97-98, 100-104, 108, 113 and 116-117 were rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Shin et al (US 6,087,264).

Claims 90, 92-93 and 106-17 were rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Shin et al. (US 6087,264) and Rossman et al (US (6,077,357).

The amendments in Claims 56, 58, 68, 70, 72-74, 77, 80-82, 84, 88, 91, 94, 98-101, 103-105, 109, 110, and 112-117 are believed to cure the issues raised by the examiner according to the responses below.. No new matter has been added.

Hence Claims 56-98, 100-104, 106-117 are pending in this application. No new matter is added.

I. Claim 56 Is Not Anticipated by JP 59-076876 Under 35 U.S.C. 102(b) Because by JP 59-076876 Does Not Teach All of the Limitations.

At least, JP 59-076876 does not teach the limitations of setting the substrate holder to a selected first temperature, selecting a thermal mass of the substrate holder for a predetermined temperature change within a specified interval of time during processing, and a specified time interval comprising the time for changing from the selected first substrate holder temperature to the selected second substrate holder temperature.

JP 59-076876 (FIG. 4) merely teaches controlling temperature of two heat transfer fluid reservoirs with controllers at 21 and 22 (to 30C and 60C respectively in the disclosed embodiment), *not* setting the temperature *of the substrate holder* (electrode) itself to a selected first temperature.

The heating in FIG. 4 of JP 59-076876 is by a fluid. Two fluids are for the temperature of the electrode 19. JP59-07686 teaches to change electrode temperature by operating the three way cocks 23 and 24 (p. 5, line 22) to divert one fluid, having a controlled temperature at a reservoir, into the electrode (FIG. 4 clearly shows the arrangement corresponding to the "rough" translated text at page 5, lines 13-15).

The actual temperature of the electrode 19 in FIG 4 is inherently determined by various uncontrolled heat inputs and losses, including from heat transfer while flowing one fluid from one of the reservoirs to the electrode (FIG. 4 shows the arrangement corresponding to the rough translation at page 5, lines 13-15). Therefore, the controllers (control circuits) disclosed by JP 59-076876 are not operable for the substrate holder (electrode) temperature itself or for the substrate temperature.

That the translation is crude and must be selectively read with caution as is apparent from the very beginning of the Detailed Description on p.2. Merely by way of example, on page 2 the terms (1) "overhanging effect" (lines 9-10), "$MoCl_5$ seems to be used as a main component" (lines 17-18), "temperature dependability" (line 19) and "steam pressure" (line 19) are all poorly translated or mistranslated. Applicant submits that it would be obvious to one of ordinary skill in the art that "overhanging effect" refers to *undercutting*, that reference is to $MoCl_5$ as a *reaction product*, that a large temperature *dependence* is meant, and that line 19 refers to *vapor pressure*.

II. Claim 70 Is Not Anticipated by Tsubone under 35 U.S.C. 102(b) At Least Because Tsubone Does not Teach all of the Claim Limitations.

Tsubone does not teach heating the substrate holder with a heat transfer device or a substrate holder having at least one temperature sensing unit. Tsubone teaches *cooling* a substrate holder, not heating it.

Using a heat transfer medium is not heating. The paragraph cited by the examiner beginning at col. 3, line 65 is about circulating a cooling medium (lines 65, 67). Col 4 line 1-2 makes reference to this as a "circulated heat [transfer] medium" (bracketed term inserted) as evidenced by the construction and language immediately preceding and following ("the heat transfer gas" at col 4: line 5, 8, 11, et seq.). Hence the referenced paragraphs merely disclose circulating the medium through the sample bed.

Tsubone discloses *cooling* the substrate holder, not heating it. For example, at col. 2 lines 40-42 and col. 4, lines 52-54, Tsubone teaches that the sample bed is *cooled* by a cooling medium. Tsubone teaches this further at col. 5, lines 27-31 and col. 6, lines 2-3. Moreover, Tsubone teaches that when the substrate is slightly above room temperature at (region i-j) "control is made in the same way as c-d (col. 8, lines 66-68; e.g. as Case I where the sample is cooled to a predetermined temperature lower than room temperature - col. 8, lines 35-37). Hence Tsubone teaches cooling the substrate holder for substrate temperature to be [slightly] above room temperature.

III. Claim 80 Is Not Anticipated by Tsubone under 35 U.S.C. 102(b) Because Tsubone Does not Teach All of the Limitations

At least, Tsubone fails to disclose a plasma discharge apparatus having a substrate holder temperature sensor, a control circuit operable to adjust the substrate holder to a predetermined substrate holder temperature, and heating a substrate holder above room temperature during at least one film treatment.

Tsubone does not teach sensing the temperature of a substrate holder, heating a substrate holder or a system for adjusting the temperature of a substrate holder to a predetermined substrate holder temperature value. Tsubone merely discloses a predetermined temperature of a heat medium before it is sent to the sample bed (col 4, lines 1-3, col. 5, lines 29).and pipes 10 in FIG. 1). Tsubones does not teach adjusting a predetermined temperature of the sample bed. Only the cooling medium is determined, and held at a static temperature of -60C in an embodiment.

IV. Claim 80 is Not Made Unpatentable by Any Combination of JP 59-076876, Shin or Tsubone Under 35 U.S.C. § 103(a) Because No Combination of These References Disclose or Suggest All of the Claim Limitations; Furthermore There is No Suggestion or Motivation to Combine JP 59-076876 or Tsubone with Shin.

There is nothing in Tsubone, JP59-076876 or Shin, alone or in combination to suggest a substrate holder temperature sensor, a substrate holder control circuit operable for adjusting the substrate holder to a predetermined substrate holder temperature, and heating the substrate holder above room temperature for performing one of two film treatment steps. As well there is nothing in any combination of Tsubone, JP59-076876, or Shin, to suggest changing from a selected first substrate temperature to a selected second substrate temperature within a preselected time period with the substrate holder maintained above room temperature during at least one of the steps.

Examiner references mention of a controller in JP-076876. However, as pointed out in (I) above, JP 59-076876 only discloses two controllers that are for controlling the static temperature of two heat transfer fluid reservoirs, numerals 21 and 22 in FIG. 4 of JP-076876 (to 30C and 60C respectively). There is no control circuit for the temperature of the substrate holder or for the temperature of the substrate, nor is there any substrate holder temperature sensor disclosed.

Furthermore, as pointed out by Tsubone (col. 1, lines 44-47), under JP 59-076876, the time for changing from one temperature to another temperature depends on the undisclosed physical properties and characteristics of system and heat transfer embodiments and is very long. JP-076876 teaches nothing to have a control circuit direct adjust temperature change..

There is no motivation for combining Shin with JP-076876 or Tsubone because Shin teaches etching should preferably be in the range of -50C to 0C at one selected temperature. Shin discloses that temperature has a relatively small effect on etch rate (less than about 5-10% when temperature is changed by as much as 100C – see FIG. 5) and that bias power is the dominant effective variable at any one temperature within this preferred range (in Shin: Claim 1, FIG 5 and col. 4, lines 54-57, and col. 5, lines 2-9). Tsubone teaches lowering temperature is for better (higher) selectivity (i.e. col. 1, lines 25-29, col. 7, lines 6-10), counter to Shin which teaches higher selectivity is at higher temperatures.

Shin discloses that an active reaction at the sidewalls is reduced at lower temperature of the substrate so that oxide by products such as TiO can serve as a protective layer (Col. 4, lines 27-30). Shin also discloses that the TiSix layer may not be completely etched at higher temperatures because etching selectivity between a polysilicon layer and a TiSix layer is *greater* at *higher substrate* temperatures, thereby causing residues (col. 4, lines 33-36). Hence Shin teaches away from etching the silicon layers at higher temperature because of the greater likelihood of residues and a compromised profile. Shin makes it very clear that etching the two silicon-containing layers is preferably at a single temperature from -50C to 0C (claims 1, 5 and 9) with selected bias power.

V. Claim 94 Is Not Anticipated by Tsubone under 35 U.S.C. 102(b) Because Tsubone Does not Teach All of the Limitations

Tsubone fails to disclose a substrate holder having a temperature sensor and a control circuit for maintaining the temperature of the substrate holder. Tsubone teaches that the circulated heat medium temperature is merely controlled to a predetermined temperature before it is sent to the sample bed (col 4, lines 1-3). He shows no control circuit or temperature sensor for the sample bed.

Furthermore, Tsubone does not teach transferring heat to the substrate holder with a control circuit.

VI. Claim 100 is Not Anticipated by JP 59-076876 Under 35 U.S.C. § 102 At Least Because JP 59-076876 Does not Teach Changing Temperature with a Control Circuit, Sensing a Substrate Holder Temperature or a Second Temperature at a Selected Time.

There is nothing in JP59-076876 that teaches a control circuit for performing any temperature change. Furthermore JP-076876 does not teach operably changing any temperature within a preselected time or sensing the temperature of a substrate holder.

JP-076876 merely teaches a fluid temperature controller that to control the static temperature of a heat transfer fluid, not of an electrode or a substrate.

The lines cited by the examiner reference teach two distinct controllers, each of which is for maintaining the static temperature of a fluid source in a conventional manner. . JP59-076876 has no disclosure to change any temperature during a process with either of these controllers.

JP59-07686 discloses changing the temperature of an electrode is by merely switching three way cocks 23 and 24. Therefore the manner of temperature change is subject to the vicissitudes of the characteristics of the cocks, the manner in which the cocks are operated, and undisclosed physical properties of embodiments (e.g. volume, mass, fluid flow rates, heat transfer resistances etc.). Therefore, JP59-07686 teaches nothing about effectuating a temperature change with a control circuit.

Furthermore, it was understood by those of ordinary skill in the art that a temperature change effected by conventional equipment disclosed by JP59-07686 would require excessive time to be useful. Tsubone points out that JP59-07686 did not consider the time for a change between two different temperatures (Col. 1, lines 45-55) and that the time for attaining a predetermined processing condition with this JP59-07686 method is inherently long.

Also, it would be obvious to one of ordinary skill in the art that the three lines of temperature in FIG. 5 of JP59-07686 are fictitious (e.g. it only an illustrative drawing). This is at least because heat transfer relations require a smooth S-shaped transition between the (horizontal) steady states (e.g. the "kinks," aka first derivative singularities, are not physically possible). Thus this drawing does not disclose the characteristic of a transition. Moreover, the translation is rough and thereby unreliable as pointed out in Section I, above.

In conclusion, Claim 100 is not anticipated by JP 59-076876.

VII. Claim 100 is Patentable Over JP 59-076876 in View of Shin Under 35 U.S.C. § 103(a) At Least Because No Combination of JP 59-076876 and Shin Teaches Changing a Temperature with a Control Circuit, Reaching a Second Temperature within a Preselected Time Period or Sensing a Substrate Holder Temperature, and There is No Suggestion to Combine.

There is nothing in JP59-076876 that teaches changing a temperature with a control circuit for the reasons set forth in Section VI above. Neither JP-076876 or Shin disclose changing a temperature within a preselected time period that is less than the overall process time associated with etching the first silicon containing layer and the second silicon containing layer.

Furthermore, as pointed out in Section IV above and in Section VIII below, there is no motive or suggestion to combine JP 59-076876 with Shin because Shin teaches away from etching the silicon layers at higher temperature (e.g. above 49C) and teaches that etching the two silicon-containing layers is preferably at a single temperature from -50C to 0C with a selected bias power.

VIII. Claim 100 is Patentable Over a Combination of Tsubone in View of Shin Under 35 U.S.C. § 103(a) Because These References Fail to Include All of the Limitations of the Claim.

Neither Tsubone nor Shin, alone or in any combination disclose sensing a substrate holder temperature. Furthermore, neither Tsubone nor Shin teach etching a first portion of a silicon-containing layer in a chamber while the substrate is maintained at a selected first temperature and etching a portion of a second silicon-containing layer in the chamber while the substrate is maintained at a second substrate temperature; wherein the substrate holder temperature is heated above a temperature sufficient to allow controlling at least one of the selected first and the selected second substrate temperatures above 49C.

Furthermore, there is no motivation for combining Tsubone with Shin because Shin teaches etching two layers in one step and etching preferably in the range of -50C to 0C at one selected temperature. Shin discloses that temperature has a relatively small effect on etch rate (less than about 5-10% when temperature is changed by as much as 100C – see FIG. 5) and that bias power is the leading effective variable within this preferred range (see claim 1, FIG 5 and col. 4, lines 54-57 and col. 5, lines 2-9).

Tsubone teaches changing temperature for high selectivity, particularly when overetching (col. 1, lines 25-29, 31-35 and col. 7 lines 5-10). In contradistinction, Shin teaches selecting temperature for a desirable profile, not for selectivity between the two silicon-containing layers. Shin discloses that an active reaction at the sidewalls is reduced by lowering temperature of the substrate so that oxide by products such as TiO can serve as a protective layer (Col. 4, lines 27-30). Shin further discloses that the TiSix layer may not be completely etched at higher temperatures because etching selectivity between a polysilicon layer and a TiSix layer is *higher* with an *increase* in the temperature of the substrate, causing residues (col. 4, lines 33-36 and Fig. 5). Hence Shin teaches away from etching the silicon layers at higher temperature and discloses that etching the two silicon-containing layers is preferably at a single temperature from -50C to 0C (claims 1, 5 and 9) with a selected bias power.

IX. Claim 104 is Patentable Over Tsubone in View of Shin Under 35 U.S.C. § 103(a) Because These References, Separately or in Combination, Fail to Disclose All of the Limitations of the Claim and There Is No Motivation to Combine.

Neither Tsubone, nor Shin, or Tsubone in view of Shin teach or suggest all of the limitations of Claim 104. For example, neither Tsubone nor Shin disclose sensing the substrate holder temperature. As well neither suggest heating a substrate holder with a heating device and a substrate holder control circuit to maintain a substrate holder temperature operable to effectuate a substrate temperature above room temperature while processing a substrate on a substrate holder at a first substrate temperature; and processing the substrate on the substrate holder a second substrate temperature to etch at least a portion of the silicide layer within a preselected time to etch the silicide layer.

Moreover there is no motivation to combine and no suggestion or motivation to etch a silicide layer above room temperature based on a combination. The Tsubone reference and the Shin art both teach that etching a substrate below room temperature is preferred. However Tsubone teaches higher selectivity at lower temperature (Tsubone Col. 7, lines 5-10, lines 40-45) whereas Shin teaches the opposite lower selectivity at lower temperature. Furthermore, Shin teaches substrate temperature less than room temperature, at -50 to 0C, is preferred.

As for teaching away from a combination to etch at high temperature, Shin discloses a substrate temperature less than room temperature, at -50 to 0C, is advantageous both for sidewall protection and avoiding residues, as already pointed out in the discussion in Sections IV and VIII above. The purpose of Shin is to etch TiSix and Si layers (numerals 8 and 6 in FIG.1 of Shin) together in one step and obtain a desirable profile. There is nothing in these references to suggest the possibility of improving profile by changing temperature during the etching. Shin discloses the advantages of etching both layers at a temperature below room temperature, with selected pressure, power, etc. for a desirable profile of the two-layer stack. Still further, the purpose of Shin *is to etch both* silicon-containing layers with a single set of process variables *without* etching an oxide layer (numeral 4 in FIG 1). It was known to those of ordinary skill in the art that selectivity for etching over oxide usually improves as temperature is lowered (see, for example, pps.118-121 Plasma Etching, An Introduction, Academic Press, 1989, eds. D. M. Manos, D. L. Flamm).. For this reason as well, one of ordinary skill in the art would have motivation to perform the Shin process below room temperature and not above.

X. Claim 104 is Patentable Over JP 59076876 in View of Shin Under 35 U.S.C. § 103(a) Because These References, Separately or in Combination, Fail to Disclose All of the Limitations of the Claim and There Is No Motivation to Combine.

Neither JP 59-076876, nor Shin, or JP 59-076876 in view of Shin teach or suggest all of the limitations of Claim 104. For example, neither JP 59-076876 nor Shin suggest sensing the substrate holder temperature. As well neither disclose heating a substrate holder with a heating device and a substrate holder control circuit maintaining a substrate holder temperature operable to effectuate a substrate temperature above room temperature. Moreover, neither disclose processing a substrate on a substrate holder at a first substrate temperature; and processing the substrate on the substrate holder at second substrate temperature to etch at least a portion of the silicide layer within a preselected time to etch the silicide layer.

As already pointed out in the preceding sections, JP 59-076876 discloses neither a control circuit for the temperature of the substrate nor changing any temperature with a control circuit.

Furthermore, for reasons already set forth in Section XI above, there is no suggestion or motivate to combine these references because Shin teaches to a substrate in the range of -50C to 0C for better sidewall protection, less propensity for forming residue, and a desirable profile in one processing step.

XI. Dependent Claims 57-69,71-79, 81-93, 95-99, 101-103, and 105-117 Are Allowable at least for the Reasons Enumerated in Sections I-VIII Above.

Claims 57-62 and 109-111 include all of the limitations of Claim 1. Since it is believed that Claim 1 is allowable for the reasons enumerated above, it is respectfully submitted that the Claims 57-69 and 109-111 depending on Claim 1 are also allowable.

Claims 71-79 and 112 include all of the limitations of Claim 70. For the reasons enumerated above, it is respectfully submitted that Claims 71-79 and 112 should be allowed.

Claims 81-93 and 113 include all of the limitations of Claim 80. Hence it is respectfully submitted that Claims 81-93 and 113 should be allowed for the reasons above.

Claims 95-99 and 114-115 include all of the limitations of Claim 94. For the reasons above, it is respectfully submitted that Claims 95-99 and 114-115 are allowable for the reasons above.

Claims 101-103 and 116-117 include all of the limitations of Claim 100. For the reasons above, it is respectfully submitted that Claims 95-99 and 116-117 are allowable for the reasons above.

Claims 106-108 include all of the limitations of Claim 105. For the reasons above, it is respectfully submitted that Claims 106-108 are allowable for the reasons above.

XII. "In a controlled manner" with Reference to the Previously Presented Claim 100 Under 35 U.S.C. § 112 Is Supported By the Specification .

At least at col. 2, line 34-36 teaches "effecting *a suitable controlled change* in temperature," Furthermore there is detailed description of various embodiments to change various temperatures in a controlled manner (for example cols. 16 and 17).

XIII. The Term "a plurality of heating elements" in Claim 56 with Reference to 35 U.S.C. § 112 is Supported in the Specification.

Embodiments having a "plurality of heating elements" are taught at least in col. 15, lines 6-22.

XIV. The Term Substantially in Claim 63 is Supported by the Specification and Does Not Render the Claim Indefinite Under 35 U.S.C. § 112.

The term "substantially" to reference a similarity of temperatures has antecedent basis in the specification at least at col. 15, line 23, col. 17 line 18. The term "substantially" is not indefinite per se (MPEP 2173.05(b) (D.)). Applicant further points out that the specification provides a guideline for a temperature being substantially the same as another at col. 15, line2 23-28. "Providing a *substantially uniform temperature*" (at line 23) is "in a specific embodiment," (at line 25) "within one degree Celsius" (at line 25). Therefore the term is sufficiently definite in view of the specification.

VII. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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Date: October 2, 2006

PTO/SB/06 (08-03)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 10/439245

CLAIMS AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE	FEE		RATE	FEE
BASIC FEE (37 CFR 1.16(a))				$____	OR		$____
TOTAL CLAIMS (37 CFR 1.16(c))	minus 20 =	*	X $____ =		OR	X $____ =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	minus 3 =	*	X $____ =		OR	X $____ =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))			+$____ =		OR	+$____ =	
			TOTAL		OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

CLAIMS AS AMENDED – PART II

AMENDMENT A

10/6/06	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 60	Minus	** 63	= 0	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	= 0	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+$____ =		OR	+$____ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

[illegible]	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 60	Minus	** 63	= /	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	= /	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+$____ =		OR	+$____ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	*	Minus	**	=	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	*	Minus	***	=	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+$____ =		OR	+$____ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 10/18/2006

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EXAMINER	
ALANKO, ANITA KAREN	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 10/18/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

C

Notice of Non-Compliant Amendment (37 CFR 1.121)	**Application No.** 10439245	**Applicant(s)**	
	Examiner	**Art Unit**	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

The amendment document filed on 06 October 2006 is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121 or 1.4. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

☐ 1. Amendments to the specification:
- ☐ A. Amended paragraph(s) do not include markings.
- ☐ B. New paragraph(s) should not be underlined.
- ☐ C. Other _____.

☐ 2. Abstract:
- ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
- ☐ B. Other _____.

☐ 3. Amendments to the drawings:
- ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
- ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
- ☐ C. Other _____.

☒ 4. Amendments to the claims:
- ☐ A. A complete listing of all of the claims is not present.
- ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
- ☒ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
- ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
- ☒ E. Other: *claim 101 is identified as "currently amended" but there are no markings to show changes*.

☐ 5. Other (e.g., the amendment is unsigned or not signed in accordance with 37 CFR 1.4):

–

For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714.

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment, an amendment filed after allowance, or a drawing submission (only). If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted.

2. Applicant is given **one month**, or thirty (30) days, whichever is longer, from the mail date of this notice to supply the correction, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a *Quayle* action. If any of above boxes 1. to 4. are checked, the correction required is only the **corrected section** of the non-compliant amendment in compliance with 37 CFR 1.121.

Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.

Failure to timely respond to this notice will result in:
Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or
Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

Veronica Augburn-Seaforth 5712720988
Legal Instruments Examiner (LIE), if applicable Telephone No.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 10/11/2006

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EXAMINER	
ALANKO, ANITA KAREN	
ART UNIT	**PAPER NUMBER**
1765	

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Interview Summary	Application No.	Applicant(s)	
	10/439,245	FLAMM, DANIEL L.	
	Examiner	Art Unit	
	Anita K. Alanko	1765	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Anita K. Alanko*. (3) *J. Davis Gilmer*.

(2) *Daniel L. Flamm*. (4)_____.

Date of Interview: *30 September 2006*.

Type: a)☒ Telephonic b)☐ Video Conference

c)☐ Personal [copy given to: 1)☐ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: _____.

Identification of prior art discussed: *JP 59-076876; Tsubone*.

Agreement with respect to the claims f)☐ was reached. g)☒ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *discussed objection to specification, 112 rejection and prior art rejections. Claim limitations of selecting a thermal mass, heating the substrate holder and including a control circuit were discussed since JP '876 has a three-way cock and not a control circuit and Tsubone is directed to cooling, not heating*.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Anita Alanko
ANITA ALANKO
PRIMARY EXAMINER

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Examiner's signature, if required

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)
In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

IFW

1765/#

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October 2, 2006

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Daniel L. Flamm

Docket No: OA0301

Appln. No.: 10/439,245

Group Art Unit: 1765

Filed: 5/14/2003

Examiner: A. Alanko

AMENDMENT UNDER 37 C.F.R. § 1.111

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated, June 1, 2006, please amend the above-identified application as follows on the accompanying pages.

TABLE OF CONTENTS

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1.-55 (*canceled*)

56. (*currently amended*) A method of etching a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a chamber, the substrate holder having a selected thermal mass;

setting the substrate holder to a selected first substrate holder temperature with a heat transfer device;

etching a first portion of the film while the substrate holder is at the selected first substrate holder temperature;

with the heat transfer device, changing the substrate holder temperature from the selected first substrate holder temperature to a selected second substrate holder temperature; and

etching a second portion of the film while the substrate holder is at the selected second substrate holder temperature;

~~wherein the thermal mass of the substrate holder is selected to allow changing the first substrate holder temperature to the second substrate holder temperature within a selected time period.~~

wherein the thermal mass of the substrate holder is selected for a predetermined temperature change within a specified interval of time during processing; the predetermined temperature change comprises the change from the from the selected first substrate holder temperature to the selected second substrate holder temperature, and the specified time interval comprises the time for changing from the selected first substrate holder temperature to the selected second substrate holder temperature.

57. (*currently amended*) The method of claim 56 wherein the ~~first substrate holder temperature is changed to the~~ second ~~substrate holder temperature by heat transfer means coupled to the substrate holder~~ portion of the film comprises a material composition that is different from the material composition of the first portion of the film.

58. (*currently amended*) The method of claim 56 wherein the change from the first substrate holder temperature to the second substrate holder temperature is an in–situ process during the first portion etching ~~step~~ and the second portion etching ~~step~~.

59. (*previously presented*) The method of claim 56 wherein the etching of the first portion of the film and the etching of the second portion of the film are conducted in a substantially constant plasma environment.

60. (*previously presented*) The method of claim 56 wherein etching at least one of the portions of the film comprises radiation.

61. (*previously presented*) The method of claim 56 wherein etching at least one of the portions of the film is an ion bombardment aided process.

62. (*previously presented*) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature; and

the first and the second substrate etching temperatures are in a known relationship to the first and the second substrate holder temperatures.

63. (*previously presented*) The method of claim 62 wherein the first etching temperature is substantially the first substrate holder temperature and the second etching temperature is substantially the second substrate holder temperature.

64. (*previously presented*) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is higher than the second substrate etching temperature; and

the first portion of the film is etched before the second portion of the film.

65. (*previously presented*) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is lower than the second substrate etching temperature; and

the first portion of the film is etched before the second portion of the film.

66. (*previously presented*) The method of claim 56 wherein the substrate holder comprises an electrostatic support chuck having a surface for supporting a substrate in a reaction chamber, the electrostatic support chuck overlays a heat exchange region, and the heat exchange region includes at least one fluid passage through which a fluid can be circulated to heat and/or cool the substrate holder.

67. (*previously presented*) The method of claim 66 wherein the heat exchange region includes at least two separate fluid passages, each fluid passage being configured to have an independent inlet and an independent outlet.

68. (*currently amended*) The method of claim 56 wherein the substrate holder heat transfer device includes a plurality of heating elements.

69. (*previously presented*) The method of claim 68 wherein the heating elements are configured to selectively heat one or more zones of the substrate holder.

70. (*currently amended*) A method of etching a substrate in the manufacture of a device, the method comprising:

heating ~~the~~ a substrate holder to a first substrate holder ~~operating~~ temperature with a heat transfer device, the substrate holder having at least one temperature sensing unit,

placing a substrate having a film thereon on ~~a~~ the substrate holder in a chamber;

etching a first portion of the film at a selected first substrate temperature; and

etching a second portion of the film at a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature;

wherein substrate temperature is changed from the selected first substrate temperature to the selected second substrate temperature, using a measured wafer temperature, within a preselected time interval for processing, and at least the first substrate temperature or the second substrate temperature, in single or in combination, is above room temperature. ~~operating the substrate holder at the first temperature enables the substrate temperature to be above room temperature while etching at least one of the portions of the film, and the selected first substrate~~

~~temperature is operable to be changed to the selected second substrate temperature within a selected time period to process the film.~~

71. *(previously presented)* The method of claim 70 wherein a continuous etching process comprises etching the first portion of the film and etching the second portion of the film.

72. *(currently amended)* The method of claim 70 wherein the ~~first substrate temperature is changed to the second substrate temperature within a selected period of time~~ substrate temperature change is by at least heat transfer with the substrate using at least an electrostatic chuck.

73. *(currently amended)* The method of claim 70 wherein the ~~first substrate temperature is changed to the second substrate temperature~~ substrate temperature change is by transferring heat energy using at least a pressure of gas behind said substrate.

74. *(currently amended)* The method of claim 70 wherein ~~said~~ the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

75. (*previously presented*) The method of claim 70 wherein changing the substrate temperature comprises selectively transferring energy in the form of heat from a substrate temperature control system to the substrate holder.

76. (*previously presented*) The method of claim 70 wherein changing the selected first substrate temperature to the selected second substrate temperature is an in-situ process while etching the first film portion and etching the second film portion.

77. (*currently amended*) The method of claim 70 wherein the ~~etching of the first portion of the film and the etching of the~~ second portion of the film ~~are conducted in a substantially constant plasma environment~~ comprises a material composition that is different from the material composition of the first portion of the film~~.~~

78. (*previously presented*) The method of claim 70 wherein etching at least one portion of the film comprises radiation.

79. (*previously presented*) The method of claim 70 wherein etching at least one portion of the film comprises an ion bombardment aided process.

80. (*currently amended*) A method of processing a substrate during the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder within a chamber of a plasma discharge apparatus, the plasma discharge apparatus comprising: ~~a substrate temperature sensor,~~ a substrate temperature control system ~~including~~ comprising a substrate temperature sensor and a substrate temperature control circuit operable to adjust the substrate temperature to a predetermined substrate temperature value with a ~~execute~~ first heat transfer process; and ~~the substrate holder having~~ a substrate holder temperature control system comprising a substrate holder temperature sensor and a substrate holder temperature control circuit operable to adjust the substrate holder temperature to a predetermined substrate holder temperature value with a second heat transfer process;

performing a first film treatment of a first portion of the film at a selected first substrate temperature;

with the substrate temperature control circuit, changing from the selected first substrate temperature to a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature; and

performing a second film treatment of a second portion of the film at the selected second substrate temperature;

maintaining the substrate holder temperature such that the substrate temperature remains above room temperature during at least one of the film treatments and the change from the first substrate temperature to the second substrate temperature occurs within a predetermined time period to process the film.

wherein the substrate holder is heated above room temperature during at least one of the first or the second film treatments, and the substrate temperature control circuit is operable to change the substrate temperature from the selected first substrate temperature to the selected second substrate temperature ~~occurs~~ within a ~~predetermined~~ preselected time period to process the film.

81. (*currently amended*) The method of claim 80 wherein the substrate temperature control circuit ~~system~~ comprises the substrate holder temperature control circuit ~~system~~.

82. (*currently amended*) The method of claim 80 wherein the substrate holder temperature control circuit ~~system~~ comprises the substrate temperature control circuit ~~system~~.

83. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises the substrate temperature being less than the substrate holder temperature.

84. (*currently amended*) The method of claim 80 wherein ~~at least one film treatment, selected from the first film treatment and the second film treatment, comprises the substrate temperature being greater than the substrate holder temperaturer~~ the second portion of the film comprises a material composition that is different from the material composition of the first portion of the film.

85. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate holder to the substrate.

86. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate to the substrate holder.

87. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises maintaining the temperature of the substrate holder above room temperature and selectively transferring heat energy from the substrate into the substrate holder.

88. (*currently amended*) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring energy in the form of heat ~~from the substrate temperature control system~~ to the substrate holder with the substrate temperature control circuit and maintaining the substrate holder temperature above room temperature <u>with the substrate holder control circuit</u>.

89. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises etching.

90. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises chemical vapor deposition.

91. (*currently amended*) The method of claim 80 wherein at least one film treatment <u>comprises maintaining the substrate temperature at a selected value from about 300 to 500 degrees centigrade</u>~~, selected from the first film treatment and the second film treatment, is an ion assisted process~~.

92. (previously presented) The method of claim 80 wherein the first temperature is changed to the second temperature by transferring heat using at least a pressure of gas behind the substrate.

93. (previously presented) The method of claim 80 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

94. (*currently amended*) A method of processing a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a processing chamber; the processing chamber comprising the substrate holder, a substrate control circuit operable to adjust the substrate temperature ~~control system to control the temperature of the substrate~~, a substrate holder temperature sensor, and a substrate holder control circuit operable to maintain the substrate holder temperature~~ control system to control the temperature of the substrate holder~~;

performing a first etching of a first portion of the film at a selected first substrate temperature;

performing a second etching of a second portion of the film at a selected second substrate temperature, the second temperature being different from the first temperature;

wherein at least one of the film portions is etched while heat is being transferred ~~from the substrate holder control system~~ to the substrate holder with the substrate holder control circuit ~~control system~~; and

~~effectuating a~~ the substrate temperature control circuit effectuates the change ~~in the substrate temperature~~ from the first substrate temperature to the second substrate temperature within a ~~specified~~ preselected time period. ~~to process the film.~~.

95. (*previously presented*) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate holder into the substrate.

96. (*previously presented*) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate into the substrate holder.

97. (*previously presented*) The method of claim 94 wherein the etching of at least one of the film portions comprises maintaining the temperature of the substrate in the range of 50°C to 100°C.

98. (*currently amended*) The method of claim 94 wherein the preselected ~~characteristic~~ time period to change from the first substrate temperature to the second substrate temperature subtends less than about 5 percent of ~~the~~ a total etching process time.

99. (*cancelled*) The method of claim 94 wherein the characteristic time period to change from the first substrate temperature to the second substrate temperature subtends less than 15 percent of the total etching process time.

100. (*currently amended*) A method for processing layers which are included in a stack of layers positioned on a substrate, the method comprising:

placing the substrate on a substrate holder;

sensing a substrate holder temperature,

etching at least a portion of a first silicon-containing layer in a chamber while the substrate is maintained at a selected first substrate temperature; and

etching at least a portion of a second silicon-containing layer in the chamber while the substrate is maintained at a selected second substrate temperature;

wherein the substrate holder ~~temperature~~ is heated to ~~maintained above~~ a temperature ~~sufficient to allow controlling~~ operable to maintain at least one of the selected first and the selected second substrate temperatures above 49°C, and

~~the change~~ the substrate temperature is changed from the first substrate temperature to the second substrate temperature ~~occurs in a controlled manner,~~ with a control circuit operable to effectuate the changing within a preselected ~~selected~~ time period that is less than the overall process time associated with the etching the first silicon-containing layer and the second silicon-containing layer.

101. (*currently amended*) The method of claim 100 wherein the change from the first substrate temperature to the second substrate temperature occurs within less than about 5 percent of the total etching process time.

102. (*previously presented*) The method of claim 100 wherein at least one layer is etched in a chlorine-containing ambient.

103. (*currently amended*) The method of claim 100 wherein at least one silicon-containing layer is etched in a chlorine-containing ambient;

the first layer is a polysilicon layer, the second layer is a silicide layer and the stack includes an oxide layer;

the second substrate temperature is higher than the first substrate temperature; and

~~at least one of the etching steps has high selectivity to the oxide layer~~.

a portion of at least one layer is selectively etched relative to the oxide layer.

104. (*currently amended*) A method for manufacturing a device comprising an integrated circuit, the method comprising:

transferring a substrate comprising a stack of layers including a silicide layer into a chamber, the chamber comprising a substrate holder;

sensing the substrate holder temperature;

heating the substrate holder with a substrate holder control circuit and a heating device to maintain ~~a~~ the substrate holder at a temperature that is operable to ~~place~~ effectuate ~~the~~ a substrate temperature above room temperature while processing the substrate;

processing the substrate ~~in the chamber~~ on the substrate holder at a first substrate temperature;

processing the substrate ~~in the chamber~~ on the substrate holder at a second substrate temperature to etch at least a portion of the silicide layer;

wherein the first substrate temperature is different ~~than~~ from the second substrate temperature and the first substrate temperature is changed to the second substrate temperature with a substrate temperature control circuit within a preselected time to etch the silicide layer..

~~wherein the first temperature is different than the second temperature and the first substrate temperature is changed to the second substrate temperature within a selected time that is less than an overall time associated with processing the substrate at the first substrate temperature and processing the substrate at the second substrate temperature to etch the silicide layer.~~

105. (*cancelled*) The method of claim 104 where the first substrate temperature is less than about 90 degrees centigrade and the silicide layer is etched above about 99 degrees centigrade.

106. (*previously presented*) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature within a selected period of time by at least heat transfer to the substrate using at least an electrostatic chuck.

107. (*previously presented*) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring heat using at least a pressure of gas behind the substrate.

108. (*previously presented*) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

109. (*currently amended*) The method of claim 56 wherein the second portion of the film comprises a material composition different from the first portion of the film.

110. (*currently amended*) The method of claim 56 wherein the change from the first substrate holder temperature to the second substrate holder temperature is effectuated with a control circuit ~~occurs in a controlled manner~~.

111. (*previously presented*) The method of claim 56 wherein the substrate holder reaches the second substrate holder temperature at approximately a selected time.

112. (*currently amended*) The method of claim 70 wherein the first substrate holder ~~operating~~ temperature is above room temperature.

113. (*currently amended*) The method of claim 80 wherein ~~maintaining the substrate holder temperature comprises transferring heat into the substrate holder with a heat transfer device.~~at least one film treatment comprises transferring energy from the substrate holder with a heat transfer device.

114. (*currently amended*) The method of claim 94 wherein the second portion of the film comprises a material composition different from the first portion of the film ~~change from the first substrate temperature to the second substrate temperature occurs in a controlled manner~~.

115. (*currently amended*) The method of claim 94 wherein the substrate ~~reaches~~ temperature is the second substrate temperature at approximately a selected time.

116. (*currently amended*) The method of claim 104 comprising processing the substrate while maintaining the substrate temperature at a selected value within 180 to 220 degrees centigrade. ~~wherein processing the substrate at the second substrate temperature comprises heating the substrate holder with a heating device and a substrate temperature above room temperature~~

117. (*currently amended*) The method of claim 104 comprising processing the substrate while maintaining the substrate temperature at a selected value within 50 to 100 degrees centigrade. ~~wherein the change from the first substrate temperature to the second substrate temperature occurs in a controlled manner.~~

REMARKS

Applicant thanks the Examiner for graciously granting an interview and taking the time to provide helpful explanations and suggestions.

Prior to this amendment Claims 56-98, 100-104, 106-117 were pending. Claims 1-55, 99 and 105 were previously cancelled.

Claims 56, 58, 68, 70, 72-74, 77, 80-82, 84, 88, 91, 94, 98-101, 103-105, 109, 110, and 112-117 are currently amended pursuant to examiner's guidance..

The Office Action objected to the specification as failing to provide antecedent basis for claims 100 and 109 and it rejected claim 109 under 35 U.S.C. 251. By this amendment these objections and the 35 U.S.C. 251 rejection are mooted.

Claims 99 and 105 are cancelled. The claim identifiers were in error and have been corrected.

Claims 57, 63, 68 and 103 were rejected under 35 U.S.C. 112.

Claims 56-62, 64, 70-71, 74-79, 109-112, and 114 were rejected under 35 U.S.C. 102(b) as being as being anticipated by JP 59-076876.

Claims 70-82, 84-96, 98 and 113-115 were rejected under 35 U.S.C. 102(b) as being anticipated by Tsubone et al (US 5,320,982).

Claims 97-98, 100-104, 106-108 and 116-117 were rejected under 25 U.S.C. 103(a) as being unpatentable over Tsubone et al. (US 5,230,982) in view of Shin et al. (US 6,087,264). Claims 83 and 112 were rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubone et al. (US 5,320,982) in view of Shin et al. (US 6,087,264) and Olson et al. (US 5,705,433).

Claims 63, 65, 66-69 and 72-73 were rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Rossman et al. (US 6,077,357).

Claims 80-89, 91, 97-98, 100-104, 108, 113 and 116-117 were rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Shin et al (US 6,087,264).

Claims 90, 92-93 and 106-17 were rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Shin et al. (US 6087,264) and Rossman et al (US (6,077,357).

The amendments in Claims 56, 58, 68, 70, 72-74, 77, 80-82, 84, 88, 91, 94, 98-101, 103-105, 109, 110, and 112-117 are believed to cure the issues raised by the examiner according to the responses below.. No new matter has been added.

Hence Claims 56-98, 100-104, 106-117 are pending in this application. No new matter is added.

I. Claim 56 Is Not Anticipated by JP 59-076876 Under 35 U.S.C. 102(b) Because by JP 59-076876 Does Not Teach All of the Limitations.

At least, JP 59-076876 does not teach the limitations of setting the substrate holder to a selected first temperature, selecting a thermal mass of the substrate holder for a predetermined temperature change within a specified interval of time during processing, and a specified time interval comprising the time for changing from the selected first substrate holder temperature to the selected second substrate holder temperature.

JP 59-076876 (FIG. 4) merely teaches controlling temperature of two heat transfer fluid reservoirs with controllers at 21 and 22 (to 30C and 60C respectively in the disclosed embodiment), *not* setting the temperature *of the substrate holder* (electrode) itself to a selected first temperature.

The heating in FIG. 4 of JP 59-076876 is by a fluid. Two fluids are for the temperature of the electrode 19. JP59-07686 teaches to change electrode temperature by operating the three way cocks 23 and 24 (p. 5, line 22) to divert one fluid, having a controlled temperature at a reservoir, into the electrode (FIG. 4 clearly shows the arrangement corresponding to the "rough" translated text at page 5, lines 13-15).

The actual temperature of the electrode 19 in FIG 4 is inherently determined by various uncontrolled heat inputs and losses, including from heat transfer while flowing one fluid from one of the reservoirs to the electrode (FIG. 4 shows the arrangement corresponding to the rough translation at page 5, lines 13-15). Therefore, the controllers (control circuits) disclosed by JP 59-076876 are not operable for the substrate holder (electrode) temperature itself or for the substrate temperature.

That the translation is crude and must be selectively read with caution as is apparent from the very beginning of the Detailed Description on p.2. Merely by way of example, on page 2 the terms (1) "overhanging effect" (lines 9-10), "$MoCl_5$ seems to be used as a main component" (lines 17-18), "temperature dependability" (line 19) and "steam pressure" (line 19) are all poorly translated or mistranslated. Applicant submits that it would be obvious to one of ordinary skill in the art that "overhanging effect" refers to *undercutting*, that reference is to $MoCl_5$ as a *reaction product*, that a large temperature *dependence* is meant, and that line 19 refers to *vapor pressure*.

II. Claim 70 Is Not Anticipated by Tsubone under 35 U.S.C. 102(b) At Least Because Tsubone Does not Teach all of the Claim Limitations.

Tsubone does not teach heating the substrate holder with a heat transfer device or a substrate holder having at least one temperature sensing unit. Tsubone teaches *cooling* a substrate holder, not heating it.

Using a heat transfer medium is not heating. The paragraph cited by the examiner beginning at col. 3, line 65 is about circulating a cooling medium (lines 65, 67). Col 4 line 1-2 makes reference to this as a "circulated heat [transfer] medium" (bracketed term inserted) as evidenced by the construction and language immediately preceding and following ("the heat transfer gas" at col 4: line 5, 8, 11, et seq.). Hence the referenced paragraphs merely disclose circulating the medium through the sample bed.

Tsubone discloses *cooling* the substrate holder, not heating it. For example, at col. 2 lines 40-42 and col. 4, lines 52-54, Tsubone teaches that the sample bed is *cooled* by a cooling medium. Tsubone teaches this further at col. 5, lines 27-31 and col. 6, lines 2-3. Moreover, Tsubone teaches that when the substrate is slightly above room temperature at (region i-j) "control is made in the same way as c-d (col. 8, lines 66-68; e.g. as Case I where the sample is cooled to a predetermined temperature lower than room temperature - col. 8, lines 35-37). Hence Tsubone teaches cooling the substrate holder for substrate temperature to be [slightly] above room temperature.

III. Claim 80 Is Not Anticipated by Tsubone under 35 U.S.C. 102(b) Because Tsubone Does not Teach All of the Limitations

At least, Tsubone fails to disclose a plasma discharge apparatus having a substrate holder temperature sensor, a control circuit operable to adjust the substrate holder to a predetermined substrate holder temperature, and heating a substrate holder above room temperature during at least one film treatment.

Tsubone does not teach sensing the temperature of a substrate holder, heating a substrate holder or a system for adjusting the temperature of a substrate holder to a predetermined substrate holder temperature value. Tsubone merely discloses a predetermined temperature of a heat medium before it is sent to the sample bed (col 4, lines 1-3, col. 5, lines 29).and pipes 10 in FIG. 1). Tsubones does not teach adjusting a predetermined temperature of the sample bed. Only the cooling medium is determined, and held at a static temperature of -60C in an embodiment.

IV. Claim 80 is Not Made Unpatentable by Any Combination of JP 59-076876, Shin or Tsubone Under 35 U.S.C. § 103(a) Because No Combination of These References Disclose or Suggest All of the Claim Limitations; Furthermore There is No Suggestion or Motivation to Combine JP 59-076876 or Tsubone with Shin.

There is nothing in Tsubone, JP59-076876 or Shin, alone or in combination to suggest a substrate holder temperature sensor, a substrate holder control circuit operable for adjusting the substrate holder to a predetermined substrate holder temperature, and heating the substrate holder above room temperature for performing one of two film treatment steps. As well there is nothing in any combination of Tsubone, JP59-076876, or Shin, to suggest changing from a selected first substrate temperature to a selected second substrate temperature within a preselected time period with the substrate holder maintained above room temperature during at least one of the steps.

Examiner references mention of a controller in JP-076876. However, as pointed out in (I) above, JP 59-076876 only discloses two controllers that are for controlling the static temperature of two heat transfer fluid reservoirs, numerals 21 and 22 in FIG. 4 of JP-076876 (to 30C and 60C respectively). There is no control circuit for the temperature of the substrate holder or for the temperature of the substrate, nor is there any substrate holder temperature sensor disclosed.

Furthermore, as pointed out by Tsubone (col. 1, lines 44-47), under JP 59-076876, the time for changing from one temperature to another temperature depends on the undisclosed physical properties and characteristics of system and heat transfer embodiments and is very long. JP-076876 teaches nothing to have a control circuit direct adjust temperature change..

There is no motivation for combining Shin with JP-076876 or Tsubone because Shin teaches etching should preferably be in the range of -50C to 0C at one selected temperature. Shin discloses that temperature has a relatively small effect on etch rate (less than about 5-10% when temperature is changed by as much as 100C – see FIG. 5) and that bias power is the dominant effective variable at any one temperature within this preferred range (in Shin: Claim 1, FIG 5 and col. 4, lines 54-57, and col. 5, lines 2-9). Tsubone teaches lowering temperature is for better (higher) selectivity (i.e. col. 1, lines 25-29, col. 7, lines 6-10), counter to Shin which teaches higher selectivity is at higher temperatures.

Shin discloses that an active reaction at the sidewalls is reduced at lower temperature of the substrate so that oxide by products such as TiO can serve as a protective layer (Col. 4, lines 27-30). Shin also discloses that the TiSix layer may not be completely etched at higher temperatures because etching selectivity between a polysilicon layer and a TiSix layer is *greater* at *higher substrate* temperatures, thereby causing residues (col. 4, lines 33-36). Hence Shin teaches away from etching the silicon layers at higher temperature because of the greater likelihood of residues and a compromised profile. Shin makes it very clear that etching the two silicon-containing layers is preferably at a single temperature from -50C to 0C (claims 1, 5 and 9) with selected bias power.

V. Claim 94 Is Not Anticipated by Tsubone under 35 U.S.C. 102(b) Because Tsubone Does not Teach All of the Limitations

Tsubone fails to disclose a substrate holder having a temperature sensor and a control circuit for maintaining the temperature of the substrate holder. Tsubone teaches that the circulated heat medium temperature is merely controlled to a predetermined temperature before it is sent to the sample bed (col 4, lines 1-3). He shows no control circuit or temperature sensor for the sample bed.

Furthermore, Tsubone does not teach transferring heat to the substrate holder with a control circuit.

VI. Claim 100 is Not Anticipated by JP 59-076876 Under 35 U.S.C. § 102 At Least Because JP 59-076876 Does not Teach Changing Temperature with a Control Circuit, Sensing a Substrate Holder Temperature or a Second Temperature at a Selected Time.

There is nothing in JP59-076876 that teaches a control circuit for performing any temperature change. Furthermore JP-076876 does not teach operably changing any temperature within a preselected time or sensing the temperature of a substrate holder.

JP-076876 merely teaches a fluid temperature controller that to control the static temperature of a heat transfer fluid, not of an electrode or a substrate.

The lines cited by the examiner reference teach two distinct controllers, each of which is for maintaining the static temperature of a fluid source in a conventional manner. . JP59-076876 has no disclosure to change any temperature during a process with either of these controllers.

JP59-07686 discloses changing the temperature of an electrode is by merely switching three way cocks 23 and 24. Therefore the manner of temperature change is subject to the vicissitudes of the characteristics of the cocks, the manner in which the cocks are operated, and undisclosed physical properties of embodiments (e.g. volume, mass, fluid flow rates, heat transfer resistances etc.). Therefore, JP59-07686 teaches nothing about effectuating a temperature change with a control circuit.

Furthermore, it was understood by those of ordinary skill in the art that a temperature change effected by conventional equipment disclosed by JP59-07686 would require excessive time to be useful. Tsubone points out that JP59-07686 did not consider the time for a change between two different temperatures (Col. 1, lines 45-55) and that the time for attaining a predetermined processing condition with this JP59-07686 method is inherently long.

Also, it would be obvious to one of ordinary skill in the art that the three lines of temperature in FIG. 5 of JP59-07686 are fictitious (e.g. it only an illustrative drawing). This is at least because heat transfer relations require a smooth S-shaped transition between the (horizontal) steady states (e.g. the "kinks," aka first derivative singularities, are not physically possible). Thus this drawing does not disclose the characteristic of a transition. Moreover, the translation is rough and thereby unreliable as pointed out in Section I, above.

In conclusion, Claim 100 is not anticipated by JP 59-076876.

VII. Claim 100 is Patentable Over JP 59-076876 in View of Shin Under 35 U.S.C. § 103(a) At Least Because No Combination of JP 59-076876 and Shin Teaches Changing a Temperature with a Control Circuit, Reaching a Second Temperature within a Preselected Time Period or Sensing a Substrate Holder Temperature, and There is No Suggestion to Combine.

There is nothing in JP59-076876 that teaches changing a temperature with a control circuit for the reasons set forth in Section VI above. Neither JP-076876 or Shin disclose changing a temperature within a preselected time period that is less than the overall process time associated with etching the first silicon containing layer and the second silicon containing layer.

Furthermore, as pointed out in Section IV above and in Section VIII below, there is no motive or suggestion to combine JP 59-076876 with Shin because Shin teaches away from etching the silicon layers at higher temperature (e.g. above 49C) and teaches that etching the two silicon-containing layers is preferably at a single temperature from -50C to 0C with a selected bias power.

VIII. Claim 100 is Patentable Over a Combination of Tsubone in View of Shin Under 35 U.S.C. § 103(a) Because These References Fail to Include All of the Limitations of the Claim.

Neither Tsubone nor Shin, alone or in any combination disclose sensing a substrate holder temperature. Furthermore, neither Tsubone nor Shin teach etching a first portion of a silicon-containing layer in a chamber while the substrate is maintained at a selected first temperature and etching a portion of a second silicon-containing layer in the chamber while the substrate is maintained at a second substrate temperature; wherein the substrate holder temperature is heated above a temperature sufficient to allow controlling at least one of the selected first and the selected second substrate temperatures above 49C.

Furthermore, there is no motivation for combining Tsubone with Shin because Shin teaches etching two layers in one step and etching preferably in the range of -50C to 0C at one selected temperature. Shin discloses that temperature has a relatively small effect on etch rate (less than about 5-10% when temperature is changed by as much as 100C – see FIG. 5) and that bias power is the leading effective variable within this preferred range (see claim 1, FIG 5 and col. 4, lines 54-57 and col. 5, lines 2-9).

Tsubone teaches changing temperature for high selectivity, particularly when overetching (col. 1, lines 25-29, 31-35 and col. 7 lines 5-10). In contradistinction, Shin teaches selecting temperature for a desirable profile, not for selectivity between the two silicon-containing layers. Shin discloses that an active reaction at the sidewalls is reduced by lowering temperature of the substrate so that oxide by products such as TiO can serve as a protective layer (Col. 4, lines 27-30). Shin further discloses that the TiSix layer may not be completely etched at higher temperatures because etching selectivity between a polysilicon layer and a TiSix layer is *higher* with an *increase* in the temperature of the substrate, causing residues (col. 4, lines 33-36 and Fig. 5). Hence Shin teaches away from etching the silicon layers at higher temperature and discloses that etching the two silicon-containing layers is preferably at a single temperature from -50C to 0C (claims 1, 5 and 9) with a selected bias power.

IX. Claim 104 is Patentable Over Tsubone in View of Shin Under 35 U.S.C. § 103(a) Because These References, Separately or in Combination, Fail to Disclose All of the Limitations of the Claim and There Is No Motivation to Combine.

Neither Tsubone, nor Shin, or Tsubone in view of Shin teach or suggest all of the limitations of Claim 104. For example, neither Tsubone nor Shin disclose sensing the substrate holder temperature. As well neither suggest heating a substrate holder with a heating device and a substrate holder control circuit to maintain a substrate holder temperature operable to effectuate a substrate temperature above room temperature while processing a substrate on a substrate holder at a first substrate temperature; and processing the substrate on the substrate holder a second substrate temperature to etch at least a portion of the silicide layer within a preselected time to etch the silicide layer.

Moreover there is no motivation to combine and no suggestion or motivation to etch a silicide layer above room temperature based on a combination. The Tsubone reference and the Shin art both teach that etching a substrate below room temperature is preferred. However Tsubone teaches higher selectivity at lower temperature (Tsubone Col. 7, lines 5-10, lines 40-45) whereas Shin teaches the opposite lower selectivity at lower temperature. Furthermore, Shin teaches substrate temperature less than room temperature, at -50 to 0C, is preferred.

As for teaching away from a combination to etch at high temperature, Shin discloses a substrate temperature less than room temperature, at -50 to 0C, is advantageous both for sidewall protection and avoiding residues, as already pointed out in the discussion in Sections IV and VIII above. The purpose of Shin is to etch TiSix and Si layers (numerals 8 and 6 in FIG.1 of Shin) together in one step and obtain a desirable profile. There is nothing in these references to suggest the possibility of improving profile by changing temperature during the etching. Shin discloses the advantages of etching both layers at a temperature below room temperature, with selected pressure, power, etc. for a desirable profile of the two-layer stack. Still further, the purpose of Shin *is to etch both* silicon-containing layers with a single set of process variables *without* etching an oxide layer (numeral 4 in FIG 1). It was known to those of ordinary skill in the art that selectivity for etching over oxide usually improves as temperature is lowered (see, for example, pps.118-121 Plasma Etching, An Introduction, Academic Press, 1989, eds. D. M. Manos, D. L. Flamm).. For this reason as well, one of ordinary skill in the art would have motivation to perform the Shin process below room temperature and not above.

X. Claim 104 is Patentable Over JP 59076876 in View of Shin Under 35 U.S.C. § 103(a) Because These References, Separately or in Combination, Fail to Disclose All of the Limitations of the Claim and There Is No Motivation to Combine.

Neither JP 59-076876, nor Shin, or JP 59-076876 in view of Shin teach or suggest all of the limitations of Claim 104. For example, neither JP 59-076876 nor Shin suggest sensing the substrate holder temperature. As well neither disclose heating a substrate holder with a heating device and a substrate holder control circuit maintaining a substrate holder temperature operable to effectuate a substrate temperature above room temperature. Moreover, neither disclose processing a substrate on a substrate holder at a first substrate temperature; and processing the substrate on the substrate holder at second substrate temperature to etch at least a portion of the silicide layer within a preselected time to etch the silicide layer.

As already pointed out in the preceding sections, JP 59-076876 discloses neither a control circuit for the temperature of the substrate nor changing any temperature with a control circuit.

Furthermore, for reasons already set forth in Section XI above, there is no suggestion or motivate to combine these references because Shin teaches to a substrate in the range of -50C to 0C for better sidewall protection, less propensity for forming residue, and a desirable profile in one processing step.

XI. Dependent Claims 57-69,71-79, 81-93, 95-99, 101-103, and 105-117 Are Allowable at least for the Reasons Enumerated in Sections I-VIII Above.

Claims 57-62 and 109-111 include all of the limitations of Claim 1. Since it is believed that Claim 1 is allowable for the reasons enumerated above, it is respectfully submitted that the Claims 57-69 and 109-111 depending on Claim 1 are also allowable.

Claims 71-79 and 112 include all of the limitations of Claim 70. For the reasons enumerated above, it is respectfully submitted that Claims 71-79 and 112 should be allowed.

Claims 81-93 and 113 include all of the limitations of Claim 80. Hence it is respectfully submitted that Claims 81-93 and 113 should be allowed for the reasons above.

Claims 95-99 and 114-115 include all of the limitations of Claim 94. For the reasons above, it is respectfully submitted that Claims 95-99 and 114-115 are allowable for the reasons above.

Claims 101-103 and 116-117 include all of the limitations of Claim 100. For the reasons above, it is respectfully submitted that Claims 95-99 and 116-117 are allowable for the reasons above.

Claims 106-108 include all of the limitations of Claim 105. For the reasons above, it is respectfully submitted that Claims 106-108 are allowable for the reasons above.

XII. "In a controlled manner" with Reference to the Previously Presented Claim 100 Under 35 U.S.C. § 112 Is Supported By the Specification .

At least at col. 2, line 34-36 teaches "effecting *a suitable controlled change* in temperature," Furthermore there is detailed description of various embodiments to change various temperatures in a controlled manner (for example cols. 16 and 17).

XIII. The Term "a plurality of heating elements" in Claim 56 with Reference to 35 U.S.C. § 112 is Supported in the Specification.

Embodiments having a "plurality of heating elements" are taught at least in col. 15, lines 6-22.

XIV. The Term Substantially in Claim 63 is Supported by the Specification and Does Not Render the Claim Indefinite Under 35 U.S.C. § 112.

The term "substantially" to reference a similarity of temperatures has antecedent basis in the specification at least at col. 15, line 23, col. 17 line 18. The term "substantially" is not indefinite per se (MPEP 2173.05(b) (D.)). Applicant further points out that the specification provides a guideline for a temperature being substantially the same as another at col. 15, line2 23-28. "Providing a *substantially uniform temperature*" (at line 23) is "in a specific embodiment," (at line 25) "within one degree Celsius" (at line 25). Therefore the term is sufficiently definite in view of the specification.

VII. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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Date: October 2, 2006

PATENT

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to:

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On October 2, 2006

By: Daniel L. Flamm

Daniel L. Flamm

PTO/SB/06 (08-03)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 10/439245

CLAIMS AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE (37 CFR 1.16(a))				$____	OR		$____
TOTAL CLAIMS (37 CFR 1.16(c))	minus 20 =	*	X $____ =		OR	X $____ =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	minus 3 =	*	X $____ =		OR	X $____ =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))			+ $____ =		OR	+ $____ =	
			TOTAL		OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

CLAIMS AS AMENDED – PART II

AMENDMENT A

10/6/06	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 60	Minus	** 63	= 0	X $____ =		OR	~~X $____ =~~	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	= 0	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	*	Minus	**	=	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	*	Minus	***	=	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT C

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	*	Minus	**	=	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	*	Minus	***	=	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
ALANKO, ANITA KAREN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 06/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)
	10/439,245	FLAMM, DANIEL L.
	Examiner	Art Unit
	Anita K. Alanko	1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 2/21/06 RCE & amdt.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 56-98,100-104 and 106-117 is/are pending in the application.

4a) Of the above claim(s) _ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 56-98,100-104 and 106-117 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/21/06 has been entered.

Specification

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: explicit basis for the new limitations "in a controlled manner" in claim 100, and setting the temperature "before" the substrate is placed on the substrate holder in claim 109.

The terms may be merely added to the specification, provided they are not new matter.

Claim Rejections - 35 USC § 251

The following is a quotation from 35 U.S.C. 251:

> Whenever any patent is, through error without any deceptive intention, deemed wholly or partly inoperative or invalid, by reason of a defective specification or drawing, or by reason of the patentee claiming more or less than he had a right to claim in the patent, the Director shall, on the surrender of such patent and the payment of the fee required by law, reissue the patent for the invention disclosed in the original patent, and in accordance with a new and amended application, for the unexpired part of the term of the original patent. No new matter shall be introduced into the application for reissue.

Claim 109 is rejected under 35 U.S.C. 251 as being based upon new matter added to the patent for which reissue is sought. The added material that is not supported by the prior patent is as follows:

the new limitation, setting the temperature "before" the substrate is placed on the substrate holder, in claim 109.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 109 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The phrase, setting the temperature "before" the substrate is placed on the substrate holder, in claim 109 is new matter.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 57, 63, 68 and 103 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As to claim 57, "heat transfer means" lacks proper antecedent basis or fails to further limit its base claim. Does this comprise the heat transfer device in claim 56, or something different? It appears to be the same device, and therefore for the purposes of the rejection, claim

57 is treated as citing the heat transfer device. The distinction between the "heat transfer device" in claim 56 and the "heat transfer means" in claim 57 is unclear.

As to claim 68, the term "a plurality of heating elements" lacks proper antecedent basis. It is unclear if the heating elements are the "heat transfer device" or are in addition to the "heat transfer device" of claim 56.

The term "substantially" in claim 63 and the term "high" in claim 103 are relative terms, which render the claims indefinite. The term "high" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is unclear which values of temperatures are within the range of being "substantially" equal and which value of selectivity is "high."

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 56-62, 64, 70-71, 74-79, 94-96, 109-112, 114-115 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 59-076876.

JP 59-076876 discloses a method of etching a substrate in the manufacture of a device, the method comprising:

placing a substrate 14 (Fig.4) having a film ($MoSi_2$, Fig.2) thereon on a substrate holder 19 in a chamber 11, the substrate holder having a selected thermal mass (inherent since the holder has thermal mass);

setting the substrate holder 19 to a selected first substrate holder temperature (60 °C, using temperature controller 21, page 5, lines 20-21 of English translation) with a heat transfer device (controller 21 and cocks 23, 24 provide heat transfer);

etching (page 6, line 1-2) a first portion of the film (the "etching region" in Fig.5) while the substrate holder is at a selected first substrate holder temperature (see Fig.5 and page 5, lines 13+);

with the heat transfer device (controller 22 and cocks 23,24) changing the substrate holder temperature from the selected first substrate holder temperature to a selected second substrate holder temperature (30 °C using temperature controller 22, see Fig.5 and page 5, line 18); and

etching a second portion (the "overetching region" of Figure 5) of the film while the substrate holder is at the selected second substrate holder temperature;

wherein the thermal mass of the substrate holder is selected to allow changing the first substrate holder temperature to the second selected substrate holder temperature within a selected time period (inherent since Figure 5 shows a time period for the change of temperature, and the holder does not inhibit the temperature change, it allows for the temperature change).

As to new claims 109-111, JP 59-076876 discloses that the substrate holder 19 is set to the selected first substrate temperature before the substrate 14 is placed on the substrate holder (page 5, lines 21-23). JP 59-076876 discloses to use a controller 21,22 which encompasses changing temperatures in a controlled manner, such that the second temperature is reached at a selected time.

Claims 70-82, 84-96, 98 and 113-115 are rejected under 35 U.S.C. 102(b) as being anticipated by Tsubone et al (US 5,320,982).

Tsubone discloses a method of etching comprising:

heating the substrate holder to a first substrate holder operating temperature with a heat transfer device ("circulated heat medium is controlled to a predetermined temperature and is sent to the sample bed 5" col.3, line 65-col.4, line 3);

placing a substrate 6 having a film thereon (inherent in forming a semiconductor device) on a substrate holder 5 in a chamber 1 (col.3, lines 37-60);

etching a first portion of the film at a selected first substrate temperature ("sample temperature" in Fig.4)

etching a second portion of the film at a different second temperature (Fig.4), wherein operating the substrate holder at the first temperature enables the substrate temperature to be above room temperature while etching at least one of the portions of the film (Fig.4, Case III), and the selected first substrate temperature is operable to be changed to the selected second substrate temperature within a selected time period to process said film (Figure 4 shows how the change in temperature occurs within in a certain/predetermined time period, the time periods between the steady state temperature steps, a-c, d-f, g-i, j-k).

Further, as to claim 80, Tsubone discloses to use a control circuit 25 operable to execute a heat transfer process (col.4, lines 43-45).

As to claim 84, Tsubone discloses that the substrate temperature (-30°C) is greater than the substrate holder temperature (-60°C; col.6, lines 2-5).

As to claim 98, Figure 4 of Tsubone depicts that the change times (d-e) subtends less than about 5% of the total etch process time (b-g; since 6% is about 5%, broadly interpreted).

As to claims 113-117, Tsubone discloses transferring heat using a heat transfer gas, changing temperature in a controlled manner by using a controller at a selected time, with a temperature above room temperature (Fig.4).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 97-98, 100-104, 106-108 and 116-117 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubone et al (US 5,320,982) in view of Shin et al (US 6,087,264).

The discussion of Tsubone from above is repeated here.

As to claims 100 and 104, Tsubone discloses that his method is an improvement for the etch of a silicide layer (col.1, lines 23-28), however Tsubone does not disclose the specific layers such as a gate oxide, polysilicon layer and a silicide layer. Shin teaches that an oxide layer 4, a polysilicon layer 6 and a silicide layer 8 is a conventional structure to etch through photoresist layer 12 mask by a chlorine plasma (col.2, lines 2-4, 41-51). It would have been obvious to one with ordinary skill in the art to deposit an oxide layer, a polysilicon layer and a silicide layer and to etch them through a photoresist layer mask by a chlorine plasma in the method of Tsubone because Shin teaches that this is a useful structure and method to pattern by etching.

Further, as to amended claim 100, Tsubone does not disclose an exact temperature for etching, such as above 49°C. Shin teaches that etching can occur at 50 °C (col.4, lines 40-42, 66-67), which is above 49°C. It would have been obvious to etch at 50 °C in the modified method of Tsubone because Shin teaches that this is a useful temperature for etching silicon-containing layers. As to the temperature range greater than 50 °C, Shin teaches that the temperature is a result effective variable (e.g., temperature and etch rate are related, Figure 5). It would have been obvious to one with ordinary skill in the art to vary the temperature to that cited in the modified method of Tsubone since the temperatures appear to reflect result-effective variables, which can be optimized. See MPEP 2144.05 IIB.

Still further as to amended claim 100, the temperature change occurs in a controlled manner since a controller is used to control the pressure of the heat transfer gas under the back of the substrate (col.7, lines 1-4).

As to claims 98 and 101, Tsubone discloses less than "about 5%" since 6% is about 5%. However, it would have been obvious to use less time since the time depends on which material is being etched, whether a high degree of etch control/etch rate is desired or not, how large a temperature change is desired, and what the relative temperatures are. Therefore, it would have been obvious to one with ordinary skill in the art to vary the time to that cited in the modified method of Tsubone since the temperatures and time to change the temperatures appear to reflect result-effective variables, which can be optimized. See MPEP 2144.05 IIB.

Claims 83 and 112 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubone et al (US 5,320,982) in view of Shin et al (US 6,087,264) and Olson et al (US 5,705,433).

The discussion of Tsubone from above is repeated here.

As to claim 112, Tsubone does not disclose that the first substrate holder operating temperature is above room temperature, rather it is, in one example, at –60 °C (col.6, line 4). Shin teaches that to etch silicides that the temperature can be 50 °C (Fig.5, 8A), but does not disclose the substrate holder temperature. Olson teaches that during etching of silicon-containing layers to achieve good wall profiles and high selectivity (col.3, lines 12-47), that it is useful to have the substrate holder at temperatures including the range –40°C – +70°C (col.3, line 62), which include the cited range of above room temperature. Thus, the holder temperature is also a result-effective variable. Therefore, it would have been obvious to etch at a first substrate holder operating temperature above room temperature in the method of Tsubone modified by Shin because Olson teaches that such temperatures are useful for etching silicon-containing layers, and appear to reflect result-effective variables, which can be optimized. See MPEP 2144.05 IIB.

As to claim 83, it is expected to have the same relative temperatures cited in the modified method of Tsubone because since the same steps are conducted as in the instant invention, the same results are expected.

Claims 63, 65, 66-69 and 72-73 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Rossman et al (US 6,077,357).

The discussion of JP 59-076876 from above is repeated here.

As to claim 63, JP 59-076876 discloses that the first and second substrate holder and substrate temperatures are related, but does not explicitly disclose that they are equal. However, it is obvious that the method of JP 59-076876 can be used for different substrates than those disclosed, and that different substrates with different films have different temperature requirements. For example, etch rates are dependent on etch temperatures (see Fig.1), and thus the temperature is a result effective variable. It would have been obvious to one with ordinary skill in the art to have the temperatures be substantially equal in the method of JP 59-076876 because the temperature appears to reflect a result-effective variable which can be optimized. See MPEP 2144.05 IIB.

As to claim 65, JP 59-076876 fails to disclose that the first substrate etching temperature is lower than the second substrate etching temperature. Rather, JP 59-076876 discloses that the first substrate etching temperature is higher. However, it is obvious that the method of JP 59-076876 can be used for different substrates than those disclosed, and that different substrates with different films have different temperature requirements. For example, etch rates are dependent on etch temperatures (see Fig.1), and thus the temperature is a result effective variable.

Rossman also teaches that it is useful to either heat or cool during plasma processing (col.10, lines 9-12; col.13, lines 14-17) using a heat transfer gas compatible with the chemical process (col.10, lines 41-50).

It would have been obvious to one with ordinary skill in the art to etch at a higher temperature in the method of JP 59-076876 because processing of multi-film substrates has different etching requirements for each film, for which the temperature appears to reflect a result-effective variable, which can be optimized. See MPEP 2144.05 IIB. Still further, it would have been obvious to heat or cool, with corresponding heat transfer to or from the substrate, in the method of JP 59-076876 because Rossman teaches that such heating or cooling of the substrate during plasma processing is useful.

As to claims 66 and 72, JP 59-076876 does not disclose the type of chuck. Rossman teaches that an electrostatic chuck 104 is useful (col.9, lines 43-44). It would have been obvious to one with ordinary skill in the art to use an electrostatic chuck in the method of JP 59-076876 because Rossman teaches that they are useful during plasma processing.

As to claims 66-69 and 73, JP 59-076876 does not disclose how the substrate temperature is changed. Rossman teaches that it is useful to use fluid passages 144, 146 in the substrate holder, to heat and cool zones 168, 170, and to use a heat transfer gas behind the substrate (col.9, lines 26-42; col.10, lines 9-12) during plasma processing. It would have been obvious to heat and cool the wafer as taught by Rossman in the method of JP 59-076876 because Rossman teaches that they are useful techniques for controlling the temperature of the substrate during processing.

Claim 80-89, 91, 97-98, 100-104, 108, 113 and 116-117 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Shin et al (US 6,087,264).

The discussion of modified JP 59-076876 from above is repeated here.

As to claim 80, JP 59-076876 discloses to use a controller, which encompasses using a control circuit. JP 59-076876 fails to disclose the substrate temperature. However, JP 59-076876 discloses that the substrate holder temperature is above room temperature.

JP 59-076876 discloses that his method is an improvement for the etch of a silicide layer 2 (Fig.2), however JP 59-076876 does not disclose the specific layers such as a gate oxide, polysilicon layer and a silicide layer. Shin teaches that an oxide layer 4, a polysilicon layer 6 and a silicide layer 8 is a conventional structure to etch through photoresist layer 12 mask by a chlorine plasma (col.2, lines 2-4, 41-51). It would have been obvious to one with ordinary skill in the art to deposit an oxide layer, a polysilicon layer and a silicide layer and to etch them through a photoresist layer mask by a chlorine plasma at above room temperature in the method of JP 59-076876 because Shin teaches that this is a useful structure and method to pattern by etching.

As to claims 81-89, the various relative temperatures and heat transfer directions are obvious since processing substrates depends on the material being etched, the type of etchant and the temperature. The modified method of JP 59-076876 is applicable to other materials and processes such as CVD, for which various temperatures and heat transfer directions such as those cited are obvious to one with ordinary skill in the art depending on the material being etched, the type of etchant and the temperature, since these all appear to reflect result-effective variables, which can be optimized. See MPEP 2144.05 IIB.

As to claims 97 and 100, the method of JP 59-076876 modified by Shin teaches that a useful temperature includes 50 °C (col.4, lines 42 and 67), which is within the claimed range. It would have been further obvious to increase the temperature even further for the reasons cited under the rejection of claims 81-89.

As to claim 98, JP 59-076876 does not disclose the length of time it takes to change temperatures. However, Shin teaches that a useful temperature includes 50 °C. Since the same method steps are conducted as in the instant invention, similar results of a time change less than 5% of the total etching time are expected in the modified method of JP 59-076876. It would have been obvious to one with ordinary skill in the art to change the time as cited in the modified method of JP 59-076876 since it depends on the relative temperatures used, which appears to reflect result-effective variables, which can be optimized. See MPEP 2144.05 IIB.

As to claim 100, see the rejections of claims 80 and 97.

As to claim 101, see the rejection of claim 98.

As to claim 102, see the rejection of claim 80 since Shin teaches chlorine.

As to claim 103, since the modified method of JP 59-076876 has the same steps as in the instant invention, the same results of high selectivity are expected.

As to claim 104, see the rejection of claim 97. Since 50° C is above room temperature, it is obvious to heat in order to achieve the same final result.

As to claim 108, the plasma inherently provides radiation.

Claims 90, 92-93 and 106-107 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Shin et al (US 6,087,264) and Rossman et al (US 6,077,357).

The discussion of modified JP 59-076876 from above is repeated here.

As to claim 90, JP 59-076876 is directed to etching, however Rossman teaches that CVD or etching both use plasma tools (col.1, lines 13-14). It would have been obvious to conduct CVD in the tool of JP 59-076876 because it is useful to use plasma tools for both etching and CVD as taught by Rossman.

As to claims 92-93 107, JP 59-076876 does not disclose how the substrate temperature is changed. Rossman teaches that it is useful to use fluid passages 144, 146 in the substrate holder, to heat and cool zones 168, 170, and to use a heat transfer gas behind the substrate (col.9, lines 26-42; col.10, lines 9-12) during plasma processing. It would have been obvious to heat and cool the wafer as taught by Rossman in the method of JP 59-076876 because Rossman teaches that they are useful techniques for controlling the temperature of the substrate during processing.

As to claim 106, JP 59-076876 does not disclose the type of chuck. Rossman teaches that an electrostatic chuck 104 is useful (col.9, lines 43-44). It would have been obvious to one with ordinary skill in the art to use an electrostatic chuck in the method of JP 59-076876 because Rossman teaches that they are useful during plasma processing.

Response to Amendment

Page 5 of the amendment recites that claims 99 and 105 are cancelled, whereas the claim identifiers cite "withdrawn". The identifiers should cite "cancelled," and the text of the claim should not be presented. All new claim text should be underlined.

The objection to the specification is withdrawn since the corrections have now been made according to what was printed in the issued patent.

The objection to the amendment under 35 USC §132 is withdrawn since the new terms ("as shown in Fig.10, is typically more than 99 °C"; "intervals which subtend …less than 15 percent and well under 40 percent of the total process time") have now been deleted from the specification.

The objection to the specification is withdrawn for the following reasons, as pointed out by applicant. Basis for the term "heat transfer means coupled to the substrate holder" is found at col.14, line 58 (heat transfer fluid), col.15, lines 66+ (system 700, which includes a heater 705 coupled to the substrate holder 701 by line 707). Basis for the term "substrate temperature control system including a microprocessor and a heat transfer process" is found at col.15, lines 61-64 which cites system 700 (that includes a substrate holder, 701, heater 705 and line 707); col.16, line 64 cites the microprocessor. Thus the substrate temperature control system controls the temperature of the substrate by controlling the temperature of the substrate holder (by using heater 705).

The terms "subtends less than 40 percent;" "subtends less than 15 percent"; "the first substrate temperature is less than about 90 °C and the silicide layer is etched above about 99°C" and "substrate holder is maintained above room temperature" have been deleted from the claims, and therefore the objection to the specification, 35 USC §251 and 35 USC §112, first paragraph rejection over them are withdrawn.

The 35 USC §112, 2nd paragraph rejection is withdrawn since the term "substantially" has been deleted.

As to the new limitations, for example in claim 56, lines 5-6, the term "heat transfer device" has basis in the specification as the heater 705. In claim 56, last line, the term "selected time period" has basis in the specification as the term "characteristic time period" at col.2, lines 49-52. In claim 97, lines 3-4, the temperature range has basis at col.18, line 12. Claim 98 has basis for less than about 5% in Figure 10. Claim 100, line 10, basis for "above 49 °C" is at col.19, line 12, since the etch occurs at above 49°.

The new limitations "in a controlled manner" in claim 100, and setting the temperature "before" the substrate is placed on the substrate holder in claim 109, do not have explicit basis in the specification. The specification discusses, e.g., rapidly increasing the temperature (Fig.10) or using a PID controller (col.16, line 41). The Webster's II New Riverside Univ. Dictionary defines "control" or "controlled" as "1. To exercise authority or influence over:DIRECT. ..." Thus, the term "in a controlled manner" is interpreted as directing or influencing the temperature change. For example, this could be done by heating the heat transfer fluid, and using the fluid to heat/direct the temperature change in the substrate holder and substrate.

The claims remain rejected over JP 59-076876 and Tsubone. Olson is newly cited to teach useful temperatures for substrate holders during the etching of silicon-containing layers.

Response to Arguments

Applicant's arguments filed 2/21/06 have been fully considered but they are not persuasive.

As to claims 56-64, applicant argues that JP 59-076876 does not suggest a selected time period or selecting the thermal mass. In response, examiner considers the limitation "a selected time" to be broad, and broadly interpreted many parameters are included in deciding a selected time period (the type of etch process, the composition of the materials being etched and the etchant, the final desired result - - a controlled etch, a fast etch, selectivity, global planarity.) These are inherent in etching a material, and thus JP 59-076876, broadly interpreted, selected to do the process within a selected time period. Applicant's arguments are also not commensurate in scope with the claim limitation since the claim does not cite that the thermal mass is directly correlated to the selected time period, the claim merely cites that the thermal mass "allows" the change in temperature.

As to the limitation of "wherein the thermal mass of the substrate holder is selected", this is a wherein clause that merely cites a necessary step and result of the method (a thermal mass must be chosen in order to have a feasible etch within a selected time period), and is given little weight.

As to claims 70-79, 94-98, 104, 108, applicant argues that JP 59-076876 does not disclose the temperature of the substrate, does not disclose that the substrate temperature is known or selected, and does not disclose processing within a selected time period. Again these limitations cited by applicant are in a wherein clause, are a necessary result of the method, and are given little weight. It is inherent that the substrate has first and second temperatures. That the holder "enables" the temperature to be above room temperature is a statement of intended use. The holder is capable of etching at above room temperature. The argument about knowing or selecting the substrate temperature or time period is not commensurate in scope with the claim language. Again, these are all necessary results of the method- that the holder is capable of etching within an ill-defined time period.

As to the claim 100 limitation of above 49°C, this limitation is taught by Shin, as discussed in the rejection. If the temperature of the substrate is at a certain value, then the holder is capable of providing that temperature, otherwise the substrate temperature would not be attained. That the change time is less than the overall ill-defined process time, is also shown in Figure 5 of JP 59-076876.

Applicant argues that JP 59-076876 does not disclose controlling a substrate temperature. This argument is not understood because JP 59-076876 has controllers and cocks, and clearly the substrate holder temperature is related to the substrate temperature. If not, there would be no need to control the temperature of the substrate holder.

Applicant argues that JP 59-076876 does not teach etching each of two silicon containing layers at distinct temperatures. The etching of multiple layers is obvious, as taught by Shin, since the method of JP 59-076876 is applicable to other devices since one with skill in the art knows that an apparatus can be used to process more than one kind of substrate layer.

As to claims 70-79, 94-98, applicant argues that Tsubone does not teach heating the substrate holder. In response, Tsubone discloses a "circulated heat medium" in a process which heats the substrate (Fig.4, shows above room temperature). Since the substrate temperature is related to the substrate holder temperature, this includes heating. The "heating device" is interpreted broadly since no explicit definition has been given in the specification. Since Tsubone has heat medium that enables the substrate to be above room temperature while etching, this includes a heat device. Broadly interpreted, the whole chamber could be the heat device.

As to claims 80-93, applicant argues that exhausting the heat supply gas provides for an uncontrolled temperature. Examiner disagrees since the exhausting is not necessarily uncontrolled. Since Tsubone has "heat medium ...controlled to a predetermined temperature", Tsubone reads on the step of treating the film at a selected substrate temperature above room temperature. The claims do not cite that exhausting may not be present.

Applicant argues that Tsubone teaches away from maintaining the substrate holder to have a selected substrate temperature above room temperature. This argument is not understood since Tsubone discloses to etch at above room temperature (Fig.4). Why wouldn't this be maintained until the etch process (Case III) is complete?

As to claims 100-108, applicant argues that there is no suggestion to keep the substrate above 49 °C. In response, Shin teaches that this is obvious.

As to claims 65-69, applicant agues that there is noting in JP and Rossman to suggest a thermal mass to allow changing the temperature. In response, see the argument above under claim 56.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anita K. Alanko whose telephone number is 571-272-1458. The examiner can normally be reached on Mon-Fri until 2:30 pm (Wed until 11:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Anita K. Alanko

Anita K Alanko
Primary Examiner
Art Unit 1765

Notice of References Cited	Application/Control No. 10/439,245	Applicant(s)/Patent Under Reexamination FLAMM, DANIEL L.	
	Examiner Anita K. Alanko	Art Unit 1765	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,705,433	01-1998	Olson et al.	438/695
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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PATENT

IFW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Re-Issue Application of U.S. Patent No. 6,231,776 B1	Examiner: Anita K. Alanko
	Art Unit: 1765
Application No.: 10/439,245	AMENDMENT
Filed: May 14, 2003	
For: Daniel L. Flamm	

Attn: Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Mailing Date: March 17, 2006

Sir:

In response to the Office Communication mailed March. 2, 2006, please enter the enclosed check for the $683.00 for the Excess Claims Fees.

Thank you.

Daniel L. Flamm

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed as above. Daniel L. Flamm

03/23/2006 ZJUHAR1 00000058 10439245
01 FC:2204 400.00 OP
02 FC:2205 275.00 OP

03/22/2006 ZJUHAR1 00000008 10439245
01 ~~FC:2201~~ ~~400.00 OP~~
02 ~~FC:2202~~ ~~275.00 OP~~
03 FC:2622 8.00 OP

10/439,245

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NOTICE REQUIRING EXCESS CLAIMS FEES

The excess claim(s) filed on 5/14/03 + 2/21/06 is not accompanied by the appropriate payment of excess claims fees set forth in 37 CFR 1.16(h)-(j) or 1.492(d)-(f). Excess claims fees are required for each claim in independent form in excess of three (§ 1.16(h)), each claim (whether dependent or independent) in excess of twenty (note that § 1.75(c) indicates how multiple dependent claims are considered for fee calculation purposes) (§ 1.16(i)), and each application that contains a multiple dependent claim (§ 1.16(j)).

Since the application is not under a final rejection, applicant is given a time period of **ONE (1) MONTH or THIRTY (30) DAYS** from the mailing date of this notice, whichever is longer, to submit either: (1) the fee payment of $ 683 , or (2) an amendment in compliance with 37 CFR 1.121 that cancels the excess claim(s), in order to avoid ABANDONMENT. Extensions of this time period may be granted under 37 CFR 1.136, unless the excess claim(s) was presented in a preliminary amendment.

☐ 1. The funds in Deposit Account No. ______________ are insufficient to cover the entire fee due. The balance is due within the time period set forth in this notice. See note below regarding the appropriate service charge.

☐ 2. The Credit Card payment to cover the entire fee due to Account ______________________________ (**Card type + last 4 digits ONLY**) was refused. The balance is due within the time period set forth in this notice. See note below regarding the appropriate service charge.

☐ 3. The amendment that includes the excess claim(s) has not been entered, since applicant has failed to remit (or authorize charge to a Deposit Account or Credit Card) the fee as indicated on the attached Patent Application Fee Determination Record (PTO/SB/06). Remittance or authorization is due within the time period set forth in this notice.

☐ 4. The fee submitted in this application is insufficient. A balance of $ ______________ is due for presentation of excess claims (37 CFR 1.16(h)-(j) or 1.492(d)-(f)).

☐ 5. Other.

Explanation (*Provide specific details of the required correction in order to assist the applicant. Indicate whether a service charge has been added to the fee due*):

THE CLAIMS FILED WERE 55 TOTAL CLMS WITH 7 INDEPENDENT CLAIMS. CLAIMS FILED ON 2/21/06 ~~[illegible]~~ ADDED EIGHT MORE CLAIMS.

THE AMOUNT OF THE FEE(S) DUE IS SUBJECT TO CHANGE, GENERALLY ON OCTOBER 1 OF EACH YEAR (37 CFR 1.16, 1.21 & 1.492). **THE AMOUNT OF THE FEE(S) DUE IS DETERMINED AS OF THE DATE A COMPLETE REPLY WITH THE APPROPRIATE FEE(S) IS RECEIVED BY THE OFFICE** (37 CFR 1.8 & 1.10). BECAUSE THE AMOUNT DUE IS SUBJECT TO CHANGE, IT IS RECOMMENDED THAT APPLICANT CHECK THE CURRENT FEE SCHEDULE WHICH IS AVAILABLE ON THE USPTO'S WEBSITE AT: ***http://www.uspto.gov/web/offices/ac/qs/ope/fees.htm***

Service Charges: There is a $50 service charge for processing each payment refused (including a check returned "unpaid") or charged back by a financial institution (37 CFR 1.21(m)). There is a $25.00 service charge for each month when the balance of a deposit account is below $1000 at the end of the month (37 CFR 1.21(b)(2)).

Kory M. Holland (571) 272 - 1619
Technical Support Staff (TSS)

Note to TSS: Please do NOT use this notice if the application is under a final rejection.

PTOL-319 (Rev 5-05)

PTO/SB/06 (08-03)
Approved for use through 7/31/2006. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number: 10/439,245

CLAIMS AS FILED – PART I

FOR	NUMBER FILED (Column 1)		NUMBER EXTRA (Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE (37 CFR 1.16(a))					395 PD.	OR		$
TOTAL CLAIMS (37 CFR 1.16(c))	55	minus 20 =	* 35	x $9 =	315	OR	X $____ =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	7	minus 3 =	* 4	x $42 =	168	OR	X $____ =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))				+ $____ =		OR	+ $____ =	
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	878	OR	TOTAL	

CLAIMS AS AMENDED – PART II

AMENDMENT A — 5-14-05

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 55	Minus	** 55	=	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	* 7	Minus	*** 7	=	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B — 7-25-05

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 53	Minus	** 55	=	X $____ =		OR	X $____ =	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	=	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
56, 70, 80, 94, 100, 104,					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT C — 3-21-06

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 63	Minus	** 55	= 8	x $25 =	200	OR	X $____ =	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	= ~~0~~	X $____ =		OR	X $____ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $____ =		OR	+ $____ =	
56, 70, 80, 94, 100, 104					TOTAL ADD'L FEE	200	OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 03/02/2006

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EXAMINER	
ALANKO, ANITA KAREN	

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1765	

DATE MAILED: 03/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

UNITED STATES PATENT AND TRADEMARK OFFICE

10/439,245

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NOTICE REQUIRING EXCESS CLAIMS FEES

The excess claim(s) filed on 5/14/03 + 2/21/06 is not accompanied by the appropriate payment of excess claims fees set forth in 37 CFR 1.16(h)-(j) or 1.492(d)-(f). Excess claims fees are required for each claim in independent form in excess of three (§ 1.16(h)), each claim (whether dependent or independent) in excess of twenty (note that § 1.75(c) indicates how multiple dependent claims are considered for fee calculation purposes) (§ 1.16(i)), and each application that contains a multiple dependent claim (§ 1.16(j)).

Since the application is not under a final rejection, applicant is given a time period of **ONE (1) MONTH** or **THIRTY (30) DAYS** from the mailing date of this notice, whichever is longer, to submit either: (1) the fee payment of $ 683 , or (2) an amendment in compliance with 37 CFR 1.121 that cancels the excess claim(s), in order to avoid ABANDONMENT. Extensions of this time period may be granted under 37 CFR 1.136, unless the excess claim(s) was presented in a preliminary amendment.

- ☐ 1. The funds in Deposit Account No. ________ are insufficient to cover the entire fee due. The balance is due within the time period set forth in this notice. See note below regarding the appropriate service charge.
- ☐ 2. The Credit Card payment to cover the entire fee due to Account ________ (**Card type + last 4 digits ONLY**) was refused. The balance is due within the time period set forth in this notice. See note below regarding the appropriate service charge.
- ☐ 3. The amendment that includes the excess claim(s) has not been entered, since applicant has failed to remit (or authorize charge to a Deposit Account or Credit Card) the fee as indicated on the attached Patent Application Fee Determination Record (PTO/SB/06). Remittance or authorization is due within the time period set forth in this notice.
- ☐ 4. The fee submitted in this application is insufficient. A balance of $ ________ is due for presentation of excess claims (37 CFR 1.16(h)-(j) or 1.492(d)-(f)).
- ☐ 5. Other.

Explanation (*Provide specific details of the required correction in order to assist the applicant. Indicate whether a service charge has been added to the fee due*):
THE CLAIMS FILED WERE 55 TOTAL CLAIMS WITH 7 INDEPENDENT CLAIMS. CLAIMS FILED ON 2/21/06 ~~[illegible]~~ ADDED EIGHT MORE CLAIMS.

THE AMOUNT OF THE FEE(S) DUE IS SUBJECT TO CHANGE, GENERALLY ON OCTOBER 1 OF EACH YEAR (37 CFR 1.16, 1.21 & 1.492). THE **AMOUNT OF THE FEE(S) DUE IS DETERMINED AS OF THE DATE A COMPLETE REPLY WITH THE APPROPRIATE FEE(S) IS RECEIVED BY THE OFFICE** (37 CFR 1.8 & 1.10). BECAUSE THE AMOUNT DUE IS SUBJECT TO CHANGE, IT IS RECOMMENDED THAT APPLICANT CHECK THE CURRENT FEE SCHEDULE WHICH IS AVAILABLE ON THE USPTO'S WEBSITE AT: ***http://www.uspto.gov/web/offices/ac/qs/ope/fees.htm***

Service Charges: There is a $50 service charge for processing each payment refused (including a check returned "unpaid") or charged back by a financial institution (37 CFR 1.21(m)). There is a $25.00 service charge for each month when the balance of a deposit account is below $1000 at the end of the month (37 CFR 1.21(b)(2)).

Kora M. Holland (571) 272 - 1619
Technical Support Staff (TSS)

Note to TSS: Please do NOT use this notice if the application is under a final rejection.

PTOL-319 (Rev 5-05)

OIPE
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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to:

PATENT

Attn: Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

On February 16, 2006

By: Daniel J. Flamm

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Re-Issue Application of U.S. Patent No. 6,231,776 B1	Examiner: Anita K. Alanko
	Art Unit: 1765
Application No.: 10/439,245	AMENDMENT
Filed: May 14, 2003	
For: Daniel L. Flamm	

Attn: Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action mailed Sept. 16, 2005, please enter the following amendments and remarks:

IN THE SPECIFICATION:

Please amend the specification as follows:

At Col. 3, Par. 10:

Fig. 10 is a simplified ~~flow diagram of a heating~~ process according to the present invention.

At Col. 11, Par. 3:

Fig. 4 is a simplified diagram of a resist stripper according to the present invention. The present stripping apparatus includes similar elements as the previous described CVD apparatus. The present stripping apparatus includes a chamber 112, a feed source 114, an exhaust 116, a pedestal 118, which can be an agile temperature controlled chuck, an rf power source 122, a ground 124, a helical resonator 126, and other elements. The helical resonator 126 includes a coil 132, an outer shield 133, a wave adjustment circuit 400, and other elements. The chamber can be any suitable chamber capable of housing a product 119 such as a photoresist coated wafer for stripping, and for providing a plasma discharge therein. The plasma discharge is derived from a plasma source, which is preferably a helical resonator discharge or other inductive discharge using a wave adjustment circuit or other techniques to selectively adjust phase/anti-phase potentials. Of course, in some applications other configurations such as parallel plate capacitive discharges and microwave powered discharges such as electron cyclotron resonance machines, resonant cavities and slow ~~waver~~ wave applicator structures may also be suitable. The present stripping apparatus provides for stripping or ashing photoresist, e.g., implant hardened, etc. Further examples of such a stripping apparatus are described in the experiments section below.

At Col. 14, Par. 2:

Fig. 6 is a simplified block diagram of a substrate holder 600 according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. The substrate holder 600 or ~~suceptor~~ susceptor includes, among others, a lower or backside surface 608, which includes a plurality of concentric zones 608A, 608B, 608C, and 608D. In a specific embodiment, each of the zones can be in fluidic communication with each other and can be partly separated from each other. Each of the zones can have an inlet 613 and an outlet 611. Fluid enters the inlet, traverses in an annular manner in the zone, and leaves the outlet. A baffle can separate the inlet from the outlet. Each of the zones can have an inlet and outlet, which are independent from the other inlets and outlets. Alternatively, the inlet and outlets can be in fluid communication with each other.

At Col. 15, Par. 3:

The substrate holder has an upper surface, which holds an object in a secure manner during processing. The upper surface is generally made of a suitable material that has desirable heat transfer characteristics. In a specific embodiment, the upper surface is made using a low thermal mass, high conductivity material. As merely an example, the upper surface can be a diamond-like or diamond film overlying a copper or copper-like substrate. Of course, the type of surface used depends upon the application.

At Col. 15, Par. 4:

In a specific embodiment, the substrate holder also has temperature sensing units 615 such as the one shown in "SIDE-VIEW C." The temperature sensing unit can be any suitable unit that is capable of being adapted to the upper surface of the substrate holder. Alternatively, the temperature sensing unit can measure the temperature of the fluid or lower surface of the substrate holder. As merely an example, the temperature sensing unit is a "fluoroptic" sensor unit made by a company called Luxtron in Santa Clara, California. Alternatively, the sensing unit can be ~~an~~ a band edge IR sensor or the like. The sensing unit is capable of measuring a variety of spatial locations along the upper or lower surface of the substrate holder. The substrate holder can be implemented using a variety of systems for heating and/or cooling applications such as the one described below, but can be others.

At Col. 18, Par. 2:

Fig. 10 ~~is~~ shows a simplified ~~flow diagram of a heating~~ process according to the present invention. This ~~diagram~~ process is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. As shown, there is an isotropic breakthrough step during which an SF_6 plasma is used to remove very thin native oxide can be conducted at a low temperature such as room temperature. Ordinarily the breakthrough step is conducted at a high temperature. High temperatures have a serious disadvantage in that the etching rate of both oxide and tungsten silicide by SF_6 may be isotropic. Therefore the duration of the breakthrough step, especially if the native oxide layer is thin, must often be limited to a few seconds to avoid undesired undercut. At low temperature the etching rate is slower and therefore the extent to which materials under the native oxide are etched is easier to control.

At Col. 19, Par. 2:

Since it is not practical to change chuck temperature, at this point the etch rate would increase rapidly. As a consequence it can often be difficult to detect and terminate the polysilicon etching step when the thin oxide layer is reached. Another problem associated with the use of a single temperature for both silicide and polysilicon layers is that chlorine etching processes often undercut (etch along the mask direction, sideways- e.g. the etch is partly isotropic) silicon at the elevated temperatures suitable for a low residue tungsten silicide etch. Therefore it is highly desirable and advantageous to reduce the etching temperature during the polysilicon etch. The wafer temperature is gradually reduced at point ~~DD~~ <u>D</u> in order to achieve a slower and more anisotropic polysilicon etching step. The temperature<u>s</u> necessary to etch tungsten silicide <u>and polysilicon</u> during this temperature programmed sequence are compared in ~~the~~ <u>FIG. 10</u>. <u>As shown, the</u> ~~The~~ emission signal intensity increases when the temperature is lowered because the rate of consumption of chlorine species by the etching process is slowed (the rate decreases with decreasing temperature). Stopping the etch process ~~at endpoint~~ <u>beyond the endpoint</u> where all of the silicon has "cleared," denoted by E is also easier and less critical because attack on the oxide has also slowed. <u>Fig. 10 shows temperature changes between BB and B and between points D and E occurring over intervals which subtend less than about 5 percent of the tungsten silicide/polysilicon stack etching time.</u>

IN THE CLAIMS:

Please cancel claims 99 and 105 without prejudice. Please amend claims 56, 60, 61, 70, 75, 80, 94, 97, 98, 100, 101, and 104.

1.-55 (canceled)

56. (currently amended) A method of etching a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a chamber, the substrate holder having a selected thermal mass;

setting the substrate holder to a selected first substrate holder temperature with a heat transfer device;

etching a first portion of the film while the substrate holder is at the selected first substrate holder temperature;

with the heat transfer device, changing the substrate holder temperature from the selected first substrate holder temperature to a selected second substrate holder temperature; and

etching a second portion of the film while the substrate holder is at the selected second substrate holder temperature;

wherein the ~~selected~~ thermal mass of the substrate holder is selected to allow ~~allows a change from~~ changing the first ~~selected~~ substrate holder temperature to the second ~~selected~~ substrate holder temperature within a selected time period.

57. (previously presented) The method of claim 56 wherein the first substrate holder temperature is changed to the second substrate holder temperature by heat transfer means coupled to the substrate holder.

58. (previously presented) The method of claim 56 wherein the change from the first substrate holder temperature to the second substrate holder temperature is an in–situ process during the first portion etching step and the second portion etching step.

59. (previously presented) The method of claim 56 wherein the etching of the first portion of the film and the etching of the second portion of the film are conducted in a substantially constant plasma environment.

60. (currently amended) The method of claim 56 wherein etching at least one of the portions of the film comprises radiation.

61. (currently amended) The method of claim 56 wherein etching at least one of the portions of the film is an ion bombardment aided process.

62. (previously presented) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature; and

the first and the second substrate etching temperatures are in a known relationship to the first and the second substrate holder temperatures.

63. (previously presented) The method of claim 62 wherein the first etching temperature is substantially the first substrate holder temperature and the second etching temperature is substantially the second substrate holder temperature.

64. (previously presented) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is higher than the second substrate etching temperature; and

the first portion of the film is etched before the second portion of the film.

65. (previously presented) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is lower than the second substrate etching temperature; and

the first portion of the film is etched before the second portion of the film.

66. (previously presented) The method of claim 56 wherein the substrate holder comprises an electrostatic support chuck having a surface for supporting a substrate in a reaction chamber, the electrostatic support chuck overlays a heat exchange region, and the heat exchange region includes at least one fluid passage through which a fluid can be circulated to heat and/or cool the substrate holder.

67. (previously presented) The method of claim 66 wherein the heat exchange region includes at least two separate fluid passages, each fluid passage being configured to have an independent inlet and an independent outlet.

68. (previously presented) The method of claim 56 wherein the substrate holder includes a plurality of heating elements.

69. (previously presented) The method of claim 68 wherein the heating elements are configured to selectively heat one or more zones of the substrate holder.

70. (currently amended) A method of etching a substrate in the manufacture of a device, the method comprising:

heating the substrate holder to a first substrate holder operating temperature with a heat transfer device,

placing a substrate having a film thereon on a substrate holder in a chamber;

etching a first portion of the film at a selected first substrate temperature; and

etching a second portion of the film at a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature;

wherein ~~the~~ operating the substrate holder ~~is maintained~~ at the first temperature enables the substrate temperature to be above room temperature while etching at least one of the portions of the film, and the selected first substrate temperature is operable to be ~~is~~ changed to the selected second substrate temperature within a ~~characteristic~~ selected time period to process the film.

71. (previously presented) The method of claim 70 wherein a continuous etching process comprises etching the first portion of the film and etching the second portion of the film.

72. (previously presented) The method of claim 70 wherein the first substrate temperature is changed to the second substrate temperature within a selected period of time by at least heat transfer with the substrate using at least an electrostatic chuck.

73. (previously presented) The method of claim 70 wherein the first substrate temperature is changed to the second substrate temperature by transferring heat energy using at least a pressure of gas behind said substrate.

74. (previously presented) The method of claim 70 wherein said first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

75. (previously presented) The method of claim 70 wherein changing the substrate temperature comprises selectively transferring energy in the form of heat from a substrate temperature control system to the substrate holder.

76. (previously presented) The method of claim 70 wherein changing the selected first substrate temperature to the selected second substrate temperature is an in-situ process while etching the first film portion and etching the second film portion.

77. (previously presented) The method of claim 70 wherein the etching of the first portion of the film and the etching of the second portion of the film are conducted in a substantially constant plasma environment.

78. (previously presented) The method of claim 70 wherein etching at least one portion of the film comprises radiation.

79. (previously presented) The method of claim 70 wherein etching at least one portion of the film comprises an ion bombardment aided process.

80. (currently amended) A method of processing a substrate during the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder within a chamber of a plasma discharge apparatus, the plasma discharge apparatus comprising a substrate temperature sensor, a substrate temperature control system including a ~~microprocessor~~ control circuit operable to execute ~~and~~ a heat transfer process; the substrate holder having a substrate holder temperature control system;

performing a first film treatment of a first portion of the film at a selected first substrate temperature;

changing the selected first substrate temperature to a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature; and

performing a second film treatment of a second portion of the film at the selected second substrate temperature;

maintaining ~~wherein~~ the substrate holder temperature such that the substrate temperature remains ~~is maintained substantially~~ above room temperature during at least one of the film treatments and the change from the first substrate temperature to the second substrate temperature occurs within a ~~characteristic~~ predetermined time period to process the film.

81. (previously presented) The method of claim 80 wherein the substrate temperature control system comprises the substrate holder temperature control system.

82. (previously presented) The method of claim 80 wherein the substrate holder temperature control system comprises the substrate temperature control system.

83. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises the substrate temperature being less than the substrate holder temperature.

84. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises the substrate temperature being greater than the substrate holder temperature.

85. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate holder to the substrate.

86. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate to the substrate holder.

87. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises maintaining the temperature of the substrate holder above room temperature and selectively transferring heat energy from the substrate into the substrate holder.

88. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring energy in the form of heat from the substrate temperature control system to the substrate holder and maintaining the substrate holder temperature above room temperature.

89. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises etching.

90. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises chemical vapor deposition.

91. (previously presented) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, is an ion assisted process.

92. (previously presented) The method of claim 80 wherein the first temperature is changed to the second temperature by transferring heat using at least a pressure of gas behind the substrate.

93. (previously presented) The method of claim 80 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at

least radiation.

94. (currently amended) A method of processing a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a processing chamber, the processing chamber comprising the substrate holder, a substrate temperature control system to control the temperature of the substrate, and a substrate holder temperature control system to control the temperature of the substrate holder;

performing a first etching of a first portion of the film at a selected first substrate temperature;

performing a second etching of a second portion of the film at a selected second substrate temperature, the second temperature being different from the first temperature;

wherein at least one of the film portions is etched while ~~the substrate holder temperature is substantially above room temperature and~~ heat is being transferred from the substrate holder control system to the substrate holder; and

~~wherein~~ effectuating a ~~the~~ change in the substrate temperature ~~control system allows a change~~ from the first substrate temperature to the second substrate temperature within a ~~characteristic~~ specified time period to process the film.

95. (previously presented) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate holder into the substrate.

96. (previously presented) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate into the substrate holder.

97. (currently amended) The method of claim 94 wherein the etching of at least one of the film portions comprises maintaining the temperature of the substrate ~~holder above room temperature, and heat flow from the substrate into the substrate holder~~ in the range of 50°C to 100°C.

98. (currently amended) The method of claim 94 wherein the characteristic time period to change from the first substrate temperature to the second substrate temperature subtends less than ~~40~~ about 5 percent of the total etching process time.

99. (withdrawn) The method of claim 94 wherein the characteristic time period to

change from the first substrate temperature to the second substrate temperature subtends less than 15 percent of the total etching process time.

100. (currently amended) A method for processing layers which are included in a stack of layers positioned on a substrate, the method comprising:

placing the substrate on a substrate holder;

etching at least a portion of a first silicon-containing layer in a chamber while the substrate is maintained at a selected first substrate temperature; and

etching at least a portion of a second silicon-containing layer in the chamber while the substrate is maintained at a selected second substrate temperature;

wherein the substrate holder temperature is maintained ~~substantially~~ above ~~room~~ a temperature sufficient to allow controlling at least one of the selected first and the selected second substrate temperatures above 49°C, ~~when etching at least one of the silicon-containing layer portions, selected from the portion of the first silicon containing layer and the portion of the second silicon-containing layer;~~ and the change from the first substrate temperature to the second substrate temperature occurs in a controlled manner, within a selected time period that is less than the overall process time associated with etching the first silicon-containing layer and the second silicon-containing layer.

101. (currently amended) The method of claim 100 wherein the change from the first substrate temperature to the second substrate temperature occurs within less than about 5 percent of the ~~overall~~ total etching process time.

102. (previously presented) The method of claim 100 wherein at least one layer is etched in a chlorine-containing ambient.

103. (previously presented) The method of claim 100 wherein at least one silicon-containing layer is etched in a chlorine-containing ambient;

the first layer is a polysilicon layer, the second layer is a silicide layer and the stack includes an oxide layer;

the second substrate temperature is higher than the first substrate temperature; and

at least one of the etching steps has high selectivity to the oxide layer.

104. (currently amended) A method for manufacturing a device comprising an integrated circuit, the method comprising:

transferring a substrate comprising a stack of layers including a silicide layer into a chamber, the chamber comprising a substrate holder;

heating the substrate holder with a heating device to maintain a substrate holder temperature operable to place the substrate temperature above room temperature while processing the substrate;

processing the substrate in the chamber at a first substrate temperature; and

processing the substrate in the chamber at a second substrate temperature to etch at least a portion of the silicide layer; ~~while maintaining the substrate holder substantially above room temperature~~;

wherein the first temperature is different than the second temperature and the first substrate temperature is changed to the second substrate temperature ~~in~~ within a selected time that is less than an overall time associated with processing the substrate at the first substrate temperature and processing the substrate at the second substrate temperature to etch the silicide layer.

105. (withdrawn) The method of claim 104 where the first substrate temperature is less than about 90 degrees centigrade and the silicide layer is etched above about 99 degrees centigrade.

106. (previously presented) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature within a selected period of time by at least heat transfer to the substrate using at least an electrostatic chuck.

107. (previously presented) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring heat using at least a pressure of gas behind the substrate.

108. (previously presented) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

109. (new) The method of claim 56 wherein the substrate holder is set to the selected first substrate temperature before the substrate is placed on the substrate holder.

110. (new) The method of claim 56 wherein the change from the first substrate holder temperature to the second substrate holder temperature occurs in a controlled manner.

111. (new) The method of claim 56 wherein the substrate holder reaches the second substrate holder temperature at approximately a selected time.

112. (new) The method of claim 70 wherein the first substrate holder operating temperature is above room temperature.

113. (new) The method of claim 80 wherein maintaining the substrate holder temperature comprises transferring heat into the substrate holder with a heat transfer device.

114. (new) The method of claim 94 wherein the change from the first substrate temperature to the second substrate temperature occurs in a controlled manner.

115. (new) The method of claim 94 wherein the substrate reaches the second substrate temperature at approximately a selected time.

116. (new) The method of claim 104 wherein processing the substrate at the second substrate temperature comprises heating the substrate holder with a heating device and a substrate temperature above room temperature.

117. (new) The method of claim 104 wherein the change from the first substrate temperature to the second substrate temperature oocurs in a controlled manner.

REMARKS

Prior to this amendment, claims 56-108 were pending. By this amendment, Claims 56, 60, 61, 70, 80, 94, 98, 100 and 104 are amended. Claim 99 is cancelled in the subject application without prejudice. Claims 109-117 have been added. Claims 1-46 were previously cancelled and Claims 47-55 were previously withdrawn by the Examiner in connection with a restriction requirement. Hence Claims 56–98 and Claims 100 –117 are pending in this application. No new matter has been added.

Prior to this amendment the specification was amended to correct certain typographical errors and formalities. The applicant maintains that no new matter was added.

The examiner objected to amendments to the specification, maintaining that there were corrections which did not have proper bracketing and underlining and that some changes introduced new matter. In a subsequent telephonic interview the examiner clarified these remarks. She instructed that the amendments to the specification should be entered relative to the published specification rather than relative to the specification inclusive of the amendment after allowance. It was previously noted that Patent Office omitted the textual portion of the amendment after allowance from the publication.

As for the objected to amendments to the specification in page 1 of the previous office action, the applicant hereby withdraws the changes *at column 19, paragraph 1*, and at *column 19, paragraph 2* without prejudice, and enters a new amendment at *column 19, paragraph* 2. If the claims are allowed, Applicant will submit a clean copy of the amended specification, including the amendment after allowance and corrections made to the specification during reissue prosecution.

The remarks responsive to Examiner's Office Action mailed on 9/16/05, below, are referenced to the pagination of that office action.

Page 2, Specification- The objected to corrections are withdrawn. A new correction is entered at Col. 19, Par. 2 relative to the published specification.

Page 2- 35 USC § 132- The correction at Col. 19, Par. 1 has been withdrawn. As to Fig. 10 being a "flow diagram," authorities consulted by the Applicant define a flow diagram as a "*flow chart*" which is "*a graphical representation of a process, such as a manufacturing operation or computer operation, indicating the various steps that are taken as the product moves along the production line or the problem moves through the computer. Individual operations can be represented by closed boxes on the chart, with arrows between boxes indicating the order in which the steps are taken*" (from Encyclopedia Brittanica, 2005). Other authorities such as the Electrical Engineering Dictionary (La Plante, CRC Press, 2000) and dictionary.com on the internet have consistent definitions. Since FIG. 10 is essentially two x-y graphs, it is not a flow diagram by these authorities.

Col. 19, Par. 2, as now amended, recites intervals which "subtend less than about 5 percent of the tungsten silicide/polysilicon stack etching time (60s in the exemplary embodiment).

Page 3. Specification, Antecedant Basis Objections -

Please note that Claim 99 is withdrawn without prejudice.

"heat transfer means coupled to the substrate holder"

Applicant maintains that there is proper antecedant basis which has been overlooked. Various means are described including at least those means at: Col. 14, line 58; Col. 15, line 66 through Col. 16 line 6; including heating elements 607 which can be "any suitable device for supplying heat energy" (Col. 15, lines 15-16 et. seq.) "as merely an example, ... can be a resistive ..., infrared, and others" (Col. 15, lines 18-20), and the system 700 including component parts such as the heating unit 705, among others (Col. 16, par. 1, par. 2, etc.).

"substrate temperature control system including a microprocessor and a heat transfer process"

Applicant maintains that there is proper antecedant basis which has been overlooked. The term is set forth at least at: Col. 15, lines 61-63 (state that Fig. 7 is a simplified diagram of a temperature control system 700 according to an embodiment); Col. 16, line 64 ("uses a microprocessor to oversee operations of the system described above" -heat transfer, a temperature control system, etc. are described above this line).

Between a substrate and substrate holder temperature control system.

Applicant maintains that the specification expressly teaches controlling the substrate temperature and controlling the substrate holder temperature with control systems. Col. 16, lines 32-34 teach that the system can be controlled to a measured **wafer OR wafer chuck (e.g. substrate holder) temperature.** Col. 16, lines 37-41 teach that if the measured temperature of the wafer or chuck is below the desired temperature [of the wafer or chuck] "a control algorithm increases the temperature by supplying more power to the heater" (e.g. expressly, depending on the selection, the heater controls a wafer temperature and/or chuck temperature, depending on the embodiment).

"subtends less than 40 percent"- "subtends less than 40 percent"- this language is withdrawn per the remarks above.

"subtends less than 15 percent"; and - "subtends less than 40 percent"- "- this language is withdrawn per the remarks above.

"the first substrate temperature is less than about 90 degrees ….."''- this language is withdrawn per the remarks above.

Page 4- Explicit basis for the phrase "substrate holder is maintained above room temperature" as used in claims 70, 80, 94, 100, 104.

Please note that amended Claims 70, 80, 94, 100 and 104 no longer have the limitation of a *substrate holder being maintained above room temperature*. Therefore the objection does not apply to the instant claims.

However Applicant respectfully wishes to point out that a substrate holder temperature above room temperature is not new matter. Please observe that that Col. 3, lines 57-58 teach that the support and wafer temperature are often at substantially equal temperature. Therefore the substrate holder is maintained above room temperature at least in embodiments where the substate is maintained above room temperature and the "support and wafer temperature are at substantially equal temperature" as, for example, at Col. 18 line 12 et seq.."

Conclusion Regarding Basis Objections

According to the above discussion, applicant believes that all of the antecedant basis objections have been traversed.

Claim Rejections – 35 USC § 251 Page 4.

Claim 99 and 105 are withdrawn.

Claims 98 and 101 have been amended to include a limitation less than about 5 percent of the total etching process time responsive to the corrected specification and examiner's telephonic remarks.

The instant Claims 70-108 do not have the rejected limitation.

Therefore it is believed that the examiner's rejections are respectfully traversed.

Page 4, Page 5, Page 6 – Claim Rejections 35 USC § 112

Claims 99 and 105 are withdrawn.

Claims 80, 94, 98-99, 100, 101, 104 and their dependent claims, as amended, do not have the rejected limitations: "subtends less than 40 percent," "subtends less than 15 percent," "the first silicide layer is less than about 90 degrees centigrade…", "substrate holder is maintained above room temperature". The discussion above regarding Claims 98, 101, and 105 is repeated here.

Therefore it is believed that the examiner's rejections are respectfully traversed.

Page 6, Page 7- Claim Rejections – 35 USC § 102

JP 59-076876

Claims 56-64

Claims 56-64 as amended include a limitation that the "thermal mass of the substrate holder is selected" to allow changing the first substrate holder temperature to the second substrate holder temperature within a selected time period. Unlike the instant Claims 56-64, JP 59-076876 does not suggest a selected time period or selecting the thermal mass.

Claims 70-79

Amended claims 70-79 include selecting first and second *substrate temperatures* wherein "operating the substrate holder at the first temperature enables the substrate temperature to be above room temperature while etching at least one of the portions of the film, and the selected first substrate temperature is operable to be changed to the selected second substrate temperature within a selected time period to process the film."

Please observe that JP 59-076876 merely the temperature of a substrate holder is controlled (electrode), not the temperature of a substrate. Also, JP 59-076876 does not teach a substrate temperature that is known or selected. It merely posits that increasing substrate holder temperature results in an increase in substrate temperature. Further, JP 59-076876 does not disclose processing within a selected time period.

Therefore the claims as currently written have portions not in the art cited by the examiner. Applicant respectfully requests that the examiner withdraw the rejections.

Claims 94-98

Amended claims 94-98 include controlling a substrate temperature and effectuating a change in the substrate temperature within a specified time period. JP-59-076876 does not teach controlling a substrate temperature or effectuating a change in the substrate temperature within a specified time period.

Therefore the claims as currently written have portions not in the art cited by the examiner. Applicant respectfully requests that the examiner withdraw the rejections.

Claims 100-102

Claims 100-102 as amended include etching a portion of a first silicon-containing layer maintained at a selected first substrate temperature, and etching a portion of a second silicon-containing layer portion maintained at a selected second substrate temperature, while maintaining a substrate holder temperature sufficient to keep the substrate above 49°C when etching at least one of the layer portions (e.g. col. 18 line 12 and FIG. 10), and changing from the first substrate temperature to the second in a time that is less than the overall process time associated with etching the two layer portions.

Unlike the instant claims, 100-102, JP 59-076876 only discloses a substrate holder temperature. It does not disclose controlling a substrate temperature. Furthermore, JP 59-076876 describes etching only one layer and etching only one silicon-containing layer at different substrate holder temperatures. It does not teach etching each of two silicon containing layers at distinct temperatures (the inherent resist mask erosion in JP 59-076876 is an undesirable side effect; resist is not a layer intentionally being etched and it does not contain silicon).

Therefore the claims as currently written have portions not in the art cited by the examiner. Applicant respectfully requests that the examiner withdraw the rejections..

Claims 104 and 108

Amended claims 104 and 108 include changing the first temperature to the second temperature within a selected time that is less than an overall time associated with processing the substrate and the first and second substrate temperatures to etch the silicide layer. JP 59-076876 does not teach or suggest a selected time.

Therefore the claims as currently written have portions not in the art cited by the examiner. Applicant respectfully requests that the examiner withdraw the rejections.

Tsubone et al.

Claims 70-79, 94-98

Amended claims 70-79, 94-98 are not anticipated by Tsubone for at least the following reasons. Regarding amended claims 70-79, Tsubone does not teach heating the substrate holder, heating the substrate holder to a first substrate holder temperature with a heating device, and operating the substrate holder at a first temperature that enables the substrate temperature to be above room temperature while etching at least one of the portions of the film.

Regarding amended claims 94-98, Tsubone does not teach a film portion being etched while transferring heat from the substrate holder control system to the substrate holder.

Therefore the claims as currently written have portions not in the art cited by the examiner. Applicant respectfully requests that the examiner withdraw the rejections.

Page 8-11- Claim Rejections – 35 USC § 103

Tsubone, p. 8

Claims 80-93

As to amended claim 80 (and dependent claims), Tsubone does not disclose a step of treating a film at a selected a substrate temperature while maintaining the substrate holder temperature such that the substrate temperature remains above room temperature during at least one of the film treatments.

As examiner has pointed out, the graph of Case III, FIG. 4 of Tsubone evidences a temperature somewhat above room temperature. However this temperature is uncontrolled. Tsubone teaches (Col. 8, lines 55-64) that Case III is realized by completely exhausting the supply of heat transfer gas. The sample temperature is uncontrolled and unselected since the sample is heated by (available) radiant heat inside of the vacuum chamber and/or heat input from the plasma. Furthermore, Tsubone teaches away from maintaining the substrate holder temperature to have a selected substrate temperature above room temperature.

Therefore there is nothing in Tsubone, alone or in combination with the knowledge of one having ordinary skill in the art, to suggest what is claimed. Therefore the claims as currently written have portions not in the art cited by the examiner. Applicant respectfully requests that the examiner withdraw the rejections.

Tsubone and Shin, p. 8-9

Claims 100-108

As to amended claims 100-108, there is nothing in Tsubone or Shin, alone or in combination, that suggests maintaining a substrate holder temperature sufficient to keep the substrate above 49°C when etching at least one of the silicon-containing layers, wherein the change from the first substrate temperature to the second substrate temperature occurs within a time that is less than the overall process time associated with etching the first and the second layers. Also there is nothing in these references to suggest a combination to this limitation or to suggest combining a change in substrate temperature while keeping the substrate above 49°C while etching a layer.

Therefore the claims as currently written have portions not in the art cited by the examiner. Applicant respectfully requests that the examiner withdraw the rejections.

JP 59-076876 and Rossman, p. 9-11

Claims 65, 66-69

Please refer to amended claims 65, 66-69. There is nothing in JP-59-076876 or JP 59-076876 and Rossman in combination which suggests a thermal mass of the substrate holder selected to allow changing the first substrate holder temperature to the second substrate holder temperature within a selected period of time.

Referring to amended claims 72-73, nothing in JP-59-076876 or JP 59-076876 and Rossman in combination suggests etching a first portion of a film at a selected first substrate temperature that is operable to be changed to a selected second substrate temperature within a selected time period to process the film.

Referring to amended claims 80-93, nothing in JP-59-076876 or JP 59-076876 and Rossman in combination suggests changing a first substrate temperature to a second substrate temperature within a predetermined time period to process the film.

Refering to amended claim 106, nothing in JP-59-076876 or JP 59-076876 and Rossman in combination suggests changing the first substrate temperature to the second substrate temperature within a selected time that is less than an overall time associated with processing the substrate.

In conclusion the claims as currently written respectfully traverse the examiner's rejections. Therefore it is respectfuly requested that examiner's rejections be withdrawn.

Re: Response to Arguments, p. 12

Re: Temperature of the Substrate Holder and Substrate

Turning to the temperature of the substrate holder, applicant wishes to point out that Col. 15, line 66 to Col. 16, line 16 teach heating a substrate holder and Col. 17, lines 45-52 teach that wafer temperature will (often) be slightly less than the substrate holder temperature when the substrate holder and etching temperature are greater than the temperature of the walls. Further Col. 3, lines 57-58 teach that the substrate holder temperature and wafer temperature are often maintained at substantially equal temperature.

As for the temperatures shown in FIG. 10, Col. 17 line 53 to Col. 18, line 15 expressly reference *processing the semiconductor substrate* 900 without reference to a support, and at Col. 18, line 12 *temperatures for processing layers* thereon are disclosed without reference to any holder or holder temperature. Accordingly the paragraph beginning at Col. 18, line 16 refers to substrate temperatures and speaks to a process for processing the stack at "*substrate temperatures*", not substrate holder temperature. Furthermore, Col. 18, line 42 references an etching process for tungsten silicide and polysilicon layers that uses more than one temperature (of the etching process) and it distinctly points out that details are shown by way of FIG. 10, for example (Col. 18, lines 49-50).

Also, for the breakthrough step (Co. 18, line 58) and others, e.g. the "*tungsten silicide is etched at this temperature*" (Col. 19 lines 3-4), the written description expressly teaches temperatures of the materials and makes reference to FIG. 10.

Accordingly, it is respectfully submitted that reference to substrate temperature in FIG. 10 is clear from the written description, at least.

CONCLUSION

In view of the foregoing, Applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 925-947-1909.

Respectfully submitted,

Daniel L. Flamm

RCE

PTO/SB/30 (04-05)
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Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	10/439,245
Filing Date	5/14/2003
First Named Inventor	Daniel L. Flamm
Art Unit	1765
Examiner Name	Anita K. Alanko
Attorney Docket Number	

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

a. ☑ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on ________

ii. ☐ Other ________

b. ☑ Enclosed

i. ☑ Amendment/Reply
ii. ☐ Affidavit(s)/ Declaration(s)
iii. ☐ Information Disclosure Statement (IDS)
iv. ☐ Other ________

2. Miscellaneous

a. ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of ________ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

b. ☐ Other ________

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

a. ☐ The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. ________. I have enclosed a duplicate copy of this sheet.

i. ☑ RCE fee required under 37 CFR 1.17(e)

ii. ☑ Extension of time fee (37 CFR 1.136 and 1.17)

iii. ☐ Other ________

02/22/2006 HDEMESS1 00000050 10439245
01 FC:2801 395.00 OP

b. ☑ Check in the amount of $ 620.00 enclosed

02/22/2006 HDEMESS1 00000050 10439245
02 FC:2252 225.00 OP

c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	Daniel L. Flamm	Date	February 16, 2006
Name (Print/Type)	Daniel L. Flamm	Registration No.	54,100

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature	Daniel L. Flamm		
Name (Print/Type)	Daniel L. Flamm	Date	February 16, 2006

PTO/SB/06 (08-03)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 10/439,245

CLAIMS AS FILED – PART I

FOR	(Column 1) NUMBER FILED		(Column 2) NUMBER EXTRA	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE (37 CFR 1.16(a))					395 pd.	OR		$
TOTAL CLAIMS (37 CFR 1.16(c))	55	minus 20 =	* 35	x $ 9 =	315	OR	x $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(b))	7	minus 3 =	* 4	x $ 42 =	168	OR	x $ =	
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))				+ $ =		OR	+ $ =	
				TOTAL	878	OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

CLAIMS AS AMENDED – PART II

AMENDMENT A — 5-14-05

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 55	Minus	** 55	=	x $ =		OR	x $ =	
Independent (37 CFR 1.16(b))	* 7	Minus	*** 7	=	x $ =		OR	x $ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B — 2-25-05

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 53	Minus	** 55	=	x $ =		OR	x $ =	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	=	x $ =		OR	x $ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

56, 70, 80, 94, 100, 104

AMENDMENT C — 2-21-06

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
Total (37 CFR 1.16(c))	* 63	Minus	** 55	= 8	x $ 25	200	OR	x $ =	
Independent (37 CFR 1.16(b))	* 6	Minus	*** 7	= ~~0~~	x $ =		OR	x $ =	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))					+ $ =		OR	+ $ =	
					TOTAL ADD'L FEE	200	OR	TOTAL ADD'L FEE	

56, 70, 80, 94, 100, 104

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 10/11/2005

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

EXAMINER	
ALANKO, ANITA KAREN	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 10/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Interview Summary	**Application No.** 10/439,245	**Applicant(s)** FLAMM, DANIEL L.	
	Examiner Anita K. Alanko	**Art Unit** 1765	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Anita Alanko*. (3)_____.

(2) *Daniel Flamm*. (4)_____.

Date of Interview: *05 October 2005*.

Type: a)☒ Telephonic b)☐ Video Conference

c)☐ Personal [copy given to: 1)☐ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: *1,47,56,57,70 and 80-82*.

Identification of prior art discussed: *Tsubone, JP 59-076876*.

Agreement with respect to the claims f)☐ was reached. g)☒ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *See Continuation Sheet*.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Anita Alanko
ANITA ALANKO
PRIMARY EXAMINER

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Examiner's signature, if required

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)
In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Discussed objection to the specification, 112, 132, 102 rejections, Discussed time limitation of 3-5% which can be gleaned from the time scale in Figure 10, antecedent basis in the specification for the control system, and including claim language that includes selecting a thermal mass. Amendment "B" was made to the specifcation on 1/2/2001, however the issued patent did not include all of the amendments. Applicant should amend the specification relative to the issued patent.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 09/16/2005

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

EXAMINER	
ALANKO, ANITA KAREN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 09/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	10/439,245	FLAMM, DANIEL L.	
	Examiner	Art Unit	
	Anita K. Alanko	1765	

-- ***The MAILING DATE of this communication appears on the cover sheet with the correspondence address*** --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *7/25/05 amdt*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *56-108* is/are pending in the application.

4a) Of the above claim(s) _ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *56-108* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Specification

The disclosure is objected to because of the following informalities: The corrections to column 19, paragraphs 1 and 2 appear to not have proper bracketing and underlining for deleted and added terms. The second line of paragraph 1 cites time "B" whereas the patent recites time "C". The eighth line of paragraph 2 cites point "D" whereas the patent recites point "DD".

Appropriate correction is required.

35 USC § 132

The amendment filed 7/25/05 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

At column 19, paragraph 1, the phrase "as shown in Fig.10, is typically more than 99 °C" is new matter. The specification does not recite that the flow diagram is drawn to a specific temperature scale, therefore the addition of the designated temperature is new matter.

At column 19, paragraph 2, the phrase "intervals which subtend significantly less than 15 percent of the total stack etching time and well under 40 percent of the total process time" is new matter. These ranges were not recited in the original specification, and are not readily envisaged by one of ordinary skill in the art. The specification describes the intervals as taking place over "several seconds" (col.19, lines 1-3) and that at point H the stack etch is complete (col.19, line 40). It is unclear what "several seconds" encompasses. According to Figure 10, point H is at about 110 seconds. Therefore the interval is arguably (since it is not known what several seconds are) about 2-5 seconds/110 seconds, or 2-5%. This number would be doubled for two intervals, or 4-10%. The range of less than 15% is therefore not readily envisaged. Why not choose 5%, 10%, 20% or any other number?

The total process time is, according to Figure 10 at point J, 180 seconds. Therefore the intervals are 3-5 seconds/180 seconds, or 2-3%. For five intervals, 15-25 seconds/180, or 8-14%. The range of less than 40% is therefore not readily envisaged. Why not choose 15%, 20%, 50% or any other number?

Applicant is required to cancel the new matter in the reply to this Office Action.

Specification

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: explicit basis for claims 57, 80, 98, 99, 101, 105, i.e., for the terms:

"heat transfer means coupled to the substrate holder";

"substrate temperature control system including a microprocessor and a heat transfer process" (note that the paragraph bridging columns 16 and 17 describes a microprocessor for a substrate *holder* temperature control system; the distinction between a substrate control system and a substrate holder control system is not explicit in the specification);

"subtends less than 40 percent";

"subtends less than 15 percent"; and

"the first substrate temperature is less than about 90 degrees centigrade and the silicide layer is etched above about 99 degrees centigrade".

Explicit basis is also not provided for the phrase "substrate holder is maintained above room temperature" as in the context of claims 70, 80, 94, 100 and 104.

The terms may be merely added to the specification, provided they are not new matter.

Claim Rejections - 35 USC § 251

The following is a quotation from 35 U.S.C. 251:

> Whenever any patent is, through error without any deceptive intention, deemed wholly or partly inoperative or invalid, by reason of a defective specification or drawing, or by reason of the patentee claiming more or less than he had a right to claim in the patent, the Director shall, on the surrender of such patent and the payment of the fee required by law, reissue the patent for the invention disclosed in the original patent, and in accordance with a new and amended application, for the unexpired part of the term of the original patent. No new matter shall be introduced into the application for reissue.

Claims 98-99, 101 and 105 are rejected under 35 U.S.C. 251 as being based upon new matter added to the patent for which reissue is sought. The added material that is not supported by the prior patent is as follows:

the terms "subtends less than 40 percent", "subtends less than 15 percent" and "the first substrate temperature is less than about 90 degrees centigrade and the silicide layer is etched above about 99 degrees centigrade".

Claims 70-108 are rejected under 35 U.S.C. 251 as being based upon new matter added to the patent for which reissue is sought. The added material that is not supported by the prior patent is as follows:

The phrase "substrate holder is maintained above room temperature" as in the context of claims 70, 80, 94, 100 and 104 is new matter.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 98-99, 101 and 105 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The terms "subtends less than 40 percent", "subtends less than 15 percent" and "the first substrate temperature is less than about 90 degrees centigrade and the silicide layer is etched above about 99 degrees centigrade" are new matter.

Claims 70-108 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The phrase "substrate holder is maintained above room temperature" as in the context of claims 70, 80, 94, 100 and 104 is new matter.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 80, 94, 100, 104, and their dependent claims 81-93, 95-99, 101-103, 105-108 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term "substantially above room temperature" renders the metes and bounds of the claims unclear. How much above room temperature must the temperature be in order to be "substantially" above room temperature? Neither the specification nor the prior art provides a clear definition of what temperature range is encompassed by the claims.

Claims 81-93, 95-99, 101-103, 105-108 do not cure the indefiniteness of their base claims are are therefore also rejected.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 56-64, 70-71, 74-79, 94-98, 100-102, 104 and 108 are rejected under 35 U.S.C. 102(b) as being anticipated by JP 59-076876.

JP 59-076876 discloses a method of etching a substrate in the manufacture of a device, the method comprising:

placing a substrate 14 (Fig.4) having a film ($MoSi_2$, Fig.2) thereon on a substrate holder 19 in a chamber 11, the substrate holder having a selected thermal mass (inherent since the holder has thermal mass);

etching a first portion of the film (the "etching region" in Fig.5) while the substrate holder is at a selected first substrate holder temperature (60 °C using temperature controller 21, see Fig.5 and page 5, lines 13+ of English translation);

changing the substrate holder temperature from the selected first substrate holder temperature to a selected second substrate holder temperature (30 °C using temperature controller 22, see Fig.5 and page 5, line 18)

etching a second portion (the "overetching region" of Figure 5) of the film while the substrate holder is at the selected second substrate holder temperature;

wherein the selected thermal mass allows a change from the first to the second selected substrate holder temperature within a characteristic time period to process the film (inherent since Figure 5 shows a time period for the change of temperature).

Claims 70-79, 94-99 are rejected under 35 U.S.C. 102(b) as being anticipated by Tsubone et al (US 5,320,982).

Tsubone discloses a method of etching comprising etching at a first temperature and at a different second temperature (Fig.4), wherein the selected thermal mass inherently allows a change from the first to the second temperature within a characteristic time period to process said film, since the same method steps are performed in Tsubone as in the instant invention. Figure 4 shows how the change in temperature occurs within in a certain time period (the time periods between the steady state temperature steps, a-c, d-f, g-i, j-k), therefore since the change occurs within a time period, the thermal mass, as broadly cited, "allows" for the change in temperatures. Figure 4 also shows a temperature above room temperature, or substantially above room temperature (Case III of Figure 4), as broadly interpreted.

As to claims 98-99, Figure 4 of Tsubone depicts that the change times (a-c, d-f, g-i, j-k) subtend less that 40% or 15% of the total etch time.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 80-93 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubone et al (US 5,320,982).

The discussion of Tsubone from above is repeated here.

As to claim 80, Tsubone discloses all of the steps, but fails to explicitly disclose that a microprocessor is used. However, Tsubone does disclose that the controller stores a relation between the heat transfer gas pressure and the sample temperature (col.4, lines 43-44). It would have been obvious to one with ordinary skill in the art to use a microprocessor to store the relation and use it for the control in the method of Tsubone because they are useful for processing numbers and relations.

Claims 100-108 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubone et al (US 5,320,982) in view of Shin et al (US 6,087,264).

The discussion of Tsubone from above is repeated here.

As to claims 100 and 104, Tsubone discloses that his method is an improvement for the etch of a silicide layer (col.1, lines 23-28), however Tsubone does not disclose the specific layers such as a gate oxide, polysilicon layer and a silicide layer. Shin teaches that an oxide layer 4, a polysilicon layer 6 and a silicide layer 8 is a conventional structure to etch through photoresist layer 12 mask by a chlorine plasma (col.2, lines 2-4, 41-51). It would have been obvious to one with ordinary skill in the art to deposit an oxide layer, a polysilicon layer and a silicide layer and to etch them through a photoresist layer mask by a chlorine plasma in the method of Tsubone because Shin teaches that this is a useful structure and method to pattern by etching.

Claims 65, 66-69, 72-73, 80-93, 99, 106-107 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Rossman et al (US 6,077,357).

The discussion of JP 59-076876 from above is repeated here.

As to claims 64, 73, 92 and 107, JP 59-076876 fails to disclose that the first substrate etching temperature is lower than the second substrate etching temperature. Rather, JP 59-076876 discloses that the first substrate etching temperature is higher. However, it is obvious that the method of JP 59-076876 can be used for different substrates than those disclosed, and that different substrates with different films have different temperature requirements. For example, etch rates are dependent on etch temperatures (see Fig.1), and thus the temperature is a result effective variable.

Rossman also teaches that it is useful to either heat or cool during plasma processing (col.10, lines 9-12; col.13, lines 14-17) using a heat transfer gas compatible with the chemical process (col.10, lines 41-50).

It would have been obvious to one with ordinary skill in the art to etch at a higher temperature in the method of JP 59-076876 because processing of multi-film substrates has different etching requirements for each film, for which the temperature appears to reflect a result-effective variable, which can be optimized. See MPEP 2144.05 IIB. Still further, it would have been obvious to heat or cool, with corresponding heat transfer to or from the substrate, in the method of JP 59-076876 because Rossman teaches that such heating or cooling of the substrate during plasma processing is useful.

As to claims 72 and 106, JP 59-076876 does not disclose the type of chuck. Rossman teaches that an electrostatic chuck 104 is useful (col.9, lines 43-44). It would have been obvious to one with ordinary skill in the art to use an electrostatic chuck in the method of JP 59-076876 because Rossman teaches that they are useful during plasma processing.

As to claims 66-69, JP 59-076876 does not disclose how the substrate temperature is changed. Rossman teaches that it is useful to use fluid passages 144, 146 in the substrate holder, to heat and cool zones 168, 170, and to use a heat transfer gas behind the substrate (col.9, lines 26-42; col.10, lines 9-12) during plasma processing. It would have been obvious to heat and cool the wafer as taught by Rossman in the method of JP 59-076876 because Rossman teaches that they are useful techniques for controlling the temperature of the substrate during processing.

As to claim 80, JP 59-076876 does not disclose to use a microprocessor. Rossman teaches how memory 245, used in a microprocessor, is useful for controlling processes (col.13, lines 38-55). It would have been obvious to use a microprocessor to control the temperature in the method of JP 59-076876 because the etch rate depends on the temperature, and the relationship is useful to control by microprocessors as taught by Rossman.

As to claims 83-84, JP 59-076876 does not explicitly disclose the relative temperatures, however it would have been obvious to have both since they depend on the temperature, pressure and type of process.

As to claim 90, JP 59-076876 is directed to etching, however Rossman teaches that CVD or etching both use plasma tools (col.1, lines 13-14). It would have been obvious to conduct CVD in the tool of JP 59-076876 because it is useful to use plasma tools for both etching and CVD as taught by Rossman.

As to claim 99, Figure 5 of JP 59-076876 shows a time that subtends about 15%. It would have been obvious to one with ordinary skill in the art to subtend less than 15% in order to optimize the process for the best results, since the time depends on the temperature, pressure and type of process.

Claim 103 is rejected under 35 U.S.C. 103(a) as being unpatentable over JP 59-076876 in view of Shin et al (US 6,087,264) and Rossman et al (US 6,077,357).

The discussion of modified JP 59-076876 from above is repeated here.

As to claim 103, JP 59-076876 discloses that his method is an improvement for the etch of a silicide layer 2 (Fig.2), however JP 59-076876 does not disclose the specific layers such as a gate oxide, polysilicon layer and a silicide layer. Shin teaches that an oxide layer 4, a polysilicon layer 6 and a silicide layer 8 is a conventional structure to etch through photoresist layer 12 mask by a chlorine plasma (col.2, lines 2-4, 41-51). It would have been obvious to one with ordinary skill in the art to deposit an oxide layer, a polysilicon layer and a silicide layer and to etch them through a photoresist layer mask by a chlorine plasma in the method of JP 59-076876 because Shin teaches that this is a useful structure and method to pattern by etching.

Response to Arguments

Applicant's arguments filed 7/25/05 have been fully considered but they are not persuasive.

Applicant argues about the change in temperature subtending less than 40% or 15% of the time. However, these ranges are not readily envisaged by the original specification, as discussed above.

Applicant argues about B-D being in the range of 100 to 122.5 °C. However, the specification does not recite that the figure (originally described as a flow diagram) is drawn to scale. The insertion of specific temperature ranges are new matter.

Applicant's arguments about antecedent basis for "radiation" is persuasive.

Applicant argues that claims 56-69 include a limitation that the temperature of the substrate holder is changed. Applicant's arguments are persuasive that Tsubone do not teach or suggest the limitations of claim 56. For example, Tsubone discloses that the temperature is not changed (col.3, line 33: "the temperature of the sample bed is kept as such").

The limitation about the substrate holder being above room temperature is new matter. It is unclear whether Figure 10 refers to the substrate temperature or the substrate holder temperature.

Applicant's arguments about Tsubone and the substrate holder temperature are persuasive for claims 56-69. However, the remainder of the claims are not limited to the substrate holder temperature, but rather they cite only the substrate temperature, which as broadly cited, Tsubone discloses. The limitation about the substrate holder being above room temperature is not persuasive since Tsubone shows in Figure 4 a temperature that is above room temperature.

JP 59-076876 is newly cited to disclose changing the temperature of the substrate holder during processing.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anita K. Alanko whose telephone number is 571-272-1458. The examiner can normally be reached on Mon-Fri until 2:30 pm (Wed until 11:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Anita K. Alanko

Anita K Alanko
Primary Examiner
Art Unit 1765

Notice of References Cited	Application/Control No. 10/439,245	Applicant(s)/Patent Under Reexamination FLAMM, DANIEL L.	
	Examiner Anita K. Alanko	Art Unit 1765	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,077,357	06-2000	Rossman et al.	118/728
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	JP 59076876 A	05-1984	Japan	OKUMURA et al.	C23F 01/00
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

JP 59-076876
English translation

PTO: 2005-6100

Japanese Published Unexamined (Kokai) Patent Publication No. 59-076876; Publication Date: May 2, 1984; Application No. 57-185449; Application Date: October 22, 1982; Int. Cl.^{3}: C23F 1/00 1/08 H01L 21/306; Inventor(s): Katsuya Okumura et al.; Applicant: Toshiba Corporation; Japanese Title: Hannousei Ionecchinngu Houhou oyobi Sono Souchi (Method for Reactive Ion Etching and Apparatus Therefor)

Specification

1. Title of Invention

Method for Reactive Ion Etching and Device Used Therefor

2. Claim(s)

1. A method for a reactive ion etching wherein a material to be etched is arranged on an electrode provided in a reactive gas and wherein a gas discharging is performed by charging voltage to the electrode to etch the material, characterized in that the etching of the material is performed at two or more different electrode temperatures.

2. The method for a reactive ion etching, as disclosed in Claim 1, characterized in that after the material has been etched at a higher electrode temperature, an over-etching is applied at a lower electrode temperature.

3. A device for a reactive ion etching wherein a material to be etched is placed on an electrode arranged in a reactive gas and wherein a gas discharging is performed by charging voltage to the electrode to etch the material, characterized in that an electrode structure such that the etching of the material can be performed at two or more different temperatures is given.

4. The device for the reactive ion etching, as disclosed in Claim 3, characterized in that the electrode is comprised of a plurality of electrode bodies; the temperatures of the electrode bodies are made various to each other.

5. The device for the reactive ion etching, as disclosed in Claim 3, characterized in that the temperature of the electrode is made adjustable according to the etching process.

3. Detailed Description of the Invention

[Field of Industrial Application]

This invention pertains to a method for a reactive ion etching that can improve the selectivity and the productivity and that can control the occurrence of an overhanging effect and a device used therefor.

[Technical Background of the Invention and the Problem]

A $MoSi^2$ film is generally highly expected as the material for the electrode and the wiring of a super LSI and one of high melting point metal silicides that are variously studied. Since the $MoSi^2$ film is used for the super LSI, a fine process naturally needs to be applied. Accordingly, the applicants have studied and developed an etching of the $MoSi^2$ film by a reactive etching means (henceforth referred to merely as an etching) and on the application of the etching in the form of chloride of Mo ($MoCl_5$ seems to be used as a main component) mainly using a Cl-based gas so far.

When this method is used, the steam pressure of $MoCl_5$ has extremely high temperature dependability. When the temperature changes by 40°C, the steam pressure changes almost 10 times. More specifically, when an etching is applied while increasing the temperature of a substrate to be etched, as shown in a graph of Fig.1, the etching speed of $MoSi_2$ largely changes. On the other hand, the etching speed of a resist to be a mask during the etching does not have any temperature dependability.

Taking the etching selection ratio of $MoSi_2$ to the resist and the productivity into consideration based on the aforementioned fact, it is proper that the etching is performed while increasing the temperature of the substrate to be etched. When an etching is performed while increasing the substrate temperature by the applicants, it is identified that both selection ratio and the productivity improve.

However, when an over-etching is applied, as shown in Fig.2, it is identified that an overhanging effect occurs to the $MoSi_2$ film. More specifically, in Fig.2, reference number 1 refers to a substrate; 2 to a $MoSi_2$ film as a material to be etched; 3 to a resist as a mask. The left end of the $MoSi_2$ film shows an overhanging effect in which the upper part projects more than the lower part.

Such an overhanging effect conspicuously occurs the higher the temperature of the substrate 1 is. When the substrate temperature is reduced, the overhanging effect is hardly seen.

The substrate temperature needs to be increased with respect to the selection ratio and the productivity. On the other hands, the substrate temperature needs to be reduced with respect to the overhanging. Thus, temperature conditions that contradict each other are required.

[Purpose of the Invention]

JP59-076876

In consideration of the aforementioned aspects, the present invention aims to offer a method for a reactive ion etching that is capable of improving the selection ratio and the productivity and effectively preventing a generation of an overhanging effect and a device therefor.

[Abstract of the Invention]

According to the invention, this purpose is achieved by performing an etching of a material to be etched at two or more different electrode temperatures.

[Working Examples of the Invention]

Fig.3 illustrates a first working example of the invention. An etching electrode 12 and an over-etching electrode 13 are separately provided inside a vacuum container 11, wherein the electrodes are electrically insulated from the container 11. A substrate 14 is placed on the electrodes 12 and 13. High frequency power sources 15 and 16 and temperature controllers 17 and 18 that control the temperatures of the electrodes 12 and 13 are provided on the electrodes 12 and 13. First, the substrate 14 is placed on the etching electrode 12 at a high temperature using a transferring mechanism as not shown in the drawing to carry out an etching. The substrate 14 is then transferred onto the over-etching electrode 13 to carry out an over-etching.

The effect of the working example is described next.

At the etching, the substrate 14 is first transferred from the outside location into the vacuum container 11 using the transferring mechanism as not shown in the drawing

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and then placed onto the etching electrode 12 whose temperature is controlled at 60°C. Almost 90% of the thickness of a $MoSi_2$ film is etched.

Following this, the substrate 14 is transferred and placed onto the over-etching electrode 13 whose temperature is controlled at 30°C to perform an over-etching and to complete the etching process.

According to such a working example, because the over-etching is applied at a lower electrode temperature after the etching has been applied at a higher electrode temperature, the selection ratio of $MoSi_2$ to a resist and the productivity improve. Furthermore, an overhanging effect that occurs to the $MoSi_2$ film is effectively prevented.

As in the aforementioned working example, a single etching electrode is provided to a single over-etching electrode. The number of the etching electrodes can be increased so that the etching period and the over-etching period can be well balanced.

Fig.4 illustrates a second working example. An electrode 19 where the substrate 14 is placed on the upper surface is arranged inside the vacuum container 11 while it is electrically insulated from the container 11. As shown in the drawing, the electrode 19 is comprised of a high frequency power source 20, a temperature controller 21 that controls the temperature of the electrode 19 to 60°C and a temperature controller 22 that controls the temperature of the electrode 19 to 30°C. The temperature controllers 21 and 22 are switched using three-way cocks 23 and 24.

The effect of the working example is described next.

At the etching, the temperature of the electrode 19 is first controlled to 60°C using the temperature controller 21 by operating the three-way cocks 23 and 24. The material 14 to be etched is then placed onto the electrode 19 using a transferring mechanism as not shown in the drawing. After almost 80% of the thickness of the $MoSi_2$ film of the material 14 has been etched, an over-etching is performed at a temperature of the electrode 19 at 30°C by switching the three-way cocks 23 and 24 to the temperature adjuster side to complete the etching process. The graph of Fig.5 illustrates this state.

As similarly to as in the first working example, this working example improves the etching selection ratio of $MoSi_2$ to a resist and the productivity and effectively prevents the overhanging effect that occurs to the $MoSi_2$ film.

[Advantageous Effect of the Invention]

As described above, according to the invention, the etching is applied at two or more different electrode temperatures, thereby improving the etching selection ratio of $MoSi_2$ to the resist and the productivity and effectively preventing the overhanging effect that occurs to the $MoSi_2$ film.

4. Brief Description of the Drawings

Fig.1 is a graph illustrating a relation between the etching speed of a $MoSi_2$ film and the electrode speed. Fig.2 illustrates an overhanging effect that occurs to the $MoSi_2$ film. Fig.3 and Fig.4 are cross-sectional views illustrating the respective working examples of the invention. Fig.5 is a graph illustrating a relation between the etching period and the electrode temperature by an etching method that uses the apparatus of Fig.4.

11...Vacuum container

JP 59-076876

12…Etching electrode

13…Over-etching electrode

14…Material to be etched

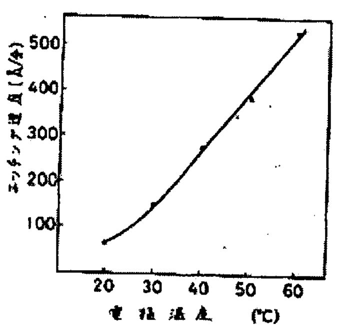
17, 18, 21 and 22…Temperature adjusters

19…Power source

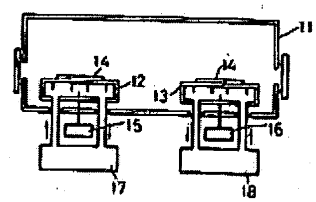
23 and 24…Three-way cocks

特開昭59-768

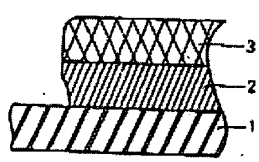
第1図



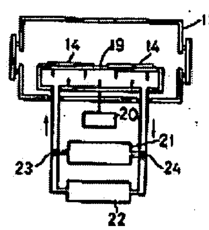
第3図



第2図

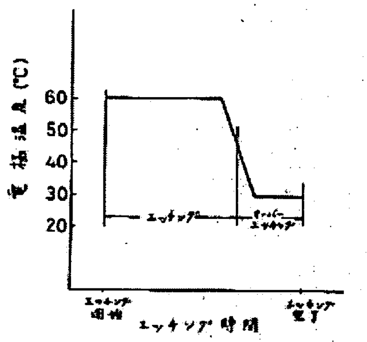


第4図



JP 59-076876

第5図



[In Fig.5, the vertical line indicates electrode temperature, and the horizontal line etching period. In the graph, the first longer region indicates etching, and the second shorter region over-etching. On the horizontal line, the left point indicates the beginning of the etching, and the right point the completion of the etching.]

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Translations Branch
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Chisato Morohashi

PATENT ABSTRACTS OF JAPAN

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H01L 21/306

(21)Application number : **57-185449**

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(71)Applicant : **TOSHIBA CORP**

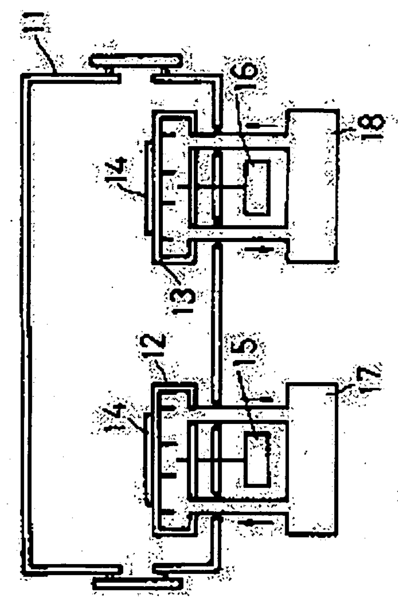
(72)Inventor : **OKUMURA KATSUYA**
WATANABE TORU

(54) **METHOD AND DEVICE FOR REACTIVE ION ETCHING**

(57)Abstract:

PURPOSE: To improve selectivity and productivity by performing etching of a material to be etched at ≥2 different electrode temps.

CONSTITUTION: A vacuum vessel 11 is installed therein with an etching electrode 12 and an overetching electrode 13 insulated electrically from said vessel and the electrodes 12, 13 are provided respectively with high-frequency electrodes 15, 16 and temp. controllers 17, 18 controlling the temp. thereof. A substrate 14 to be etched is first brought by a conveyance mechanism into the vessel 11 from the outside, and is placed on the electrode 12 controlled to about 60°C by the controller 17, whereby the substrate is etched. The substrate 14 is then moved, and is placed on the electrode 13 controlled to about 30°C by the controller 18, whereby the substrate is etched.



LEGAL STATUS

[Date of request for examination]

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of

Fig. 4+5
one electrode - Δ temp
while substrate
is kept on el.

rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

⑲ 日本国特許庁（JP）　　⑪特許出願公開

⑫ 公開特許公報（A）　　昭59—76876

⑤Int. Cl.³	識別記号	庁内整理番号	㊸公開 昭和59年（1984）5月2日
C 23 F 1/00		7011—4K	
1/08		7011—4K	発明の数 2
H 01 L 21/306		8223—5F	審査請求 未請求

（全 4 頁）

㉔反応性イオンエッチング方法およびその装置

㉑特　　願　昭57—185449

㉒出　　願　昭57（1982）10月22日

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川崎市幸区堀川町72番地

㉔代 理 人　弁理士　猪股清　外3名

明　　細　　書

1. 発明の名称

反応性イオンエッチング方法およびその装置

2. 特許請求の範囲

1) 反応性ガス中に配置された電極上に被エッチング材を配置し、かつこの電極に電圧を印加してガス放電せしめ、この放電ガスにより前記被エッチング材をエッチングする反応性イオンエッチング方法において、前記被エッチング材のエッチングを二つ以上の異なる電極温度で行なうことを特徴とする反応性イオンエッチング方法。

2) 被エッチング材を、高温の電極温度でエッチングした後、低温の電極温度でオーバーエッチングすることを特徴とする特許請求の範囲第1項記載の反応性イオンエッチング方法。

3) 反応性ガス中に配置された電極上に被エッチング材を配置し、かつこの電極に電圧を印加してガス放電せしめ、この放電ガスにより前記被エッチング材をエッチングする反応性イオンエッチング装置において、前記被エッチング材のエッチングを二つ以上の異なる温度で行なうことができる電極構造としたことを特徴とする反応性イオンエッチング装置。

4) 電極を複数の電極体で構成し、かつ電極体の温度を相互に異ならしめたことを特徴とする特許請求の範囲第3項記載の反応性イオンエッチング装置。

5) 電極の温度をエッチング工程に合わせて調節可能としたことを特徴とする特許請求の範囲第3項記載の反応性イオンエッチング装置。

3. 発明の詳細な説明

〔発明の技術分野〕

本発明は反応性イオンエッチング方法およびその選択比および生産性の改善をはかることができ、しかもオーバーハング現象の発生を抑制することができる反応性イオンエッチング方法およびその

昇温に関する。

〔発明の技術的背景とその問題点〕

一般に、$MoSi_2$膜は、超LSIの電極、配線材料として非常に期待され数多く研究されている高融点金属シリサイドの一つである。この$MoSi_2$膜は超LSIに用いられるわけであるから当然微細加工がなされなければならず、このため本出願人は、旧来からこの$MoSi_2$膜を反応性イオンエッチング法を用いてエッチング（以下単にエッチングと称す）することを研究・開発してきており、主としてCl系ガスでMoの塩化物（$MoCl_5$を主成分にしたものと考えられる）にしてエッチングさせていくことを検討してきた。

ところで、この方法を用いる場合、$MoCl_5$の蒸気圧は非常に温度依存性が強く、40℃変化すると略々10倍も蒸気圧が変化する。すなわち、被エッチング基板の温度を上昇させてエッチングすると、第1図のグラフに示すように、$MoSi_2$のエッチング速度は大きく変化する。一方、エッチング時のマスクとなるべきレジストのエッチング速度は温度依存性がほとんどない。

このことから、$MoSi_2$とレジストのエッチング選択比および生産性という観点から考えると、被エッチング基板の温度を上昇させてエッチングすることは望ましいことであると考えられる。そこで、本出願人が基板温度を上げてエッチングを行なったところ、選択比、生産性とも改善されることが確認された。

ところが、オーバーエッチングを行なうと、第2図に示すように、$MoSi_2$膜にオーバーハング現象が発生することが判った。すなわち、第2図において、1は基板、2は被エッチング材としての$MoSi_2$膜、3はマスクであるレジストであるが、$MoSi_2$膜の左端面は、その下部より上部の方が前方に突出するオーバーハング現象を示している。

このようなオーバーハング現象は、基板1の温度が高い程顕著に現われ、基板温度を低下させるとほとんどみられないことが確認されている。

このように、選択比、生産性という点から考えると基板温度を上げる必要がある反面、オーバーハングという点から考えると基板温度を下げる必要があり、相互に矛盾する温度条件が要求される。

〔発明の目的〕

本発明は、このような点に鑑み、選択性および生産性の改善をはかることができ、しかもオーバーハング現象の発生を有効に防止することができる反応性イオンエッチング方法およびその装置を提供することを目的とする。

〔発明の概要〕

この目的は、本発明によれば、被エッチング材のエッチングを二つ以上の異なる基板温度で行なうことにより達成される。

〔発明の実施例〕

第3図は本発明の第1実施例を示すものであり、真空容器11内には、この容器11と電気的に絶縁されたエッチング電極12、オーバーエッチング電極13がそれぞれ設置され、各電極12、13上には被エッチング基板14が載置されている。また、各電極12、13には、高周波電源15、16および各電極12、13の温度をコントロールする温度調節器17、18がそれぞれ設けられている。そして、被エッチング基板14は、まず図示しない搬送機構により高温のエッチング電極12上に載置されてエッチングが行なわれ、その後オーバーエッチング電極13上に移動されてオーバーエッチングが行なわれるようになっている。

つぎに、前述した実施例の作用について説明する。

エッチングに際しては、まず図示しない搬送機構により被エッチング基板14を外部から真空容器11内に取込み、80℃に温度制御されたエッチング電極12上に載置する。そして、$MoSi_2$膜厚の略々90%をエッチングする。

ついで、この被エッチングの基板14を移動させ、30℃に温度制御されたオーバーエッチング電極13上に載置してオーバーエッチングを行ない、エッチング工程を完了させる。

このような実施例によれば、高温の電極温度でエッチングした後に低温の電極温度でオーバーエッチングするようにしているので、$MoSi_2$とレジ

ストのエッチング選択比および生産性の改善をはかることができ、しかも$MoSi_2$膜に発生するオーバーハング現象を有効に防止することができる。

なお、前述した実施例においては、1個のオーバーエッチング電極に対して1個のエッチング電極12を設けるように説明したが、エッチング時間とオーバーエッチング時間のバランスがとれるようにエッチング電極12の数を増やしてもよい。

第4図は本発明の第2実施例を示すものであり、真空容器11内には、上面部に被エッチング基板14が載置される電極19が容器11と電気的に絶縁された状態で配設されている。この電極19には、図示するように、高周波電源20、電極19を60℃に温度制御する温度調節器21、および電極19を30℃に温度制御する温度調節器22がそれぞれ設けられており、前記両温度調節器21、22は、三方コック23、24により切換えられるようになっている。

つぎに、前述した実施例の作用について説明する。

エッチングに際しては、まず、三方コック23、24を操作して電極19を温度調節器21により60℃に温度制御する。そして、この電極19上に図示しない搬送機構により被エッチング材14を載置する。

被エッチング材14の$MoSi_2$膜厚の約80%がエッチングされた後、三方コック23、24を温度調節器22側に切換えて30℃の電極19の温度によりオーバーエッチングを行ない、エッチング工程を完了させる。第5図のグラフはこの状態を示すものである。

そして、本実施例によっても、前述した第1実施例と同様、$MoSi_2$とレジストのエッチング選択比および生産性の改善をはかることができ、しかも$MoSi_2$膜に発生するオーバーハング現象を有効に防止することができる。

〔発明の効果〕

以上説明したように、本発明は、二つ以上の異なる電極温度でエッチングするようにしているので、$MoSi_2$とレジストのエッチング選択比および生産性を改善することができ、しかも$MoSi_2$膜に発生するオーバーハング現象を有効に防止することができる。

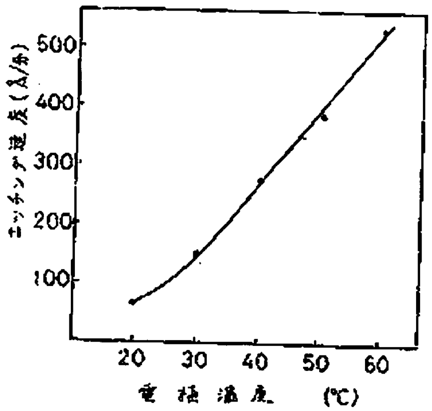
4. 図面の簡単な説明

第1図は反応性イオンエッチング法における$MoSi_2$膜のエッチング速度と電極温度との関係を示すグラフ、第2図は$MoSi_2$膜に発生するオーバーハング現象を示す説明図、第3図および第4図はそれぞれ本発明の実施例を示す断面図、第5図は第4図に示す装置を用いるエッチング法におけるエッチング時間と電極温度との関係を示すグラフである。

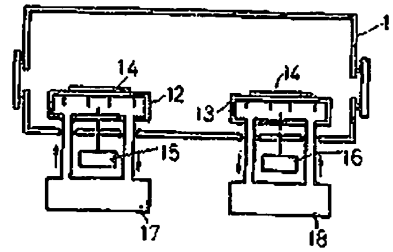
11…真空容器、12…エッチング電極、13…オーバーエッチング電極、14…被エッチング材、17、18、21、22…温度調節器、19…電極、23、24…三方コック。

出願人代理人　鈴 江　武 彦

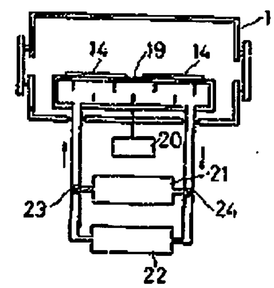
第1図



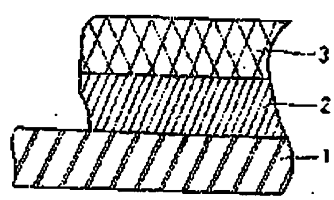
第3図



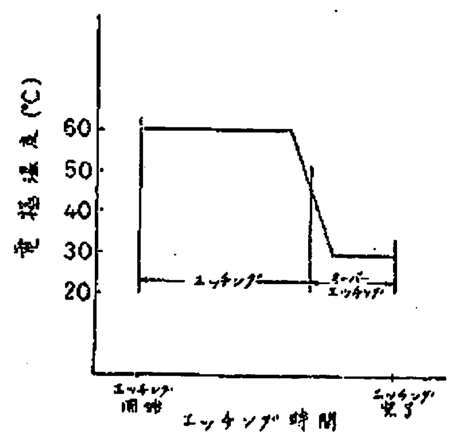
第4図



第2図



第5図



特許法第１７条の２の規定による補正の掲載

昭和 57 年特許願第 185449 号（特開昭 59- 76876 号，昭和 59 年 5 月 2 日発行 公開特許公報 59- 769 号掲載）については特許法第１７条の２の規定による補正があったので下記のとおり掲載する。 3（4）

Int.Cl.⁴	識別記号	庁内整理番号
C23F 1/00		6793-4K
1/08		6793-4K
H01L 21/306		7342-5F

平成 1.7.13 発行

手続補正書

平成 1 年 4 月 7 日

特許庁長官 吉田文毅 殿

1 事件の表示

昭和 57 年特許願第 185449 号

2 発明の名称

反応性イオンエッチング方法およびその装置

3 補正をする者

事件との関係 特許出願人

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6426 弁理士 佐藤 一

5 補正命令の日付

発送日 平成 年 月 日

6 補正により する発明の数

7 補正の対象

明細書の「特許請求の範囲」及び「発明の詳細な説明」の欄

特許庁
1. 4.10

8 補正の内容

(1) 明細書の「特許請求の範囲」を別紙の通り補正する。

(2) 同第５頁第１１行「二つ以上の異なる電極温度で」を「第１の被エッチング材温度と第２の被エッチング材温度で」に補正する。

特許請求の範囲

1. 反応性ガス中に配置された電極上に被エッチング材を配置し、かつこの電極に電圧を印加してガス放電せしめ、この放電ガスにより前記被エッチング材をエッチングする反応性イオンエッチング方法において、前記被エッチング材のエッチングを第１の被エッチング材温度と第２の被エッチング材温度で行なうことを特徴とする反応性イオンエッチング方法。

2. 被エッチング材を、高温の電極温度でエッチングした後、低温の電極温度でオーバーエッチングすることを特徴とする特許請求の範囲第１項記載の反応性イオンエッチング方法。

3. 反応性ガス中に配置された電極上に被エッチング材を載置し、かつこの電極に電圧を印加してガス放電せしめ、この放電ガスにより前記被エッチング材をエッチングする反応性イオンエッチング装置において、前記被エッチング材のエッチングを二つ以上の異なる温度で行なうことができる電極構造としたことを特徴とする反応性イオ

ンエッチング装置。

4. 電極を複数の導電体で構成し、かつ電極体の温度を相互に異ならしめたことを特徴とする特許請求の範囲第3項記載の反応性イオンエッチング装置。

5. 電極の温度をエッチング工程に合わせて調節可能としたことを特徴とする特許請求の範囲第3項記載の反応性イオンエッチング装置。

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Assistant Commissioner for Patents
U. S. Patent and Trademark Office
Washington, D.C. 20231

On July 23, 2003

By: Daniel L. Flamm

PATENT

1765

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Re-Issue Application of U.S. Patent No. 6,231,776 B1	Examiner: Anita K. Alanko
	Art Unit: 1765
Application No.: 10/439,245	AMENDMENT
Filed: May 14, 2003	
For: Daniel L. Flamm	

Attn: Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action mailed Jan. 25, 2005, please enter the following amendments and remarks:

IN THE SPECIFICATION:

Please amend the specification as follows:

At Col. 3, Par. 10:

Fig. 10 is a simplified ~~flow diagram of a heating~~ process according to the present invention.

At Col. 11, Par. 3:

Fig. 4 is a simplified diagram of a resist stripper according to the present invention. The present stripping apparatus includes similar elements as the previous described CVD apparatus. The present stripping apparatus includes a chamber 112, a feed source 114, an exhaust 116, a pedestal 118, which can be an agile temperature controlled chuck, an rf power source 122, a ground 124, a helical resonator 126, and other elements. The helical resonator 126 includes a coil 132, an outer shield 133, a wave adjustment circuit 400, and other elements. The chamber can be any suitable chamber capable of housing a product 119 such as a photoresist coated wafer for stripping, and for providing a plasma discharge therein. The plasma discharge is derived from a plasma source, which is preferably a helical resonator discharge or other inductive discharge using a wave adjustment circuit or other techniques to selectively adjust phase/anti-phase potentials. Of course, in some applications other configurations such as parallel plate capacitive discharges and microwave powered discharges such as electron cyclotron resonance machines, resonant cavities and slow ~~waver~~ wave applicator structures may also be suitable. The present stripping apparatus provides for stripping or ashing photoresist, e.g., implant hardened, etc. Further examples of such a stripping apparatus are described in the experiments section below.

At Col. 14, Par. 2:

Fig. 6 is a simplified block diagram of a substrate holder 600 according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. The substrate holder 600 or ~~suceptor~~ susceptor includes, among others, a lower or backside surface 608, which includes a plurality of concentric zones 608A, 608B, 608C, and 608D. In a specific embodiment, each of the zones can be in fluidic communication with each other and can be partly separated from each other. Each of the zones can have an inlet 613 and an outlet 611. Fluid enters the inlet, traverses in an annular manner in the zone, and leaves the outlet. A baffle can separate the inlet from the outlet. Each of the zones can have an inlet and outlet, which are independent from the other inlets and outlets. Alternatively, the inlet and outlets can be in fluid communication with each other.

At Col. 15, Par. 3:

The substrate holder has an upper surface, which holds an object in a secure manner during processing. The upper surface is generally made of a suitable material that has desirable heat transfer characteristics. In a specific embodiment, the upper surface is made using a low thermal mass, high conductivity material. As merely an example, the upper surface can be a diamond-like or diamond film overlying a copper or copper-like substrate. Of course, the type of surface used depends upon the application.

At Col. 15, Par. 4:

In a specific embodiment, the substrate holder also has temperature sensing units 615 such as the one shown in "SIDE-VIEW C." The temperature sensing unit can be any suitable unit that is capable of being adapted to the upper surface of the substrate holder. Alternatively, the temperature sensing unit can measure the temperature of the fluid or lower surface of the substrate holder. As merely an example, the temperature sensing unit is a "fluoroptic" sensor unit made by a company called Luxtron in Santa Clara, California. Alternatively, the sensing unit can be ~~an~~ a band edge IR sensor or the like. The sensing unit is capable of measuring a variety of spatial locations along the upper or lower surface of the substrate holder. The substrate holder can be implemented using a variety of systems for heating and/or cooling applications such as the one described below, but can be others.

At Col. 18, Par. 2:

Fig. 10 ~~is~~ shows a simplified ~~flow diagram of a heating~~ process according to the present invention. This ~~diagram~~ process is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. As shown, there is an isotropic breakthrough step during which an SF_6 plasma is used to remove very thin native oxide can be conducted at a low temperature such as room temperature. Ordinarily the breakthrough step is conducted at a high temperature. High temperatures have a serious disadvantage in that the etching rate of both oxide and tungsten silicide by SF_6 may be isotropic. Therefore the duration of the breakthrough step, especially if the native oxide layer is thin, must often be limited to a few seconds to avoid undesired undercut. At low temperature the etching rate is slower and therefore the extent to which materials under the native oxide are etched is easier to control.

At Col. 19, Par. 1:

At the end of the room temperature breakthrough step, at time BB, the control program increases within several seconds to a higher steady state value at time B which, as shown in Fig. 10, is typically more than 99°C. The tungsten silicide is etched at this temperature until this layer is breached at random locations on the wafer. This endpoint is conveniently observed by a change in the slope of intensity of an optical light emission from the plasma such as optical emission at 530nm (point C in Fig. 10). The complete removal of the unmasked tungsten silicide areas is similarly signaled by a change in light emission such as that shown at point D (at time D all "patches" of the tungsten silicide are "cleared" from unmasked polysilicon areas; the signal begins to rapidly decease at time D because at constant temperature, polysilicon consumes chlorine more rapidly than tungsten silicide (e.g. a faster etch rate) and optical emission at this wavelength originates from a chlorine species.

At Col. 19, Par. 2:

Since it is not practical to change chuck temperature, at this point the etch rate would increase rapidly. As a consequence it can often be difficult to detect and terminate the polysilicon etching step when the thin oxide layer is reached. Another problem associated with the use of a single temperature for both silicide and polysilicon layers is that chlorine etching processes often undercut (etch along the mask direction, sideways- e.g. the etch is partly isotropic) silicon at the elevated temperatures suitable for a low residue tungsten silicide etch. Therefore it is highly desirable and advantageous to reduce the etching temperature during the polysilicon etch. The wafer temperature is gradually reduced at point D in order to achieve a slower and more anisotropic polysilicon etching step. The temperature necessary to etch tungsten silicide and polysilicon during this temperature programmed sequence are schematically compared in Fig. 10. As shown, the ~~The~~ emission signal intensity increases when the temperature is lowered because the rate of consumption of chlorine species by the etching process is slowed (the rate decreases with decreasing temperature). Stopping the etch process beyond the endpoint where all of the silicon has "cleared," denoted by E is also easier and less critical because attack on the oxide has also slowed. Fig. 10 shows temperature changes between BB and B and between points D and E occurring over intervals which subtend significantly less than 15 percent of the total stack etching time and well under 40 percent of the total process time.

IN THE CLAIMS:

Please cancel claims 1–55 without prejudice

1.-55 (canceled)

Please add the following new claims:

56. (New) A method of etching a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a chamber, the substrate holder having a selected thermal mass;

etching a first portion of the film while the substrate holder is at a selected first substrate holder temperature;

changing the substrate holder temperature from the selected first substrate holder temperature to a selected second substrate holder temperature; and

etching a second portion of the film while the substrate holder is at the selected second substrate holder temperature;

wherein the selected thermal mass allows a change from the first selected substrate holder temperature to the second selected substrate holder temperature within a characteristic time period to process the film.

57. (New) The method of claim 56 wherein the first substrate holder temperature is changed to the second substrate holder temperature by heat transfer means coupled to the substrate holder.

58. (New) The method of claim 56 wherein the change from the first substrate holder temperature to the second substrate holder temperature is an in–situ process during the first portion etching step and the second portion etching step.

59. (New) The method of claim 56 wherein the etching of the first portion of the film and the etching of the second portion of the film are conducted in a substantially constant plasma environment.

60. (New) The method of claim 56 wherein etching at least one portion of the film comprises radiation.

61. (New) The method of claim 56 wherein etching at least one portion of the film is an ion bombardment aided process.

62. (New) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature; and

the first and the second substrate etching temperatures are in a known relationship to the first and the second substrate holder temperatures.

63. (New) The method of claim 62 wherein the first etching temperature is substantially the first substrate holder temperature and the second etching temperature is substantially the second substrate holder temperature.

64. (New) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is higher than the second substrate etching temperature; and

the first portion of the film is etched before the second portion of the film.

65. (New) The method of claim 56 wherein:

a first substrate etching temperature corresponds to the first substrate holder temperature;

a second substrate etching temperature corresponds to the second substrate holder temperature;

the first substrate etching temperature is lower than the second substrate etching temperature; and the first portion of the film is etched before the second portion of the film.

66. (New) The method of claim 56 wherein the substrate holder comprises an electrostatic support chuck having a surface for supporting a substrate in a reaction chamber, the electrostatic support chuck overlays a heat exchange region, and the heat exchange region includes at least one fluid passage through which a fluid can be circulated to heat and/or cool the substrate holder.

67. (New) The method of claim 66 wherein the heat exchange region includes at least two separate fluid passages, each fluid passage being configured to have an independent inlet and an independent outlet.

68. (New) The method of claim 56 wherein the substrate holder includes a plurality of heating elements.

69. (New) The method of claim 68 wherein the heating elements are configured to selectively heat one or more zones of the substrate holder.

70. (New) A method of etching a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a chamber;

etching a first portion of the film at a selected first substrate temperature; and

etching a second portion of the film at a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature;

wherein the substrate holder is maintained above room temperature while etching at least one of the portions of the film, and the selected first substrate temperature is changed to the selected second substrate temperature within a characteristic time period to process the film.

71. (New) The method of claim 70 wherein a continuous etching process comprises etching the first portion of the film and etching the second portion of the film.

72. (New) The method of claim 70 wherein the first substrate temperature is changed to the second substrate temperature within a selected period of time by at least heat transfer with the substrate using at least an electrostatic chuck.

73. (New) The method of claim 70 wherein the first substrate temperature is changed to the second substrate temperature by transferring heat energy using at least a pressure of gas behind said substrate.

74. (New) The method of claim 70 wherein said first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

75. (New) The method of claim 70 wherein changing the substrate holder temperature comprises selectively transferring energy in the form of heat from a substrate temperature control system to the substrate holder.

76. (New) The method of claim 70 wherein changing the selected first substrate temperature to the selected second substrate temperature is an in-situ process while etching the first film portion and etching the second film portion.

77. (New) The method of claim 70 wherein the etching of the first portion of the film and the etching of the second portion of the film are conducted in a substantially constant plasma environment.

78. (New) The method of claim 70 wherein etching at least one portion of the film comprises radiation.

79. (New) The method of claim 70 wherein etching at least one portion of the film comprises an ion bombardment aided process.

80. (New) A method of processing a substrate during the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder within a chamber of a plasma discharge apparatus, the plasma discharge apparatus comprising a substrate temperature sensor, a substrate temperature control system including a microprocessor and a heat transfer process; the substrate holder having a substrate holder temperature control system;

performing a first film treatment of a first portion of the film at a selected first substrate temperature;

changing the selected first substrate temperature to a selected second substrate temperature, the selected second substrate temperature being different from the selected first substrate temperature; and

performing a second film treatment of a second portion of the film at the selected second substrate temperature;

wherein the substrate holder temperature is maintained substantially above room temperature during at least one of the film treatments, and the change from the first substrate temperature to the second substrate temperature occurs within a characteristic time period to process the film.

81. (New) The method of claim 80 wherein the substrate temperature control system comprises the substrate holder temperature control system.

82. (New) The method of claim 80 wherein the substrate holder temperature control system comprises the substrate temperature control system.

83. (New) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises the substrate temperature being less than the substrate holder temperature.

84. (New) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises the substrate temperature being greater than the substrate holder temperature.

85. (New) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate holder to the substrate.

86. (New) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring heat energy from the substrate to the substrate holder.

87. (New) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises maintaining the temperature of the substrate holder above room temperature and selectively transferring heat energy from the substrate into the substrate holder.

88. (New) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises selectively transferring energy in the form of heat from the substrate temperature control system to the substrate holder and maintaining the substrate holder temperature above room temperature.

89. (New) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises etching.

90. (New) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, comprises chemical vapor deposition.

91. (New) The method of claim 80 wherein at least one film treatment, selected from the first film treatment and the second film treatment, is an ion assisted process.

92. (New) The method of claim 80 wherein the first temperature is changed to the second temperature by transferring heat using at least a pressure of gas behind the substrate.

93. (New) The method of claim 80 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

94. (New) A method of processing a substrate in the manufacture of a device, the method comprising:

placing a substrate having a film thereon on a substrate holder in a processing chamber, the processing chamber comprising the substrate holder, a substrate temperature control system to control the temperature of the substrate, and a substrate holder temperature control system to control the temperature of the substrate holder;

performing a first etching of a first portion of the film at a selected first substrate temperature;

performing a second etching of a second portion of the film at a selected second substrate temperature, the second temperature being different from the first temperature;

wherein at least one of the film portions is etched while the substrate holder temperature is substantially above room temperature and heat is transferred from the substrate holder control system to the substrate holder; and

wherein the substrate temperature control system allows a change from the first substrate temperature to the second substrate temperature within a characteristic time period to process the film.

95. (New) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate holder into the substrate.

96. (New) The method of claim 94 wherein the etching of at least one of the film portions comprises heat flow from the substrate into the substrate holder.

97. (New) The method of claim 94 wherein the etching of at least one of the film portions comprises maintaining the temperature of the substrate holder above room temperature, and heat flow from the substrate into the substrate holder.

98. (New) The method of claim 94 wherein the characteristic time period to change from the first substrate temperature to the second substrate temperature subtends less than 40 percent of the total etching process time.

99. (New) The method of claim 94 wherein the characteristic time period to change from the first substrate temperature to the second substrate temperature subtends less than 15 percent of the total etching process time.

100. (New) A method for processing layers which are included in a stack of layers positioned on a substrate, the method comprising:

etching at least a portion of a first silicon-containing layer in a chamber while the substrate is maintained at a selected first substrate temperature; and

etching at least a portion of a second silicon-containing layer in the chamber while the substrate is maintained at a selected second substrate temperature;

wherein the substrate holder is maintained substantially above room temperature when etching at least one of the silicon-containing layer portions, selected from the portion of the

first silicon containing layer and the portion of the second silicon-containing layer; and
the change from the first substrate temperature to the second substrate temperature occurs within a time that is less than the overall process time associated with etching the first silicon-containing layer and the second silicon-containing layer.

101. (New) The method of claim 100 wherein the change from the first substrate temperature to the second substrate temperature occurs within less than 40 percent of the overall process time.

102. (New) The method of claim 100 wherein at least one layer is etched in a chlorine-containing ambient.

103. (New) The method of claim 100 wherein at least one silicon-containing layer is etched in a chlorine-containing ambient;

the first layer is a polysilicon layer, the second layer is a silicide layer and the stack includes an oxide layer;

the second substrate temperature is higher than the first substrate temperature; and

at least one of the etching steps has high selectivity to the oxide layer.

104. (New) A method for manufacturing a device comprising an integrated circuit, the method comprising:

transferring a substrate comprising a stack of layers including a silicide layer into a chamber, the chamber comprising a substrate holder;

processing the substrate in the chamber at a first substrate temperature; and

processing the substrate in the chamber at a second substrate temperature to etch at least a portion of the silicide layer while maintaining the substrate holder substantially above room temperature;

wherein the first temperature is different than the second temperature and the first substrate temperature is changed to the second substrate temperature in less than an overall time associated with processing the substrate at the first substrate temperature and processing the substrate at the second substrate temperature to etch the silicide layer.

105. (New) The method of claim 104 where the first substrate temperature is less than about 90 degrees centigrade and the silicide layer is etched above about 99 degrees centigrade.

106. (New) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature within a selected period of time by at least heat transfer to the substrate using at least an electrostatic chuck.

107. (New) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring heat using at least a pressure of gas behind the substrate.

108. (New) The method of claim 104 wherein the first substrate temperature is changed to the second substrate temperature by transferring energy using at least radiation.

REMARKS

Prior to this amendment, claims 1-46 were pending. By this amendment, Claims 1-46 are cancelled in the subject application without prejudice. Claims 56-108 have been added. claims 56-108 correspond to cancelled claims 1-46. Claims 47-55 were previously withdrawn by the Examiner in connection with a restriction requirement. Hence claims 56–108 are pending in this application. No new matter has been added.

The specification is amended to correct certain typographical errors and formalities. No new matter has been added.

Formalities

Applicant wishes to note that there were certain typographical errors in the published specification which had been corrected in the Amendment After Allowance under 27 CFR 1.312 which was entered on Jan. 19, 2001. This amendment included corrections to the original Specification and Informal Drawings. Although the corrected drawings were included in the published patent, corresponding textual corrections were omitted and original language was published. As a result, there were minor inconsistencies between the published (corrected) drawings and the published (uncorrected) specification.

Other corrections to the specification are submitted herewith for the purpose of correcting some additional typographical errors and to provide a proper antecedent basis for certain terms as suggested by the Examiner. Applicant believes these corrections add no new matter.

Claim Objections

To avoid disjoint numbering and in the interest of clarity and readability, Claims 1-55 are hereby cancelled and replaced with new claims 56-108. It is believed that these new claims will traverse the formalities and matters objected to.

Specification and Claim Rejections under 35 USC §112 and/or 35 USC §251

Claims 98, 99, 101 (Corresponding to cancelled claims 33, 34 and 36)

Applicant respectfully believes that the specification and drawings of the '776 patent, viewed as a whole, include the claimed matter.

Applicant wishes to point out the time-temperature history of the exemplary process depicted in the lower portion of Fig. 10. The material shown in this figure is intended to be viewed in concert with the specification and typographical corrections in the Amendment After Allowance.

Please observe that Fig. 10 teaches various temperature transitions, such as the changes between BB and B and between D and E, among others, which are shown to subtend approximately 5 seconds. Applicant respectfully notes that the graph in Fig. 10 teaches a time to clear a polysilicon layer (between B and D in Fig. 10) of about 60 seconds and an entire process time, comprising all steps, lasting about 180 seconds.

Consequently, the figure teaches a time for a temperature change which is a fraction of the total processing time (5 sec)/(180 sec). Please observe that this fraction is less than about 3% of the total process time and less than about 10% of the processing time to etch the polysilicon layer. Thus the Applicant respectfully maintains that there is a disclosure that the time in which the "change of temperature occurs subtends less than 40 percent of the total etching process time," (claim 98 corresponding to cancelled claim 33) and that the time to "change from the first substrate temperature to the second substrate temperature" "subtends less than 15 percent of the total etching process time" (claim 99 corresponding to cancelled claim 34), and "within less than 40 percent of the overall process time" (claim 101 corresponding to cancelled claim 36).

Claims 98, 99 and 101 (cancelled 33, 34 and 36)- Proper Basis

The Applicant wishes to thank the Examiner for pointing out that proper formal antecedent language should be included in the specification. As suggested, Applicant is including corresponding amendments to the language of the specification for the purpose of correcting these formalities. Please note that the language "change in temperature" is no longer in the corresponding claim (103).

Claim 105 (cancelled claim 42) Disclosure

Applicant respectfully believes that claim 105 (corresponding to cancelled claim 42) is not new matter.

Applicant respectfully requests that the Examiner consider certain teachings in the specification and Fig. 10 in view of these remarks. Applicant believes that an examination of Fig. 10 in concert with the consistent language that is contained in the Amendment After Allowance (entered on Jan. 19, 2001) will be helpful in this respect.

Col. 18, lines 56-59, teaches that a breakthrough step, in accordance with the exemplary embodiment of the instant invention shown in Fig. 10 and ending at BB (segment A-BB), is conducted at a low temperature such as room temperature (a room temperature is generally understood to be approximately 20°C to 25°C). Lines 59-67 of the specification recite the disadvantages of a high temperature breakthrough step and the advantages of being able to conduct this step at room temperature in accordance with the inventive embodiment.

Col. 19, lines 44-45 instruct that wafer temperature is rapidly increased to a selected value in the temperature range *180-220°C* (point I in Fig. 10, segment I-J) for stripping resist according to the exemplary embodiment.

Accordingly when Fig. 10 is viewed with the specification, it is understood that line segment I-J is at a temperature in the range of *180-220°C* and that line segment A-BB is at a room temperature (20-25°C). Line segment B-D is shown to bisect the difference between the temperature of I-J and the temperature of A-BB. Hence it is seen that B-D is at a temperature in the range of *100°C to 122.5°C*. The specification has been amended to provide an express antecedent.

Claim 105 (corresponding to withdrawn claim 42) comprises a method for manufacture where the "first temperature is less than 90 degrees centigrade and the silicide layer is etched at a selected temperature *above about 100 degrees* centigrade." As pointed out above, the process taught in Fig. 10 includes a first breakthrough step in which the substrate is substantially maintained at a temperature *less than 90 degrees* C and a step comprising etching the silicide layer at a second temperature which is about *100°*C *to 122.5°C*. Thus Applicant wishes to respectfully point out that the originally filed specification and drawings include a teaching of the method of claim 105. He respectfully requests reconsideration.

Claims 60,74, 78, 108 (cancelled claims 7, 8, 16, 21, 22, 31, 46, 53)

Applicant respectfully wishes to point out that original claims 7 and 8 (also in provisional application No. 60/058,650) disclose first and second etchings which comprise *radiation*. Additionally, Col. 15, lines 16-19 teaches that "heat can be supplied by single or in combination using *radiation*, conduction and convection." Further, the specification of the Ser. No. 08/567,224 priority document teaches plasma processing and etching in which "there are proportionately greater amounts of heating and cooling by *radiation* at higher temperatures, since *radiative* energy transfer depends on the temperatures of surfaces which 'view' each other raised to the fourth power, whereas conductive and convective heat transfer often depend linearly on localized temperature differences." The use of an infrared heating unit (e.g. infrared *radiation*) is also mentioned in lines 19-20 of Col. 15 of the instant specification. Accordingly, Applicant respectfully believes this antecedent language supports radiation.

Claim Rejections 35 USC § 102

Claims 56-69 (corresponding to cancelled claims 1-12)

New claims 56-69 include a limitation that the temperature of the substrate holder is changed.

The Tsubone patent does not teach a selected thermal mass of a substrate holder nor does it anticipate a substrate holder that allows a change from a first substrate holder temperature to a second substrate holder temperature within a characteristic period to process the film.

For example, the Tsubone invention comprises a sample bed (substrate holder) that is cooled to a certain predetermined fixed temperature below room temperature. Therefore Tsubone teaches away from changing the temperature of the substrate holder within a characteristic time to process the film. Therefore new claims 56-69 are patentable over Tsubone.

Claims 70-108 (cancelled claims 13-46)

New claims 70-108 include a limitation that a substrate holder temperature is at or substantially above room temperature.

Tsubone teaches a method wherein a sample bed is *cooled* by a cooling medium in order to maintain the substrate holder at a certain predetermined temperature during processing which is below room temperature. (Abstract lines 3-5; Col. 3, lines 7-9). The Tsubone invention is a method of cooling a substrate which consists of lowering a substrate temperature by increasing the pressure of a heat transfer gas behind the substrate (Tsubone Col. 5, lines 29-31; Col. 6, lines 39-40 and lines 47-50; Col. 8, lines 34-43 and lines 55-59; Col. 9, lines 3-4). It is taught that the substrate temperature is reduced and brought closer to the low temperature of the sample bed by increasing heat transfer gas pressure (e.g. the substrate holder. Tsubone Col. 3, lines 31-33). According to Tsubone, heat is transferred from the substrate, across a gap to the cooled substrate holder, through a heat transfer gas.

To the contrary, claims 7-105 include a limitation that the substrate holder (sample bed) is maintained above room temperature while processing at least a portion of the film. Unlike Tsubone, the instant claims include a substrate holder which is *heated* by a heating means. In another aspect of the instant invention, a substrate holder is heated above room temperature, where heat exchange between the substrate and substrate holder permits processing at an elevated temperature. In yet another aspect, increasing the pressure of a heat transfer gas increases the substrate temperature by improving heat exchange between the substrate holder and the substrate.

Consideration of the subject application as amended is respectfully requested.

CONCLUSION

In view of the foregoing, Applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 925-947-1909.

Respectfully submitted,

Daniel L. Flamm

PATENT APPLICATION FEE DETERMINATION RECORD Effective January 1, 2003	Application or Docket Number 10/439245

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	minus 20=	*
INDEPENDENT CLAIMS	minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐ OR OTHER THAN SMALL ENTITY

RATE	FEE		RATE	FEE
BASIC FEE	375.00	OR	BASIC FEE	750.00
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL		OR	TOTAL	

Re-issue AMDT 7-25-05

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 53	Minus	**	=
Independent	* 6	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY OR OTHER THAN SMALL ENTITY

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X42=		OR	X84=	
+140=		OR	+280=	
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AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
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Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
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X42=		OR	X84=	
+140=		OR	+280=	
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AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
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Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

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X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 12/02) *U.S. Government Printing Office: 2003 — 498-278/69151 Patent and Trademark Office, U.S DEPARTMENT OF COMMERCE

Index of Claims	**Application/Control No.** 10/439,245	**Applicant(s)/Patent under Reexamination** FLAMM, DANIEL L.
	Examiner	**Art Unit** 1700

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 04/27/2005

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

EXAMINER	
ALANKO, ANITA KAREN	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 04/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Interview Summary	Application No. 10/439,245	Applicant(s) FLAMM, DANIEL L.	
	Examiner Anita K. Alanko	Art Unit 1765	

All participants (applicant, applicant's representative, PTO personnel):

(1) Anita K. Alanko. (3)_____.

(2) Daniel Flamm. (4)_____.

Date of Interview: April 21-26,2005.

Type: a)☐ Telephonic b)☐ Video Conference ☒ electronic mail
c)☐ Personal [copy given to: 1)☐ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: none.

Identification of prior art discussed: none.

Agreement with respect to the claims f)☐ was reached. g)☒ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: see attached copies of electronic mail.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Anita Alanko
ANITA ALANKO
PRIMARY EXAMINER

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Examiner's signature, if required

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)
In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

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Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:

- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

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1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

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10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 04/26/2005

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

EXAMINER	
ALANKO, ANITA KAREN	
ART UNIT	**PAPER NUMBER**
1765	

DATE MAILED: 04/26/2005

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PTO-90C (Rev. 10/03)

10

Interview Summary	Application No. 10/439,245	Applicant(s) FLAMM, DANIEL L.	
	Examiner Anita K. Alanko	Art Unit 1765	

All participants (applicant, applicant's representative, PTO personnel):

(1) Anita K. Alanko.　　(3)_____.

(2) Daniel Flamm.　　(4)_____.

Date of Interview: 19 April 2005.

Type: a)☒ Telephonic b)☐ Video Conference
c)☐ Personal [copy given to: 1)☐ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: 1 and 13.

Identification of prior art discussed: Tsubone.

Agreement with respect to the claims f)☐ was reached. g)☒ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: See Continuation Sheet.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

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Anita Alanko
ANITA ALANKO
PRIMARY EXAMINER

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Examiner's signature, if required

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4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
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Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Discussed how Tsubone has cooling of sample temperature and change of gas pressure to transfer heat from the holder to the substrate, whereas the instant invention heats the substrate support. Also discussed restriction requirement, objection to the specification and 112 rejections. Noted that there were corrections made by amendment after allowance- corrections to the figures were in the patent, but not corrections to the specification. There were thus inconsistencies between the drawings and the specification.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/439,245	05/14/2003	Daniel L. Flamm		5963

7590 01/25/2005

Daniel L. Flamm
476 Green View Drive
Walnut Creek, CA 94596

EXAMINER	
ALANKO, ANITA KAREN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 01/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

mw

Office Action Summary	Application No. 10/439,245	Applicant(s) FLAMM, DANIEL L.
	Examiner Anita K Alanko	Art Unit 1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-55 is/are pending in the application.

4a) Of the above claim(s) 47-55 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-46 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 6/17/03,8/6/04.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. 0105.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-46, drawn to a method, classified in class 438, subclass 715.

II. Claims 47-55, drawn to an apparatus, classified in class 156, subclass 345+.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus can be used for a method with a different temperature sequence, for example, one that does not change the temperature from a first to a second temperature during etching, but rather maintains the same temperature.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

The original patent claims are constructively elected. Thus, the added apparatus claims, claims 47-55 are constructively non-elected and withdrawn from consideration. Claims 1-46 are now examined. If the original claims are found allowable, and a divisional application has been filed for the non-elected claims, further action in the application will be suspended, pending resolution of the divisional application.

Claim Objections

Claim Objections

Claim 13 is objected to because of the following informalities: In claim 13, line 7, the term "being changed" should cite "changing" to be consistent with the rest of the claim. In claim 13, line 8, the "whereupon" clause is incomplete, does applicant intend to cite "wherein"? Appropriate correction is required.

Specification

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: explicit basis for claims 3, 17, 21-22, 33-34, 36, 42, 46 (i.e., for the terms: "change in temperature ...during said first ...and said second etching step"; "radiation"; "subtends less than 40 percent"; "subtends less than 15 percent"; "first temperature is less than 90 degrees centigrade and the silicide layer is etched at a selected temperature above 100 degrees centigrade"). The terms may be merely added to the specification, provided they are not new matter.

Claim Rejections - 35 USC § 112

Claims 33-34, 36 and 42 are rejected under 35 U.S.C. 251 as being based upon new matter added to the patent for which reissue is sought. The added material which is not supported by the prior patent is as follows:

the terms "subtends less than 40 percent", "subtends less than 15 percent" and "first temperature is less than 90 degrees centigrade and the silicide layer is etched at a selected temperature above 100 degrees centigrade".

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 33-34, 36 and 42 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The terms "subtends less than 40 percent", "subtends less than 15 percent" and "first temperature is less than 90 degrees centigrade and the silicide layer is etched at a selected temperature above 100 degrees centigrade" are new matter.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Tsubone et al (US 5,320,982).

Tsubone discloses a method of etching comprising etching at a first temperature and at a different second temperature (Fig.4), wherein the selected thermal mass inherently allows a change from the first to the second temperature within a characteristic time period to process said film, since the same method steps are performed in Tsubone as in the instant invention. Figure 4 shows how the change in temperature occurs within in a certain time period (the time periods between the steady state temperature steps, a-c, d-f, g-i, j-k), therefore since the change occurs within a time period, the thermal mass, as broadly cited, "allows" for the change in temperatures.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubone et al (US 5,320,982).

The discussion of Tsubone from above is repeated here.

As to claim 27, Tsubone discloses all of the steps, but fails to explicitly disclose that a microprocessor is used. However, Tsubone does disclose that the controller stores a relation between the heat transfer gas pressure and the sample temperature (col.4, lines 43-44). It would have been obvious to one with ordinary skill in the art to use a microprocessor to store the relation and use it for the control in the method of Tsubone because they are useful for processing numbers and relations.

As to claims 33-34, Figure 4 of Tsubone depicts that the change times (a-c, d-f, g-i, j-k) subtend less that 40% or 15% of the total etch time.

Claims 1-41, 43-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsubone et al (US 5,320,982) in view of Shin et al (US 6,087,264).

The discussion of Tsubone from above is repeated here.

As to claims 35 and 38, Tsubone discloses that his method is an improvement for the etch of a silicide layer (col.1, lines 23-28), however Tsubone does not disclose the specific layers such as a gate oxide, polysilicon layer and a silicide layer. Shin teaches that an oxide layer 4, a polysilicon layer 6 and a silicide layer 8 is a conventional structure to etch through photoresist layer 12 mask by a chlorine plasma (col.2, lines 2-4, 41-51). It would have been obvious to one with ordinary skill in the art to deposit an oxide layer, a polysilicon layer and a silicide layer and to etch them through a photoresist layer mask by a chlorine plasma in the method of Tsobone because Shin teaches that this is a useful structure and method to pattern by etching.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Lenz is cited to show the use of multiple concentric zones in order to achieve uniform temperatures across the wafer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anita K Alanko whose telephone number is 571-272-1458. The examiner can normally be reached on Mon-Fri until 2:30 pm (Wed until 11:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Anita K. Alanko

Anita K Alanko
Primary Examiner
Art Unit 1765

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	10/439,245	FLAMM, DANIEL L.	
	Examiner	Art Unit	
	Anita K Alanko	1765	

All Participants:

(1) Anita K Alanko.

(2) Daniel Flamm.

(3) ____.

(4) ____.

Status of Application: pending

Date of Interview: 11 January 2005

Time: ____

Type of Interview:
- ☒ Telephonic
- ☐ Video Conference
- ☐ Personal (Copy given to: ☐ Applicant ☐ Applicant's representative)

Exhibit Shown or Demonstrated: ☐ Yes ☒ No
If Yes, provide a brief description: .

Part I.

Rejection(s) discussed:

Claims discussed:

Prior art documents discussed:

Part II.

SUBSTANCE OF INTERVIEW DESCRIBING THE GENERAL NATURE OF WHAT WAS DISCUSSED:

Maintenance fees were due in December on the surrendered patent. Applicant didn't understand that a fee was due, but the examiner determined that there was, nonetheless, a fee due.

Part III.

☐ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview directly resulted in the allowance of the application. The examiner will provide a written summary of the substance of the interview in the Notice of Allowability.

☒ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview did not result in resolution of all issues. A brief summary by the examiner appears in Part II above.

Anita K. Alanko
(Examiner/SPE Signature)

(Applicant/Applicant's Representative Signature – if appropriate)

PTO/SB/08a (08-03)
Approved for use through 07/31/2006. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	10/439,245
Filing Date	05-14-2003
First Named Inventor	Daniel L. Flamm
Art Unit	~~1648~~ 1765
Examiner Name	~~Laurie A. Scheiner~~ Alanko
Attorney Docket Number	—

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
AKA		US-6486069 B1	11-26-2002	S. Marks et al.	Col. 14, 10-67; Cols. 15-16
↓		US-6391148 B2	05-21-2002	S. Marks et al.	Col 14, 40-67, Cols 15-16
↓		US-20010003676 A1	06-14-2001	S. Marks et al.	pps. 8-10, Claims 1-54
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] Number[4] Kind Code[5] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
AKA		EP-1236226-A2	07-06-2001	S. Marks et al.	pps 30-39, Claims 1-54	
↓		WO-0141189-A2	07-26-2001	S. Marks et al.	pps. 30-36, Claims 1-54	

Examiner Signature	Anita K. Alanko	Date Considered	1/25/05

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached.

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37 CFR 1.501 INFORMATION DISCLOSURE CITATION IN A PATENT (Sheet 1 of 2)	Docket Number (Optional)	Patent Number 6,231,776
	Applicant Daniel L. Flamm	
	Issue Date	Art Unit 1765

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
AA	5,179,264	1/12/93	Cuomo et. al	219	121.43	12/13/89
	5,294,778	3/15/94	Heather	219	385	3/15/94
	5,571,366	11/5/96	Ishii	156	345	10/20/94
	5,609,720	3/11/97	Lenz	156	643.1	3/29/95
	5,645,683	7/8/97	Miyamoto	156	643.1	7/7/95
	5,667,631	3/16/97	Holland	216	13	6/28/96
	5,695,564	12/9/97	Imahashi	118	719	8/3/95
	5,700,734	12/23/97	Ooishi	438	592	6/24/96
	5,756,401	3/8/93	Iizuka	438	719	1/8/93
	5,770,099	6/23/98	Rice et. al.	216	68	7/18/95
	5,863,376	1/26/99	Wicker et al.	156	345	6/5/96
	5,925,212	7/20/99	Rice et al.	156	345	9/5/95

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER	DATE CONSIDERED
Anita Alanko	1/25/05

This collection of information is required by 37 CFR 1.501. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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37 CFR 1.501 INFORMATION DISCLOSURE CITATION IN A PATENT (Sheet 2 of 2)	Docket Number (Optional)	Patent Number 6,231,776
	Applicant Daniel L. Flamm	
	Issue Date	Art Unit 1765

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
AA	5,939,831	8/17/99	Fong et al.	315	111.21	
	5,948,283	9/7/99	Grosshart	216	67	
	6,008,139	12/28/99	Pan et al.	438	730	
	6,033,478	3/7/00	Kholodenko	118	500	
	6,042,901	3/28/00	Denison et al.	427	579	
	6,048,798	4/11/00	Gadgil et al.	438	714	
	6,068,784	5/30/00	Collins et al.	216	68	
	6,087,264	7/11/00	Shin et al.	438	706	
	6,090,303	7/18/00	Collins et al.	216	68	
	6,140,612	10/3/00	Husain et al.	219	390	
	6,165,311	12/26/00	Collins et al.	156	345	
	6,167,835	1/2/01	Wang et al.	418	723	

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER	DATE CONSIDERED
Anita K. Alanko	1/25/05

Notice of References Cited	Application/Control No. 10/439,245	Applicant(s)/Patent Under Reexamination FLAMM, DANIEL L.	
	Examiner Anita K Alanko	Art Unit 1765	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,320,982	06-1994	Tsubone et al.	438/714
	B	US-6,087,264	07-2000	Shin et al.	438/706
	C	US-5,609,720	03-1997	Lenz et al.	438/715
	D	US-5,556,204	09-1996	Tamura et al.	374/161
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application No. 10/439,245	Applicant(s) FLAMM, DANIEL L.	
	Examiner Anita K Alanko	Art Unit 1765	

SEARCHED			
Class	Subclass	Date	Examiner
438	715,719, 721,725, 737, 738	1/25/2005	AKA
216	41,49		
216	63-67		
216	75,79		
156	345.27		
156	345.52		
156	345.53	1/25/2005	AKA

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST, consulted B. Krynski	1/25/2005	AKA
Litigation search by STIC, no cases reported	1/11/05	AKA

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

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BIBDATASHEET

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CONFIRMATION NO. 5963

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/439,245	05/14/2003 RULE	438	1765	

APPLICANTS

Daniel L. Flamm, Walnut Creek, CA;

** CONTINUING DATA **************************

This application is a REI of 09/151,163 09/10/1998 PAT 6,231,776
AKL which claims benefit of 60/058,650 09/11/1997
and is a CIP of 08/567,224 12/04/1995 ABN

** FOREIGN APPLICATIONS ********************

none / AKL

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 07/03/2003

** SMALL ENTITY **

Foreign Priority claimed / 35 USC 119 (a-d) conditions met / Verified and Acknowledged	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☐ yes ☑ no 35 USC 119 (a-d) conditions met ☐ yes ☑ no ☐ Met after Allowance Verified and Acknowledged Aleney Examiner's Signature ___ Initials	CA	15	55	7

ADDRESS
Daniel L. Flamm
476 Green View Drive
Walnut Creek , CA
94596

TITLE
Multi-temperature processing

FILING FEE RECEIVED	FEES	
375	FEES: Authority has been given in Paper No. _________ to charge/credit DEPOSIT ACCOUNT No. _________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ______________ ☐ Credit

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	114	156/345.27.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:53
L2	147	156/345.52.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:53
L3	138	156/345.53.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:53
L4	266	438/715.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:54
L5	688	438/719.ccls. 438/721.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:54
L6	764	438/725.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:54
L7	627	438/737-738.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:54
L8	1573	216/41.ccls. 216/49.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:54
L9	0	438/63-67.ccls	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:54
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L11	169	438/75.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:54

L12	47	438/79.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:54
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L14	311	1 2 3	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 08:55
L15	30	14 and 4	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:38
L16	832	nonuniform$4 adj temperature$4	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:49
L17	3877	216/63-67.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:40
L18	3417	5 6 7 8	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:40
L19	232	216/72.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:40
L20	426	216/75.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:40
L21	1135	216/79.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:40
L22	4703	17 19 20 21	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:41
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L24	119	4 and (18 13 22)	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:41
L25	0	16 same (chang$4 vary$4 varied decrease$4 increas$4 lower$4 rais$4) near2 tempeature	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:49
L26	0	16 same (chang$4 vary$4 varied decrease$4 increas$4 lower$4 rais$4) same tempeature	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:50
L27	1352	nonuniform$4 near2 temperature$4	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:49
L28	0	27 same (chang$4 vary$4 varied decrease$4 increas$4 lower$4 rais$4) same tempeature	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 10:50
L29	19	27 same etch$4	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 11:51
L30	3	76876/1984	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 11:53
L31	6	"076876"	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 11:53
L32	3	"6486069"	US-PGPUB; USPAT; EPO; JPO; DERWENT ; IBM_TDB	OR	ON	2005/01/24 11:55
L33	9	("5571366" | "5645683" | "5695564" | "5700734" | "5756401" | "6008139" | "6046116" | "6087264" | "6117786").PN.	US-PGPUB; USPAT; USOCR	OR	ON	2005/01/24 11:55

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on Aug. 3, 2004
By Daniel J. Flamm

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	
Daniel L. Flamm	Examiner: Scheiner, L.
Application No.: 10/439,245	Art Unit: 1648
Filed: May 14, 2003	Supplementary Information Disclosure
For: Multi-Temperature Processing	

Commissioner for Patents
P. O. Box 1450
Alexandria VA 22313-1450

Dear Examiner Scheiner:

Please find attached a supplement to the Information Disclosure Statement mailed June 13, 2003. The earliest priority date of the referenced art is Dec. 3, 1999 whereas the instant application claimed priority to Appl. No. 08/567,224 filed on Dec. 4, 1995 and Appl. 60/058,650 filed on Sep. 11, 1997. Therefore the art referenced in the attached document is not prior art under Sec. 102 or pertinent to obviousness under Sec. 103.

REMARKS

Prosecution of the instant application commenced in 2003. Subsequently, Applicant studied for and passed the patent bar, and he later completed formal law school courses in U.S. Patent Law. Applicant graduated from law school in May 2004. As a result he now has a better understanding of patent law issues.

Applicant knew of the art cited in the attached form SB/08a when the instant application was filed in May 2003. Without deceptive intent, Applicant did not disclose this art to the Examiner at that time owing to a belief and understanding that only anticipatory art or art which is relevant to obviousness should be disclosed.

As noted above, the art disclosed on the attached form is more than two years subsequent to the priority documents of the instant application. Applicant believes there is subject matter commonly claimed by the patents listed in the attached disclosure and the instant application. Although Applicant does not believe that this art is relevant to patentability of the instant application, he wishes to exercise an abundance of caution and point this art out to the Examiner.

Applicant believes that the two Foreign Patent Documents cited therein are cumulative to the listed U.S. Patents and do not contain any additional matter.

CONCLUSION

Therefore, in view of the remarks above, Applicant respectfully submits the attached Information Disclosure Statement and requests examination. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at (925) 947-1909.

Respectfully submitted,

Daniel L. Flamm

Date: Aug. 3, 2004

476 Green View Drive
Walnut Creek, CA 94596-5459
Tel: (925) 947-1909
Fax: (925) 937-2754

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	10/439,245
Filing Date	05-14-2003
First Named Inventor	Daniel L. Flamm
Art Unit	1648
Examiner Name	Laurie A. Scheiner
Attorney Docket Number	

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Examiner Initials*	Cite No.[1]	Document Number: Number-Kind Code[2] (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US-6486069 B1	11-26-2002	S. Marks et al.	Col. 14, 10-67; Cols. 15-16
		US-6391148 B2	05-21-2002	S. Marks et al.	Col. 14, 40-67, Cols. 15-16
		US-20010003676 A1	06-14-2001	S. Marks et al.	pps. 8-10, Claims 1-54
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		EP-1236226-A2	07-06-2001	S. Marks et al.	pps 30-39, Claims 1-54	
		WO-0141189-A2	07-26-2001	S. Marks et al.	pps 30-36, Claims 1-54	

Examiner Signature		Date Considered	

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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	10/439245
Filing Date	05/14/2003
First Named Inventor	Daniel L. Flamm
Art Unit	
Examiner Name	
Attorney Docket Number	
Total Number of Pages in This Submission	3+Docs

ENCLOSURES (*Check all that apply*)

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [x] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
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- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
- [ ] After Allowance Communication to a Technology Center (TC)
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (**Appeal Notice, Brief, Reply Brief**)
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Other Enclosure(s) (please Identify below):

Remarks

Please find the attached information disclosure statement (2 pages) and copies of the art referenced therein , under 37 CFR 1.97.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual	Daniel L. Flamm
Signature	
Date	June 13, 2003

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, Washington, DC 20231 on this date: 6/13/2003

Typed or printed	Daniel L. Flamm		
Signature	Daniel L. Flamm	Date	6/13/2003

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37 CFR 1.501 INFORMATION DISCLOSURE CITATION IN A PATENT (Sheet 1 of 2)	Docket Number (Optional)	Patent Number 6,231,776
	Applicant Daniel L. Flamm	
	Issue Date	Art Unit

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	5,179,264	1/12/93	Cuomo et. al	219	121.43	12/13/89
	5,294,778	3/15/94	Heather	219	385	3/15/94
	5,571,366	11/5/96	Ishii	156	345	10/20/94
	5,609,720	3/11/97	Lenz	156	643.1	3/29/95
	5,645,683	7/8/97	Miyamoto	156	643.1	7/7/95
	5,667,631	3/16/97	Holland	216	13	6/28/96
	5,695,564	12/9/97	Imahashi	118	719	8/3/95
	5,700,734	12/23/97	Ooishi	438	592	6/24/96
	5,756,401	3/8/93	Iizuka	438	719	1/8/93
	5,770,099	6/23/98	Rice et. al.	216	68	7/18/95
	5,863,376	1/26/99	Wicker et al.	156	345	6/5/96
	5,925,212	7/20/99	Rice et al.	156	345	9/5/95

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER	DATE CONSIDERED

PTO/SB/42 (05-03)v2
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37 CFR 1.501 INFORMATION DISCLOSURE CITATION IN A PATENT (Sheet 2 of 2)	Docket Number (Optional)	Patent Number 6,231,776
	Applicant Daniel L. Flamm	
	Issue Date	Art Unit

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	5,939,831	8/17/99	Fong et al.	315	111.21	
	5,948,283	9/7/99	Grosshart	216	67	
	6,008,139	12/28/99	Pan et al.	438	730	
	6,033,478	3/7/00	Kholodenko	118	500	
	6,042,901	3/28/00	Denison et al.	427	579	
	6,048,798	4/11/00	Gadgil et al.	438	714	
	6,068,784	5/30/00	Collins et al.	216	68	
	6,087,264	7/11/00	Shin et al.	438	706	
	6,090,303	7/18/00	Collins et al.	216	68	
	6,140,612	10/31/00	Husain et al.	219	390	
	6,165,311	12/26/00	Collins et al.	156	345	
	6,167,835	1/2/01	Wang et al.	418	723	

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER	DATE CONSIDERED

05-16-03 043924S . 051403 A/RE

JC839 U.S. PTO 05/14/03

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PTO/SB/50 (02-01)
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J1036 U.S. PTO 10/439245 05/14/03

REISSUE PATENT APPLICATION TRANSMITTAL

Address to:

Assistant Commissioner for Patents
Box Reissue
Washington, DC 20231

Attorney Docket No.	
First Named Inventor	
Original Patent Number	
Original Patent Issue Date (Month/Day/Year)	
Express Mail Label No.	

APPLICATION FOR REISSUE OF: *(check applicable box)* ☒ *Utility Patent* ☐ *Design Patent* ☐ *Plant Patent*

APPLICATION ELEMENTS (37 CFR 1.173)

1. ☒ * Fee Transmittal Form *(e.g., PTO/SB/56)*
   (Submit an original, and a duplicate for fee processing)
2. ☒ Applicant claims small entity status. See 37 CFR 1.27.
3. ☒ Specification and Claims in a double column copy of patent format *(amended, if appropriate)*
4. ☒ Drawing(s) *(proposed amendments, if appropriate)*
5. ☒ Reissue Oath / Declaration (original or copy) (*37 C.F.R. § 1.175)(PTO/SB/51 or 52*) Blank
6. ☐ Power of Attorney
7. ☒ Original U.S. Patent currently assigned? ☐ Yes ☒ No
   (If Yes, check applicable box(es))
   ☐ Written Consent of all Assignees *(PTO/SB/53) Unsigned*
   ☐ 37 C.F.R. § 3.73(b) Statement (PTO/SB/96)
8. ☐ CD-ROM or CD-R in duplicate, Computer Program (Appendix) or large table
9. ☐ Nucleotide and/or Amino Acid Sequence Submission (if applicable, all of the following are necessary)
   a. ☐ Computer Readable Form (CFR)
   b. ☐ Specification Sequence Listing on:
      i ☐ CD-ROM (2 copies) or CD-R (2 copies); or
      ii ☐ paper
   c. ☐ Statements verifying identify of above copies

ACCOMPANYING APPLICATION PARTS

10. ☒ Statement of status/support for all changes to the claims. See 37 CFR 1.173(c).
11. ☒ Original U.S. Patent for surrender
    ☒ Ribboned Original Patent Grant
    ☐ Statement of Loss (PTO/SB/55)
12. ☐ Foreign Priority Claim *(35 U.S.C. 119)* *(if applicable)*
13. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
14. ☐ English Translation of Reissue Oath/Declaration *(if applicable)*
15. ☒ Preliminary Amendment
16. ☒ Return Receipt Postcard *(MPEP 503)* *(Should be specifically itemized)*
17. Other: ....

14. CORRESPONDENCE ADDRESS

☐ *Customer Number or Bar Code Label* *(Insert Customer No. or Attach bar code label here)* or ☒ *Correspondence address below*

Name	Daniel L. Flamm				
Address	476 Green View Drive				
City	Walnut Creek	State	CA	Zip Code	94596-5459
Country	U. S. A.	Telephone	(925) 947-1909	Fax	(925) 937-2754

NAME (Print/Type)	Daniel L. Flamm	Registration No. *(Attorney/Agent)*	
Signature	Daniel L. Flamm	Date May 14, 2003	

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PA 3213603 v1

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FEE TRANSMITTAL for FY 2003

Effective 01/01/2003. Patent fees are subject to annual revision.

☑ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT | ($)

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Daniel L. Flamm
Examiner Name	
Art Unit	
Attorney Docket No.	

METHOD OF PAYMENT *(check all that apply)*

☑ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☐ Deposit Account:

Deposit Account Number	
Deposit Account Name	

The Director is authorized to: *(check all that apply)*

☐ Charge fee(s) indicated below ☐ Credit any overpayments

☐ Charge any additional fee(s) during the pendency of this application

☐ Charge fee(s) indicated below, **except for the filing fee**

to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	750	2001	375	Utility filing fee	
1002	330	2002	165	Design filing fee	
1003	520	2003	260	Plant filing fee	
1004	750	2004	375	Reissue filing fee	375.00
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($) 375.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X		=	
Independent Claims		- 3** =		X		=	
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	84	2201	42	Independent claims in excess of 3
1203	280	2203	140	Multiple dependent claim, if not paid
1204	84	2204	42	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	410	2252	205	Extension for reply within second month	
1253	930	2253	465	Extension for reply within third month	
1254	1,450	2254	725	Extension for reply within fourth month	
1255	1,970	2255	985	Extension for reply within fifth month	
1401	320	2401	160	Notice of Appeal	
1402	320	2402	160	Filing a brief in support of an appeal	
1403	280	2403	140	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,300	2453	650	Petition to revive - unintentional	
1501	1,300	2501	650	Utility issue fee (or reissue)	
1502	470	2502	235	Design issue fee	
1503	630	2503	315	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	750	2809	375	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	750	2810	375	For each additional invention to be examined (37 CFR 1.129(b))	
1801	750	2801	375	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ____________

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($)

SUBMITTED BY				(Complete *(if applicable)*)	
Name *(Print/Type)*	Daniel L. Flamm	Registration No. *(Attorney/Agent)*		Telephone	925-947-1909
Signature	Daniel L. Flamm			Date	May 14, 2003

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PATENT APPLICATION FOR RE-ISSUE OF U.S. PATENT NO. 6,231,776 ISSUED ON May 15, 2001

MULTI-TEMPERATURE PROCESSING

Inventor: Daniel L. Flamm, residing at 476 Green View Drive, Walnut Creek, CA 94596

I here by certify that this Reissue Application is being deposited with the United Postal Service "Express Mail Post Office to Addressee", Express Mail Label No EH353018505US to Box Reissue Application, Assistant Commissioner for Patents, U. S. Patent and Trademark Office, Washington, D.C. 20231. Dated May. 14, 2003

Lois E. Flamm

Assignee: None

Entity: Small

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PATENT

Assistant Commissioner for Patents
Washington, D.C. 20231

On ____________

By: ____

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Re-Issue Application of Original U. S. Patent No. 6,231,776 B1	Examiner: Not Yet Assigned
Inventor: Daniel L. Flamm	Art Unit: ____________
Application No.: 09/151,163	REISSUE APPLICATION BY THE ASSIGNEE, ASSENT OF ASSIGNEE AND OFFER TO SURRENDER PATENT
Filed: September 10, 1998	
For: Daniel L. Flamm	

Assistant Commissioner for Patents
U. S. Patent and Trademark Office
Washington, D.C. 20231

Sir:

Daniel L. Flamm is the inventor, owner, and assignee of the entire interest in the original patent, U.S. Patent No. 6,231,776 B1, and such statement is made in accordance with 37 CFR 3.73(b).

I am owner and therefore am authorized to act on behalf of myself.

Assignee Daniel L. Flamm assents to the above-identified application for reissue of said patent.

Assignee Daniel L. Flamm hereby offers to surrender U. S. Patent No. 6,231,776 B1.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application, any patent issued thereon, or any patent to which this declaration is directed.

[redacted]

Date: May 14, 2003

By: ______________________

Signature of person signing for assignee

Daniel L. Flamm

Typed or printed name of person signing for assignee

[redacted]

10439245 .051403

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Washington, D.C. 20231

On ______________________________

By: ______________________________

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Re-Issue Application of U.S. Patent No. 6,231,776 B1	Examiner: Unassigned
	Art Unit:
Application No.: Unassigned	PRELIMINARY AMENDMENT
Filed: Herewith	
For: Daniel L. Flamm	

Attn: Box Missing Parts
Assistant Commissioner for Patents
U. S. Patent and Trademark Office
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Sir:

Prior to examination of the above-referenced application, please enter the following amendments and remarks.

IN THE CLAIMS:

Please retain claims 1–12 as they appear in the Reissue specification included herewith. Please add the following claims 13–55.

13. (New) A method of etching a substrate in the manufacture of a device, said method comprising:

[redacted]

placing a substrate having a film thereon on a substrate holder in a chamber and providing a uniform temperature distribution along the surface of the substrate;

performing a first etching of a first portion of said film at a first substrate temperature and performing a second etching of a second portion of said film at a second substrate temperature, said first temperature being changed to said second temperature and said first temperature being different from said second temperature, whereupon said change from said first temperature to said second temperature occurs within a characteristic time period to process said film.

14. (New) The method of claim 13 wherein said first temperature has been changed to said second temperature within a selected period of time by at least heat transfer with the substrate using at least an electrostatic chuck.

15. (New) The method of claim 13 wherein said first temperature has been changed to said second temperature by transferring heat energy using at least a pressure of gas behind said substrate.

16. (New) The method of claim 13 wherein said first temperature has been changed to said second temperature by transferring energy using at least radiation.

17. (New) The method of claim 13 wherein said change in temperature is provided using an in-situ process during said first etching step and said second etching.

18. (New) The method of claim 13 wherein said first etching and said second etching are conducted in a substantially constant plasma environment.

19. (New) The method of claim 13 wherein said first temperature is higher than said second temperature.

20. (New) The method of claim 13 wherein said first temperature is lower than said second temperature.

21. (New) The method of claim 13 wherein said first etching comprises radiation.

22. (New) The method of claim 13 wherein said second etching comprises radiation.

23. (New) The method of claim 13 wherein said first etching comprises an ion bombardment aided process.

24. (New) The method of claim 13 wherein said second etching comprises an ion bombardment aided process.

25. (New) The method of claim 13 wherein said first portion of said film is etched before said second portion of said film.

26. (New) The method of claim 13 wherein said second portion of said film is etched before said first portion of said film.

27. (New) A method of processing a substrate during the manufacture of a device, said method comprising steps of:

placing said substrate having a film thereon on a substrate holder within a chamber of a plasma discharge apparatus, said plasma discharge apparatus comprising a substrate temperature sensor, a substrate temperature control system including a microprocessor, and heat transfer means; said substrate holder having a substrate holder temperature control system,

performing a first treatment of a first portion of said film at a selected first temperature;

[redacted]

changing the selected first temperature to a selected second temperature, the second temperature being different from the first temperature, wherein said substrate temperature control system and said substrate holder temperature control system and said heat transfer means control the change from said first substrate temperature to said second substrate temperature within a characteristic time period to process said film; and

performing a second treatment of a second portion of said film at said selected second temperature.

28. (New) The method of claim 26 wherein said substrate temperature control system comprises said substrate holder temperature controlling means.

29. (New) The method of claim 27 wherein said processing method comprises etching.

30. (New) The method of claim 27 wherein said first temperature has been changed to said second temperature by transferring heat using at least a pressure of gas behind said substrate.

31. (New) The method of claim 27 wherein said first temperature has been changed to said second temperature by transferring energy using at least radiation.

32. (New) A method of etching a substrate in the manufacture of a device, said method comprising steps of:

placing a substrate having a film thereon on a substrate holder in a processing chamber, said chamber comprising a substrate holder, a substrate temperature controlling system to control the temperature of said substrate, and

performing a first etching of a first portion of said film at a selected first temperature;

[redacted]

performing a second etching of a second portion of said film at a selected second temperature, said selected second temperature being different from said selected first temperature;

wherein said selected temperature controlling system allows a change from said first temperature to said second temperature within a characteristic time period to process said film.

33. (New) The method of Claim 32 wherein the time in which said change of temperature occurs subtends less than 40 percent of the total etching process time.

34. (New) The method of Claim 32 wherein the time in which said change of temperature occurs subtends less than 15 percent of the total etching process time.

35. (New) A method for processing layers which are included in a stack of layers positioned on a substrate, said method comprising steps of:

etching at least a first silicon-containing layer in a chamber, said substrate being maintained at a selected first temperature; and

etching a second silicon-containing layer in said chamber, said substrate being maintained at a selected distinct second temperature.

characterized in that the change from said first temperature to said second temperature occurs within a predetermined time, the predetermined time being less than an overall process time associated with etching the first silicon containing layer and the second silicon containing layer.

36. (New) The method of Claim 35 wherein the change of temperature occurs within less than 40 percent of the overall process time.

37. (New) The method of Claim 35 wherein at least one silicon-containing layer is etched in a chlorine-containing ambient.

[redacted]

38. (New) The method of claim 35 wherein at least one layer is etched in a chlorine-containing ambient;

said first layer is a polysilicon layer and said second layer is a silicide layer and said stack includes an oxide layer;

said second temperature is higher than said first temperature;

characterized in that at least one of said etching steps has high selectivity to said oxide layer.

39. (New) The method of Claim 38 wherein said first layer is etched before said second layer.

40. (New) The method of Claim 38 wherein said second layer is etched before said first layer.

41. (New) A method for manufacturing a device comprising an integrated circuit, said method comprising the steps of:

putting a silicide layer included in a stack of layers positioned on a substrate into a chamber,

processing the substrate in said chamber while the substrate is substantially maintained at a selected first temperature; and

processing the substrate in said chamber at a second temperature in order to etch said silicide layer.

42. (New) The method of claim 41 where the first temperature is less than 90 degrees centigrade and the silicide layer is etched at a selected temperature above 100 degrees centigrade.

43. (New) The method of claim 41 in which the change from said first temperature to said second temperature occurs within less than an overall time associated with processing said first and second layers.

[redacted]

44. (New) The method of claim 41 wherein said first temperature has been changed to said second temperature within a selected period of time by at least heat transfer to the substrate using at least an electrostatic chuck.

45. (New) The method of claim 41 wherein said first temperature has been changed to said second temperature by transferring heat using at least a pressure of gas behind said substrate.

46. (New) The method of claim 41 wherein said first temperature has been changed to said second temperature by transferring energy using at least radiation.

47. (New) Apparatus for processing substrates in the manufacture of a device, said apparatus comprising:

a chamber;

a substrate holder having a selected thermal mass, the substrate holder disposed in said chamber,

whereupon said selected thermal mass of said substrate holder allows for a change from a first temperature to a second temperature within a characteristic time period to process a film.

48. (New) Apparatus of claim 47 further comprising a heat transfer means coupled to the substrate holder, the heat transfer means being adapted to change said first temperature to said second temperature within the characteristic time period.

49. (New) Apparatus of claim 47 wherein said change in temperature is provided in-situ within said characteristic time.

50. (New) Apparatus of claim 47 wherein said chamber provides a substantially constant plasma environment.

51. (New) Apparatus of claim 47 wherein said first temperature is higher than said second temperature.

52. (New) Apparatus of claim 47 wherein said first temperature is lower than said second temperature.

53. (New) Apparatus of claim 47 wherein said chamber provides for radiation.

54. (New) Apparatus of claim 47 wherein said chamber provides an ion bombardment aided process.

55. (New) The method of claim 47 wherein said substrate holder comprises an electrostatic chuck.

REMARKS

Claims 1–12 from the Reissue specification are retained in the subject application. Claims 13–55 have been added. Hence claims 1–55 are pending in this application. No new matter has been added. Consideration of the subject application as amended is respectfully requested.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 925-947-1909.

[redacted]

Respectfully submitted,

Daniel L. Flamm

[redacted]

CLAIMS

13. A method of etching a substrate in the manufacture of a device, said method comprising:

placing a substrate having a film thereon on a substrate holder in a chamber and providing a uniform temperature distribution along the surface of the substrate;

performing a first etching of a first portion of said film at a first substrate temperature and performing a second etching of a second portion of said film at a second substrate temperature, said first temperature being changed to said second temperature and said first temperature being different from said second temperature, whereupon said change from said first temperature to said second temperature occurs within a characteristic time period to process said film.

14. The method of claim 13 wherein said first temperature has been changed to said second temperature within a selected period of time by at least heat transfer with the substrate using at least an electrostatic chuck.

15. The method of claim 13 wherein said first temperature has been changed to said second temperature by transferring heat energy using at least a pressure of gas behind said substrate.

16. The method of claim 13 wherein said first temperature has been changed to said second temperature by transferring energy using at least radiation.

17. The method of claim 13 wherein said change in temperature is provided using an in-situ process during said first etching step and said second etching.

18. The method of claim 13 wherein said first etching and said second etching are conducted in a substantially constant plasma environment.

19. The method of claim 13 wherein said first temperature is higher than said second temperature.

20. The method of claim 13 wherein said first temperature is lower than said second temperature.

21. The method of claim 13 wherein said first etching comprises radiation.

22. The method of claim 13 wherein said second etching comprises radiation.

23. The method of claim 13 wherein said first etching comprises an ion bombardment aided process.

24. The method of claim 13 wherein said second etching comprises an ion bombardment aided process.

25. The method of claim 13 wherein said first portion of said film is etched before said second portion of said film.

26. The method of claim 13 wherein said second portion of said film is etched before said first portion of said film.

27. A method of processing a substrate during the manufacture of a device, said method comprising steps of:

placing said substrate having a film thereon on a substrate holder within a chamber of a plasma discharge apparatus, said plasma discharge apparatus comprising a substrate temperature sensor, a substrate temperature control system including a microprocessor, and heat transfer means; said substrate holder having a substrate holder temperature control system,

performing a first treatment of a first portion of said film at a selected first temperature;

changing the selected first temperature to a selected second temperature, the second temperature being different from the first temperature, wherein said substrate temperature control system and said substrate holder temperature control system and said heat transfer means control the change from said first substrate temperature to said second substrate temperature within a characteristic time period to process said film; and

performing a second treatment of a second portion of said film at said selected second temperature.

28. The method of claim 26 wherein said substrate temperature control system comprises said substrate holder temperature controlling means.

29. The method of claim 27 wherein said processing method comprises etching.

[redacted]

30. The method of claim 27 wherein said first temperature has been changed to said second temperature by transferring heat using at least a pressure of gas behind said substrate.

31. The method of claim 27 wherein said first temperature has been changed to said second temperature by transferring energy using at least radiation.

32. A method of etching a substrate in the manufacture of a device, said method comprising steps of:

placing a substrate having a film thereon on a substrate holder in a processing chamber, said chamber comprising a substrate holder, a substrate temperature controlling system to control the temperature of said substrate, and

performing a first etching of a first portion of said film at a selected first temperature;

performing a second etching of a second portion of said film at a selected second temperature, said selected second temperature being different from said selected first temperature;

wherein said selected temperature controlling system allows a change from said first temperature to said second temperature within a characteristic time period to process said film.

33. The method of Claim 32 wherein the time in which said change of temperature occurs subtends less than 40 percent of the total etching process time.

34. The method of Claim 32 wherein the time in which said change of temperature occurs subtends less than 15 percent of the total etching process time.

35. A method for processing layers which are included in a stack of layers positioned on a substrate, said method comprising steps of:

etching at least a first silicon-containing layer in a chamber, said substrate being maintained at a selected first temperature; and

etching a second silicon-containing layer in said chamber, said substrate being maintained at a selected distinct second temperature.

characterized in that the change from said first temperature to said second temperature occurs within a predetermined time, the predetermined time being less than an overall process time associated with etching the first silicon containing layer and the second silicon containing layer.

36. The method of Claim 35 wherein the change of temperature occurs within less than 40 percent of the overall process time.

[redacted]

37. The method of Claim 35 wherein at least one silicon-containing layer is etched in a chlorine-containing ambient.

38. The method of claim 35 wherein at least one layer is etched in a chlorine-containing ambient;

said first layer is a polysilicon layer and said second layer is a silicide layer and said stack includes an oxide layer;

said second temperature is higher than said first temperature;

characterized in that at least one of said etching steps has high selectivity to said oxide layer.

39. The method of Claim 38 wherein said first layer is etched before said second layer.

40. The method of Claim 38 wherein said second layer is etched before said first layer.

41. A method for manufacturing a device comprising an integrated circuit, said method comprising the steps of:

putting a silicide layer included in a stack of layers positioned on a substrate into a chamber,

processing the substrate in said chamber while the substrate is substantially maintained at a selected first temperature; and

processing the substrate in said chamber at a second temperature in order to etch said silicide layer.

42. The method of claim 41 where the first temperature is less than 90 degrees centigrade and the silicide layer is etched at a selected temperature above 100 degrees centigrade.

43. The method of claim 41 in which the change from said first temperature to said second temperature occurs within less than an overall time associated with processing said first and second layers.

44. The method of claim 41 wherein said first temperature has been changed to said second temperature within a selected period of time by at least heat transfer to the substrate using at least an electrostatic chuck.

45. The method of claim 41 wherein said first temperature has been

changed to said second temperature by transferring heat using at least a pressure of gas behind said substrate.

46. The method of claim 41 wherein said first temperature has been changed to said second temperature by transferring energy using at least radiation.

47. Apparatus for processing substrates in the manufacture of a device, said apparatus comprising:

a chamber;

a substrate holder having a selected thermal mass, the substrate holder disposed in said chamber,

whereupon said selected thermal mass of said substrate holder allows for a change from a first temperature to a second temperature within a characteristic time period to process a film.

48. Apparatus of claim 47 further comprising a heat transfer means coupled to the substrate holder, the heat transfer means being adapted to change said first temperature to said second temperature within the characteristic time period.

49. Apparatus of claim 47 wherein said change in temperature is provided in-situ within said characteristic time.

50. Apparatus of claim 47 wherein said chamber provides a substantially constant plasma environment.

51. Apparatus of claim 47 wherein said first temperature is higher than said second temperature.

52. Apparatus of claim 47 wherein said first temperature is lower than said second temperature.

53. Apparatus of claim 47 wherein said chamber provides for radiation.

54. Apparatus of claim 47 wherein said chamber provides an ion bombardment aided process.

55. The method of claim 47 wherein said substrate holder comprises an electrostatic chuck.

[redacted]

MULTI-TEMPERATURE PROCESSING

CROSS-REFERENCE TO RELATED APPLICATIONS

This present application is a continuation-in-part of U.S. application Ser. No. 60/058,650 filed Sep. 11, 1997, and a continuation-in-part of U.S. application Ser. No. 08/567,224 filed Dec. 4, 1995, now abandoned which are hereby incorporated by reference for all purposes.

BACKGROUND OF THE INVENTION

This invention relates generally to plasma processing. More particularly, one aspect of the invention is for greatly improved plasma processing of devices using an in-situ temperature application technique. Another aspect of the invention is illustrated in an example with regard to plasma etching or resist stripping used in the manufacture of semiconductor devices. The invention is also of benefit in plasma assisted chemical vapor deposition (CVD) for the manufacture of semiconductor devices. But it will be recognized that the invention has a wider range of applicability. Merely by way of example, the invention also can be applied in other plasma etching applications, and deposition of materials such as silicon, silicon dioxide, silicon nitride, polysilicon, among others.

Plasma processing techniques can occur in a variety of semiconductor manufacturing processes. Examples of plasma processing techniques occur in chemical dry etching (CDE), ion-assisted etching (IAE), and plasma enhanced chemical vapor deposition (PECVD), including remote plasma deposition (RPCVD) and ion-assisted plasma enhanced chemical vapor deposition (IAPECVD). These plasma processing techniques often rely upon radio frequency power (rf) supplied to an inductive coil for providing power to produce with the aid of a plasma.

Plasmas can be used to form neutral species (i.e., uncharged) for purposes of removing or forming films in the manufacture of integrated circuit devices. For instance, chemical dry etching is a technique which generally depends on gas-surface reactions involving these neutral species without substantial ion bombardment.

In a number of manufacturing processes, ion bombardment to substrate surfaces is often undesirable. This ion bombardment, however, is known to have harmful effects on properties of material layers in devices and excessive ion bombardment flux and energy can lead to intermixing of materials in adjacent device layers, breaking down oxide and "wear out," injecting of contaminative material formed in the processing environment into substrate material layers, harmful changes in substrate morphology (e.g. amophotization), etc.

Ion assisted etching processes, however, rely upon ion bombardment to the substrate surface in defining selected films. But these ion assisted etching processes commonly have a lower selectivity relative to conventional CDE processes. Hence, CDE is often chosen when high selectivity is desired and ion bombardment to substrates is to be avoided.

In generally most, if not all, of the above processes maintain temperature in a "batch" mode. That is, the temperature of surfaces in a chamber and of the substrate being processed in such chamber are controlled to be at a substantially a single value of temperature during processing.

From the above it is seen that an improved technique, including a method and apparatus, for plasma processing is often desired.

SUMMARY OF THE INVENTION

The present invention provides a technique, including a method and apparatus, for fabricating a product using a plasma discharge. One aspect of the present technique relies upon multi-step etching processes for selectively removing a film on a workpiece using differing temperatures. It overcomes serious disadvantages of prior art methods in which throughput and etching rate were lowered in order to avoid excessive device damage to a workpiece. In particular, this technique is extremely beneficial for removing resist masks which have been used to effect selective ion implantation of a substrate in some embodiments. In general, implantation of ions into a resist masking surface causes the upper surface of said resist to become extremely cross-linked and contaminated by materials from the ion bombardment. If the cross-linked layer is exposed to excessive temperature, it is prone to rupture and forms contaminative particulate matter. Hence, the entire resist layer is often processed at a low temperature to avoid this particle problem. Processing at a lower temperature often requires excessive time which lowers throughput. Accordingly, the present invention overcomes these disadvantages of conventional processes by rapidly removing a majority of resist at a higher temperature after an ion implanted layer is removed without substantial particle generation at a lower temperature.

In another aspect, the present invention provides a process which utilizes temperature changes to achieve high etch rates while simultaneously maintaining high etch selectivity between a layer which is being pattered or removed other material layers. An embodiment of this process advantageously employs a sequence of temperature changes as an unexpected means to avoid various types of processing damage to the a device and material layers. A novel inventive means for effecting a suitable controlled change in temperature as part of a process involves the use of a workpiece support which has low thermal mass in comparison to the heat transfer means. In an aspect of this invention, a fluid is utilized to change the temperature of a workpiece. In another aspect, the thermal capacity of a circulating fluid is sufficiently greater than the thermal capacity of the workpiece support that it permits maintaining the workpiece at a substantially uniform temperature.

Still another aspect of the invention provides an apparatus for etching a substrate in the manufacture of a device using different temperatures during etching. The apparatus includes a chamber and a substrate holder disposed in the chamber. The substrate holder has a selected thermal mass to facilitate changing the temperature of the substrate to be etched. That is, the selected thermal mass of the substrate holder allows for a change from a first temperature to a second temperature within a characteristic time period to process a film. The present apparatus can, for example, provide different processing temperatures during an etching process or the like.

The present invention achieves these benefits in the context of known process technology. However, a further understanding of the nature and advantages of the present invention may be realized by reference to the latter portions of the specification and attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a simplified diagram of a plasma etching apparatus according to the present invention;

FIGS. 2A–2E are simplified configurations using wave adjustment circuits according to the present invention;

FIG. 3 is a simplified diagram of a chemical vapor deposition apparatus according to the present invention;

[redacted]

FIG. 4 is a simplified diagram of a stripper according to the present invention;

FIGS. 5A–5C are more detailed simplified diagrams of a helical resonator according to the present invention;

FIG. 6 is a simplified block diagram of a substrate holder according to the present invention;

FIG. 7 is a simplified diagram of a temperature control system according to an embodiment of the present invention;

FIG. 8 is a simplified diagram of a fluid reservoir system according to an embodiment of the present invention;

FIG. 9 is a simplified diagram of a simplified diagram of a semiconductor substrate according to an embodiment of the present invention; and

FIG. 10 is a simplified flow diagram of a heating process according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 is a simplified diagram of a plasma etch apparatus 10 according to the present invention. This etch apparatus is provided with an inductive applicator, e.g., inductive coil. This etch apparatus depicted, however, is merely an illustration, and should not limit the scope of the claims as defined herein. One of ordinary skilled in the art may implement the present invention with other treatment chambers and the like.

The etch apparatus includes a chamber 12, a feed source 14, an exhaust 16, a product support check or pedestal 18, an inductive applicator 20, a radio frequency ("rf") power source 22 to the inductive applicator 20, wave adjustment circuits 24, 29 (WACs), a radio frequency power source 35 to the pedestal 18, a controller 36, an agile temperature control means 19, and other elements. Optionally, the etch apparatus includes a gas distributor 17.

The chamber 12 can be any suitable chamber capable of housing a product 28, such as a wafer to be etched, and for providing a plasma discharge therein. The chamber can be a domed chamber for providing a uniform plasma distribution over the product 28 to be etched, but the chamber also can be configured in other shapes or geometries, e.g., flat ceiling, truncated pyramid, cylindrical, rectangular, etc. Depending upon the application, the chamber is selected to produce a uniform entity density over the pedestal 18, providing a high density of entities (i.e., etchant species) for etching uniformity.

The product support chuck can rapidly change its temperature in ways defined herein as well as others. The wafer is often thermally coupled to the support check which permits maintaining the wafer temperature in a known relationship with respect to the chuck. Coupling will often comprise an electrostatic chuck or mechanical clamps, which apply a pressure to bring the product into close proximity with the support check, which enables a relatively good thermal contact between the wafer and support chuck. The support chuck and wafer are often maintained at a substantially equal temperature. A pressure of gas is often applied through small openings in the support chuck behind the wafer in order to improve thermal contact and heat transfer between the wafer and support chuck.

The present chamber includes a dome 25 having an interior surface 26 made of quartz or other suitable materials. The exterior surface of the chamber is typically a dielectric material such as a ceramic or the like. Chamber 12 also includes a process kit with a focus ring 32, a cover (not

shown), and other elements. Preferably, the plasma discharge is derived from the inductively coupled plasma source that is a de-coupled plasma source ("DPS") or a helical resonator, although other sources can be employed.

The de-coupled source originates from rf power derived from the inductive applicator 20. Inductively coupled power is derived from the power source 22. The rf signal frequencies ranging from 800 kHz to 80 MHz can be provided to the inductive applicator 20. Preferably, the rf signal frequencies range from 5 MHz to 60 MHz. The inductive applicator (e.g., coil, antenna, transmission line, etc.) overlying the chamber ceiling can be made using a variety of shapes and ranges of shapes. For example, the inductive applicator can be a single integral conductive film, a transmission line, or multiple coil windings. The shape of the inductive applicator and its location relative to the chamber are selected to provide a plasma overlying the pedestal to improve etch uniformity.

The plasma discharge (or plasma source) is derived from the inductive applicator 20 operating with selected phase 23 and anti-phase 27 potentials (i.e., voltages) that substantially cancel each other. The controller 36 is operably coupled to the wave adjustment circuits 24, 29. In one embodiment, wave adjustment circuits 24, 29 provide an inductive applicator operating at full-wave multiples 21. This embodiment of full-wave multiple operation provides for balanced capacitance of phase 23 and anti-phase voltages 27 along the inductive applicator (or coil adjacent to the plasma). This full-wave multiple operation reduces or substantially eliminates the amount of capacitively coupled power from the plasma source to chamber bodies (e.g., pedestal, walls, wafer, etc.) at or close to ground potential. Alternatively, the wave adjustment circuits 24, 29 provide an inductive applicator that is effectively made shorter or longer than a full-wave length multiple by a selected amount, thereby operating at selected phase and anti-phase voltages that are not full-wave multiples. Alternatively, more than two, one or even no wave adjustment circuits can be provided in other embodiments. But in all of these above embodiments, the phase and anti-phase potentials substantially cancel each other, thereby providing substantially no capacitively coupled power from the plasma source to the chamber bodies.

In alternative embodiments, the wave adjustment circuit can be configured to provide selected phase and anti-phase coupled voltages coupled from the inductive applicator to the plasma that do not cancel. This provides a controlled potential between the plasma and the chamber bodies, e.g., the substrate, grounded surfaces, walls, etc. In one embodiment, the wave adjustment circuits can be used to selectively reduce current (i.e., capacitively coupled current) to the plasma. This can occur when certain high potential difference regions of the inductive applicator to the plasma are positioned (or kept) away from the plasma region (or inductor-containing-the-plasma region) by making them go into the wafer adjustment circuit assemblies, which are typically configured outside of the plasma region. In this embodiment, capacitive current is reduced and a selected degree of symmetry between the phase and anti-phase of the coupled voltages is maintained, thereby providing a selected potential or even substantially ground potential. In other embodiments, the wave adjustment circuits can be used to selectively increase current (i.e., capacitively coupled current) to the plasma.

As shown, the wave adjustment circuits are attached (e.g., connected, coupled, etc.) to ends of the inductive applicator. Alternatively, each of these wave adjustment circuits can be attached at an intermediate position away from the inductive application ends. Accordingly, upper and lower tap positions for respective wave adjustment circuits can be adjustable. But both the inductive applicator portions below and above each tap position are active. That is, they both can interact with the plasma discharge.

A sensing apparatus can be used to sense plasma voltage which is used to provide automatic tuning of the wave adjustment circuits and any rf matching circuit between the rf generator and the plasma treatment chamber. This sensing apparatus can maintain the average AC potential at zero or a selected value relative to ground or any other reference value. This wave adjustment circuit provides for a selected potential difference between the plasma source and chamber bodies. These chamber bodies may be at a ground potential or a potential supplied by another bias supply, e.g., See FIG. 1 reference numeral 35. Examples of wave adjustment circuits are described by way of the FIGS. below.

For instance, FIGS. 2A to 2E are simplified configurations using the wave adjustment circuits according to the present invention. These simplified configurations should not limit the scope of the claims herein. In an embodiment, these wave adjustment circuits employ substantially equal circuit elements (e.g., inductors, capacitors, transmission line sections, and others) such that the electrical length of the wave adjustment circuits in series with the inductive applicator coupling power to the plasma is substantially an integral multiple of one wavelength. In other embodiments, the circuit elements provide for inductive applicators at other wavelength multiples, e.g., one-sixteenth-wave, one-eighth-wave, quarter-wave, half-wave, three-quarter wave, etc. In these embodiments (e.g., full-wave multiple, half-wave, quarter-wave, etc.), the phase and anti-phase relationship between the plasma potentials substantially cancel each other. In further embodiments, the wave adjustment circuits employ circuit elements that provide plasma applicators with phase and anti-phase potential relationships that do not cancel each other out using a variety of wave length portions.

FIG. 2A is a simplified illustration of a plasma source **50** using wave adjustment circuits and an agile temperature chuck **75** according to an embodiment of the present invention. This plasma source **50** includes a discharge tube **52**, an inductive applicator **55**, an exterior shield **54**, an upper wave adjustment circuit **57**, a lower wave adjustment circuit **59**, an rf power supply **61**, and other elements. The upper wave adjustment circuit **57** is a helical coil transmission line portion **69**, outside of the plasma source region **60**. Lower wave adjustment circuit **59** also is a helical coil transmission line portion **67** outside of the plasma source region **60**. The power supply **61** is attached **65** to this lower helical coil portion **67**, and is grounded **63**. Each of the wave adjustment circuits also are shielded **66, 68**.

In this embodiment, the wave adjustment circuits are adjusted to provide substantially zero AC voltage at one point on the inductive coil (refer to point 00 in FIG. 2A). This embodiment also provides substantially equal phase **70** and anti-phase **71** voltage distributions in directions about this point (refer to 00-A and 00-C in FIG. 2A) and provides substantially equal capacitance coupling to the plasma from physical inductor elements (00-C) and (00-A), carrying the phase and anti-phase potentials. Voltage distributions 00-A and 00-C are combined with C-D and A-B (shown by the phantom lines) to substantially comprise a full-wave voltage distribution in this embodiment where the desired configuration is a selected phase/anti-phase portion of a full-wave inductor (or helical resonator) surrounding the plasma source discharge tube.

In this embodiment, it is desirable to reduce or minimize capacitive coupling current from the inductive element to the plasma discharge in the plasma source. Since the capacitive current increases monotonically with the magnitude of the difference of peak phase and anti-phase voltages, which occur at points A and C in FIG. 2A, this coupling can be lessened by reducing this voltage difference. In FIG. 2A, for example, it is achieved by way of two wave adjustment circuits **57, 59**. Coil **55** (or discharge source) is a helical resonator and the wave adjustment circuits **57, 59** are helical resonators.

The discharge source helical resonator **53** can be constructed using conventional design formulae. Generally, this helical resonator includes an electrical length which is a selected phase portion "x" (A to 00 to C) of a full-wave helical resonator. The helical resonator wave adjustment circuits are each selected to jointly comprise a portion ($2\pi-x$) of full-wave helical resonators. Physical parameters for the wave adjustment helical resonators can be selected to realize practical physical dimensions and appropriate Q, Z_O, etc values. In particular, some or even all of the transmission line parameters (Q, Z_O, etc.) of the wave adjustment circuit sections may be selected to be substantially the same as the transmission line parameters of the inductive applicator. The portion of the inductive plasma applicator helical resonator, on the other hand, is designed and sized to provide selected uniformity values over substrate dimensions within an economical equipment size and reduced Q.

The wave adjustment circuit provides for external rf power coupling, which can be used to control and match power to the plasma source, as compared to conventional techniques used in helical resonators and the like. In particular, conventional techniques often match to, couple power to, or match to the impedance of the power supply to the helical resonator by varying a tap position along the coil above the grounded position, or selecting a fixed tap position relative to a grounded coil end and matching to the impedance at this position using a conventional matching network, e.g., LC network, π network, etc. Varying this tap position along the coil within a plasma source is often cumbersome and generally imposes difficult mechanical design problems. Using the fixed tap and external matching network also is cumbersome and can cause unanticipated changes in the discharge Q, and therefore influences its operating mode and stability. In the present embodiments, the wave adjustment circuits can be positioned outside of the plasma source (or constrained in space containing the inductive coil, e.g., See FIG. 2A. Accordingly, the mechanical design (e.g., means for varying tap position, change in the effective rf power coupling point by electrical means, etc.) of the tap position are simplified relative to those conventional techniques.

In the present embodiment, rf power is fed into the lower wave adjustment circuit **59**. Alternatively, rf power can be fed into the upper wave adjustment circuit (not shown). The rf power also can be coupled directly into the inductive plasma coupling applicator (e.g., coil, etc.) in the wave adjustment circuit design, as illustrated by FIG. 2B. Alternatively, other applications will use a single wave adjustment circuit, as illustrated by FIG. 2C. Power can be coupled into this wave adjustment circuit or by conventional techniques such as a tap in the coil phase. In some embodiments, this tap in the coil phase is positioned above the grounded end. An external impedance matching network may then be operably coupled to the power for satisfactory power transfer efficiency from, for example, a conventional coaxial cable to impedances (current to voltage rations) existing between the wave adjustment circuit terminated end of the applicator and the grounded end.

[redacted]

A further embodiment using multiple inductive plasma applicators also is provided, as shown in FIG. 2D. This embodiment includes multiple plasma applicators (PA 1, PA2. . . PAn). These plasma applicators respectively provide selected combinations of inductively coupled power and capacitively coupled power from respective voltage potentials (V1, V2. . . Vn). Each of these plasma applicators derives power from its power source (PS1, PS2. . . PSn) either directly through an appropriate matching or coupling network or by coupling to a wave adjustment circuit as described. Alternatively, a single power supply using power splitters and impedance matching networks can be coupled to each (or more than two) of the plasma applicators. Alternatively, more than one power supply can be used where at least one power supply is shared among more than one plasma applicator. Each power source is coupled to its respective wave adjustment circuits (WAC1, WAC2. . . WACn).

Generally, each plasma applicator has an upper wave adjustment circuit (e.g., WAC1*a*, WAC2*a*. . . WACna) and a lower wave adjustment circuit (e.g., WAC1*b*, WAC2*b*. . . WACnb). The combination of upper and lower wave adjustment circuits are used to adjust the plasma source potential for each plasma source zone. Alternatively, a single wave adjustment circuit can be used for each plasma applicator. Each wave adjustment circuit can provide substantially the same impedance characteristics, or substantially distinct impedance characteristics. Of course, the particular configuration used will depend upon the application.

For instance, multiple plasma applicators can be used to employ distinct excitation frequencies for selected zones in a variety of applications. These applications include film deposition using plasma enhanced chemical deposition, etching by way of ion enhanced etching or chemical dry etching and others. Plasma cleaning also can be performed by way of the multiple plasma applicators. Specifically, at least one of the plasma applicators will define a cleaning plasma used for cleaning purposes. In one embodiment, this cleaning plasma can have an oxygen containing species. This cleaning plasma is defined by using an oxygen discharge, which is sustained by microwave power to a cavity or resonant microwave chamber abutting or surrounding a conventional dielectric vessel. Of course, a variety of other processes also can be performed by way of this multiple plasma applicator embodiment.

This present application using multiple plasma applicators can provide a multi-zone (or multi-chamber) plasma source without the use of conventional mechanical separation means (e.g., baffles, separate process chambers, etc.). Alternatively, the degree of interaction between adjacent zones or chambers can be relaxed owing to the use of voltage potential control via wave adjustment circuits. This plasma source provides for multiple plasma source chambers, each with its own control via its own plasma applicator. Accordingly, each plasma applicator provides a physical zone region (i.e., plasma source) with selected plasma characteristics (e.g., capacitively coupled current, inductively coupled current, etc.). These zones can be used alone or can be combined with other zones. Of course, the particular configuration will depend upon the application.

In the present embodiments, the wave adjustment circuit can be made from any suitable combination of element(s) such as various types of transmission lines, circuits, etc. These transmission lines include conventional solid or air dielectric coaxial cable, or ordinary, repeating inductor/capacitor discrete approximations to transmission lines, and others. These types of transmission lines are co-axial transmission lines, balanced parallel transmission lines, so called slow wave transmission lines with a spiral inner conductor (e.g., selected portions of a helical resonator, etc.), and others. Individual lumped, fixed, or adjustable combinations of resistors, capacitors, and inductors (e.g., matching networks, etc.) also can be used in place of transmission line sections for the wave adjustment circuit. These general types of wave adjustment circuits are frequency dependent, and can be termed frequency dependent wave adjustment circuits (or FDWACs).

Frequency independent elements also can be used as the wave adjustment circuits. These wave adjustment circuits can be termed frequency independent WACs (or FIWACs). Frequency independent wave adjustment circuits include degenerate cases such as short-circuit connections to ground or an infinite impedance (i.e., open circuit), and others. Frequency independent wave adjustment circuits can be used alone, or in combination with the frequency dependent wave adjustment circuits. Alternatively, the frequency dependent wave adjustment circuits can be used alone or in combination with other wave adjustment circuits. Other variations, alternative constructions, and modifications also may be possible depending upon the application.

With regard to operation of the wave adjustment circuits, various embodiments can be used, as illustrated by FIG. 2E. The wave adjustment circuits are used to select a wave length portion to be applied in the plasma applicator. In some embodiments, the average rf plasma potential is maintained close to ground potential by providing substantially equal phase **90**, **81** and anti-phase **91**, **82** capacitively coupled portions of the inductive applicator. This can occur in multi-wave embodiments **92**, full-wave embodiments **93**, half-wave multiple embodiments, quarter-wave multiple embodiments, or any other embodiments **94**.

In alternative embodiments, it is desirable to maintain an elevated source plasma voltage relative to ground potential to induce a controlled ion plasma flux (or ion bombardment) to the product substrate (or any other chamber bodies). These embodiments are provided by selecting distinct electrical lengths for each of the wave adjustment circuit sections such that the capacitive coupled current from a phase section of the inductive plasma applicator is in excess of capacitive coupled current from its anti-phase portion. In these embodiments, the wave adjustment circuit provides a deliberate imbalance between the phase and anti-phase of the coupled voltages. In some embodiments **97**, this occurs by shifting the zero voltage nodes along the process chamber axially, thereby achieving a bias relative to the plasma discharge. As shown, the phase **95** is imbalanced relative to its anti-phase **96**. In other embodiments **99**, one phase portion **84** is imbalanced by way of a different period relative to its complementary phase portion **85**. Other embodiments are provided where the source plasma voltage is lower relative to ground potential. In the embodiments where imbalance is desirable, the potential difference between the phase and anti-phase potential portions is reduced (or minimized) when the amount of sputtering (e.g., wall sputtering, etc.) is reduced. The amount of sputtering, however, can be increased (or maximized) by increasing the potential difference between the phase and anti-phase potential portions. Sputtering is desirable in, for example, sputtering a quartz target, cleaning applications, and others. Of course, the type of operation used will depend upon the application.

Current maxima on an inductive applicator with distributed capacitance (e.g., helical resonator transmission line, etc.) occur at voltage minima. In particular, conventional quarter-wave helical resonator current is substantially at a relative maximum at its grounded end of the coil, and to a lesser extend in the nearby coil elements. Therefore, partial inductive coupling of power, if it occurs, will tend to be at this grounded end. In conventional half-wave helical resonators, inductive coupling tends to occur at each of the two grounded ends.

In the present invention, substantially anti-symmetric phase and anti-phase inductive half-wave and other fractional wave applicator sections support substantially more inductive coupling at a selected rf voltage node, e.g., FIG. 2A reference numeral 00. This effect is caused by high current flow in the inductor applicator zones (or sections) both directly above and below the node (corresponding to inductor elements in the phase and anti-phase sections at and immediately adjacent to the rf voltage zero point). It should be noted that conventional quarter and half-wave inductively coupled inductive applicators have inductive coupling which abruptly declines below the grounded coil locations because the coil terminates and voltage extrema are present at these locations. This generally produces conventional quarter and half-wave helical resonators that tend to operate in a capacitive mode, or with a substantial fraction of power which is capacitively coupled to the plasma, unless the plasma is shielded from coil voltages, as noted above.

In a specific embodiment, the power system includes selected circuit elements for effective operation. The power system includes an rf power source. This rf power source can be any suitable rf generator capable of providing a selected or continuously variable frequency in a range from about 800 kHz to about 80 MHz. Many generators are useful. Preferably, generators capable of operating into short and open-circuit loads without damage are used for industrial applications. One example of a suitable generator is a fixed frequency rf generator 28.12 MHz–3 kW CX-3000 power supply made by Comdel, Inc. of Beverly, Mass. A suitable variable frequency power supply arrangement capable of the 3 kW output over an 800 kHz to 50 MHz range can be made by driving an IFI Model TCCX3500 High Power Wide Band Amplifier with a Hewlett Packard HP116A, 0–50 MHz Pulse/Function Generator. Other generators including those capable of higher or lower power also can be used depending upon the application.

Power from the generator can be transmitted to the plasma source by conventional coaxial cable transmission line. An example of this transmission line is RG8/U and other higher temperature rated cable (e.g., RG1151U, etc.) with a coaxial TEFLON™ dielectric. In some embodiments, power is fed to conventional end-grounded half-wave helical resonators by positioning a movable tap on the helical coil and connecting a power source between the tap and the ground. In other embodiments, matching networks can be introduced between the coaxial cable power feed and the helical coil tap for flexibility. The matching network will depend on the selected wave configuration and wave adjustment circuits. In a balanced half-wave helical resonator embodiment, for example, the ends of the resonator coil can be terminated with wave adjustment circuits which substantially have zero susceptance. In particular, the wave adjustment circuit is designed as an open circuit by making no electrical connections to the ends of the coil, or establishing an electrical equivalence thereof. Alternatively, the ends of the coil are isolated by high series impedance chokes, thereby maintaining DC coupling to a fixed reference potential. These types of wave adjustment circuits are frequency independent and are "degenerate" cases. In these embodiments, the rf power is provided such that the phase and anti-phase current flows above and below the electrical midpoint (i.e., zero voltage node, etc.) of the coil. This provides for substantially balanced phase and anti-phase current flow from the power source stabilizing desired operation in coil voltages above the midpoint of the coil, and also provides substantially equal phase and anti-phase voltages.

The embodiments described above also can be applied to other plasma processing applications, e.g., PECVD, plasma immersion ion implantation (PIII), stripping, sputtering. For instance, FIG. 3 is a simplified CVD apparatus **100** according to the present invention. The present CVD apparatus includes a chamber **112**, a feed source **114**, an exhaust **116**, a pedestal **118**, a power source **122**, a ground **124**, a helical resonator **126**, and other elements. The helical resonator **126** has a coil **132**, an outer shield **133**, and other elements. The chamber can be any suitable chamber capable of housing a product **119** such as a wafer for deposition, and for providing a plasma discharge therein. Preferably, the chamber is a right circular cylinder chamber for providing an uniform plasma species distribution over the product. But the chamber can also be configured in the form of rectangular right cylinder, a truncated cone, and the like. The chamber and fixtures are constructed from aluminum and quartz, and other suitable materials. The plasma discharge is derived from a plasma source which is preferably a helical resonator discharge or other inductive discharge using a wave adjustment circuit or other techniques to selectively adjust phase-anti-phase potentials. The present CVD apparatus provides for deposition of a dielectric material, e.g., silicon dioxide or the like.

The product **119** having an upper surface **130** is placed into the present CVD apparatus for deposition, e.g., plasma enhanced chemical vapor deposition (PECVD), and others. Examples of deposition materials include a dielectric material such as a silicon dioxide (SiO_2), a phosphosilicate glass (PSG), a borophosphosilicate glass (BPSG), a silicon nitride (Si_3N_4), among others.

In one embodiment, the deposition occurs by introducing a mixture comprising organic silane, oxygen, and an inert gas such as helium or argon according to the present invention. The organic silane can be any suitable organic silicate material such TEOS, HMDS, OMCTS, and the like. Deposition is also conformal in selected instances. As for the oxygen, it includes a flow rate of about 1 liter/per minute and less. A relative flow rate between the organic silane such as TEOS and oxygen ranges from about 1:40 to about 2:1, and is preferably less than about 1:2 in certain applications. A deposition temperature of the organic silane-oxygen layer ranges from about **300** to about 500° C., and can also be at other temperatures. Pressures in the range of 1 to 7 Torr are generally used. Of course, other concentrations, temperatures, materials, and flow rates can be used depending upon the particular application.

This chamber also includes a wave adjustment circuit **127**. The wave adjustment circuit **127** is used to provide a helical coil operating with capacitive coupling to selected phase and anti-phase voltages. This portion **127** of the wave adjustment circuit coil also is shielded **140** to prevent rf from interfering with the plasma discharge or external elements, e.g., equipment, power, etc. The coil shield **140** is made of a conductive material such as copper, aluminum, or the like. In one embodiment, an operating frequency is selected and the wave adjustment circuit is adjusted to short circuit the upper end of the helical applicator coil to ground **124**. This provides a helical coil operating at approximately a full-wave multiple and has substantially equal phase and anti-phase sections. This full-wave multiple operation provides for balanced capacitance of phase **151** and anti-phase **153** voltages along the coil **132** adjacent to the plasma source. Full-wave multiple operation reduces or even substantially eliminates the amount of capacitively coupled power from the plasma source to chamber bodies (e.g., pedestal, walls, wafer, etc.) at or close to ground potential.

In the present embodiment, the wave adjustment circuit **127** is a variable coil portion **128** of a spiral transmission line, which is selectively placed outside the outer shield **133**. Accordingly, when the wave adjustment circuit is adjusted to become a short circuit, the plasma source "sees" only a selected full-wave multiple comprising substantially equal phase **151** and anti-phase **153** of the entire instantaneous AC voltages **134**, **135**. In this embodiment, stress of the deposited oxide film is often tensile, which can be undesirable.

Alternatively, the wave adjustment circuit **127** provides a helical resonator operating at selected phase and anti-phase voltages that are not full-wave multiples. This wave adjustment circuit provides for a selected amount of capacitive coupling from the plasma source to the chamber bodies. Stress of the deposited oxide film in this embodiment can be made to be zero or slightly compressive. In some embodiments, the oxide films can be deposited with an rf plasma potential of several hundred volts between the plasma source and the substrate to decrease the tendency of the oxide film to absorb moisture. This can occur by adjusting the wave adjustment circuit to add in a small section of transmission line outside of the source and correspondingly shortening the applicator coil (by moving the lower point at which the applicator coil is short-circuited and thereby decreasing the inductance of the applicator coil and electrical length of the helical resonator **126** (e.g., spiral transmission line, etc.)). Of course, the selected amount of capacitive coupling will depend upon the application.

FIG. **4** is a simplified diagram of a resist stripper according to the present invention. The present stripping apparatus includes similar elements as the previous described CVD apparatus. The present stripping apparatus includes a chamber **112**, a feed source **114**, an exhaust **116**, a pedestal **118**, which can be an agile temperature controlled chuck, an rf power source **122**, a ground **124**, a helical resonator **126**, and other elements. The helical resonator **126** includes a coil **132**, an outer shield **133**, a wave adjustment circuit **400**, and other elements. The chamber can be any suitable chamber capable of housing a product **119** such as a photoresist coated wafer for stripping, and for providing a plasma discharge therein. The plasma discharge is derived from a plasma source, which is preferably a helical resonator discharge or other inductive discharge using a wave adjustment circuit or other techniques to selectively adjust phase/anti-phase potentials. Of course, in some applications other configurations such as parallel plate capacitive discharges and microwave powered discharges such as electron cyclotron resonance machines, resonant cavities and slow waver applicator structures may also be suitable. The present stripping apparatus provides for stripping or ashing photoresist, e.g., implant hardened, etc. Further examples of such a stripping apparatus are described in the experiments section below.

In this embodiment, the wave adjustment circuits rely upon open circuits (i.e., zero susceptance). Power transfer can be effected with a balanced feed such as an inductively-coupled push-pull arrangement with means such as coupled inductors. Techniques for constructing these coupled inductors are described in, for example, "The ARRL Antenna Book," R. D. Straw, Editor, The American Radio Relay League, Newington, Conn. (1994) and "The Radio Handbook," W. I. Orr, Editor, Engineering Ltd, Indiana (1962), which are both hereby incorporated by reference for all purposes. In one embodiment, a ferrite or powdered iron core "balun" (balanced-unbalanced) toroidal transformer (i.e., broadband transmission transformer, broadband transformer, etc.) **401** can be used to provide balanced matching from a conventional unbalanced coaxial transmission line. Techniques for constructing toroidal baluns are described in, for example, "Transmission Line Transformers," J. Sevick, 2nd Edition, American Radio Relay League, Newington, Conn. (1990). The toroidal transformer is coupled between the rf power source **122** and the coil **132**. The midpoint **406** between the phase **405** and anti-phase voltage on the coil is effectively rf grounded, hence it may be convenient to directly ground this midpoint of the inductive application in some embodiments for stability. This permits alternate operation in which power may be coupled into the inductive applicator (e.g., coil, etc.) with a conventional unbalanced feed line tapped on one side of the center. Push-pull balanced coupling ignites the plasma more easily than conventional unbalanced coil tap matching and generally is easier to adjust in selected applications.

Referring to the helical resonator embodiments operating at substantially equal phase and anti-phase potentials, FIG. **5A** is a simplified diagram **200** of an equivalent circuit diagram of some of them. The diagram is merely an illustration and should not limit the scope of the claims herein. The equivalent circuit diagram includes a plurality of rf power supplies (V_1, V_2, V_3. . . V_n) **203**, representing for example, a single rf power source. These power supplies are connected in parallel to each other. One end of the power supply is operably coupled to a ground connection **201**. The other end of the power supplies can be represented as being connected to a respective capacitor (C_1, C_2, C_3. . . C_n). Each of these capacitors are connected in parallel to each other. During this mode of operation, no significant voltage difference exists between any of the common side of the capacitors, as they are all connected to each other in parallel.

FIG. **5B** is a simplified diagram of instantaneous AC voltage and current along a helical resonator coil of FIG. **5A** where each end of the inductive applicator is short circuited. The diagram is merely an illustration and should not limit the scope of the claims herein. This diagram includes the discharge tube **213** and an inductive plasma discharge (or plasma source) **501** therein. As shown, the plasma discharge includes an intensified "donut-shaped" glow region **501** that occupies a limited range (R) of the discharge tube **213**. The plasma discharge has an average voltage potential (V_{ave}) of magnitude that is substantially within a few zero volts (i.e., the ground potential). As can be seen, the plasma discharge **501** has capacitively coupling elements to V_H and V_G. But the average voltage potential of this plasma discharge is substantially zero. This operation provides for balanced capacitance of phase **503** and anti-phase **505** voltages along the coil adjacent to the plasma, thereby substantially preventing capacitively coupling from the plasma source to chamber bodies. As also shown, a current maxima **507** exists at V_{ave}, which corresponds to an inflection point between the phase **503** and the anti-phase **505**.

In an alternative operating mode, rings of plasma caused by inductively coupled plasma current are visible near top and bottom extremes of the inductive applicator, as illustrated by FIG. 5C. This operating mode is generally for a full-wave **517** inductive coupling coil operated at a very high power, e.g., maximum power input to the inductive applicator is often limited by thermal considerations and breakdown. The rings **513**, **515** of current in the plasma discharge are simulated by maximum coil current areas corresponding to voltage minima at the top and bottom shorted ends of the coil. Under these high power conditions, subordinate current rings are detectable and some excitation is often visible in the intermediate regions. This excitation is partially caused by capacitively driven currents within the discharge coupled to the voltage maximum and voltage minimum positions along the inductive applicator.

Alternatively, subordinate inductive plasma current rings at the top and bottom ends **513** of the resonator do not appear with limited input power. The coil current and inductive flux fall beyond the ends of the inductive applicator so that a single inductive ring **515** in the center portion is more stable, provided that the conductivity of the plasma is large enough to support a single current ring at a specified input power.

In alternative applications using high power operation, no secondary plasma current rings may be desirable. These applications often have substantially minimum internal capacitive coupling. In these applications, the inductive applicator (e.g., coil) abutting the vacuum vessel may be shortened from a full wave to an appropriate length such that only the central current maxima exists on the coil abutting the plasma source and the potential difference between maximum and minimum voltage on the applicator is substantially reduced. The present application is achieved by stabilizing the desired waveform along the applicator by appropriate impedance wave adjustment circuits.

An effective conventional method employed to avoid plasma potential shift in conventional commercially available inductive sources is to shield the plasma from the electrical fields on the inductive coupling element (commonly a multi-turn coil) by inserting a grounded conductive member between the inductive driving element and the plasma discharge tube. Shielding is, however, cumbersome and inconvenient and has serious disadvantages in practice. Shields couple to inductive applicator elements and can cause wide excursions in the natural resonance frequency, which are not predicted by conventional analytical design formulae. This often results in laborious trail and error and iterative mechanical designs to achieve a desired resonance.

Another disadvantage of shielding is that shields often make it difficult to achieve initial ignition of the plasma since shields generally exclude capacitive electric fields in the plasma discharge tube. Those with skill in the art will recognize that in practice, substantial ionization (e.g. charge carriers) must be present in the tube volume before in inductive plasma current can be sustained. Thus, it is often said that a capacitive plasma must be ignited first in order to sustain an inductive plasma. This is not completely true since other external means of generating ionization (e.g. an intense photoionizing source, electron beams, etc.) can be used to generate the ionization which is prerequisite to sustaining an inductive plasma. However, a capacitive discharge is often a convenient and cost-effective means to ignite some plasma which is a prerequisite to starting and sustaining an inductive discharge.

In general, wave adjustment circuits are employed to substantially diminish capacitive coupling between a plasma source and an inductive applicator. If most capacitive coupling is removed, it may be difficult to ignite a plasma. However, wave adjustment circuits also provide a means to overcome the difficulty with igniting a plasma in the absence of capacitive coupling under steady state operating conditions. This means is provided by electrically, mechanically, or electromechanically tuning the wave adjustment circuits prior to the time of desired plasma ignition in a manner which generates an additional imbalance and capacitive coupling to the discharge volume. Of course, the characteristics of the plasma as a load to the applicator will dynamically change during ignition. The wave adjustment circuit can also be continuously tuned under feedback control during ignition in order to provide a desired voltage coupling and diminish undesired transients during plasma breakdown.

Insertion of the shield close to high voltage RF point in a network (such as the voltage maximum points in a helical resonator or the high potential driven side of a TCP coil) also causes large displacement currents to flow through the capacitance between the shield and coil. This high potential difference is also a potential cause of damaging rf breakdown across the air gap, hence the gap may require protection by inconvenient solid or liquid dielectric insulation. The displacement current flow causes power loss and requires that higher power RF generating equipment be used to compensate for the power loss. Coupling loss in the plasma source structure is also undesirable from the standpoint of thermal control. These limitations are overcome by the present invention using the wave adjustment circuits, an inductive applicator of selected phase length, and other elements.

FIG. **6** is a simplified block diagram of a substrate holder **600** according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. The substrate holder **600** or suceptor includes, among others, a lower or backside surface **608**, which includes a plurality of concentric zones **608A**, **608B**, **608C**, and **608D**. In a specific embodiment, each of the zones can be in fluidic communication with each other and can be partly separated from each other. Each of the zones can have an inlet **613** and an outlet **611**. Fluid enters the inlet, traverses in an annular manner in the zone, and leaves the outlet. A baffle can separate the inlet from the outlet. Each of the zones can have an inlet and outlet, which are independent from the other inlets and outlets. Alternatively, the inlet and outlets can be in fluid communication with each other.

The side-view diagram shown as "SIDE-VIEW A" illustrates a plurality of zones **603**, which correspond to each of the concentric zones **608A**, **608B**, **608C**, and **608D**. Each zone is separated, in part, from each other by a baffle **605**. Each baffle extends from a lower region of the substrate holder toward an upper portion of the substrate holder, but does not touch the upper surface **601** of the substrate holder. In preferred embodiments, the baffles do not touch the upper surface. Accordingly, the temperature of the baffles, which may be different from the fluid, does not create an uneven temperature distribution along the upper surface **601**. Additionally, the upper region **604**, which is an open region within the substrate holder, provides fluid communication between each of the zones. Fluid communication in connection with the upper surface also provides an even distribution of temperature along the upper surface.

The fluid can be used to heat or cool the upper surface of the substrate holder. In a specific embodiment, the fluid generally should have a relatively high thermal conductivity and large heat capacity. The fluid should also be substantially non-corrosive, easy to transport, and can withstand a relatively large temperature range and still maintain its fluid characteristics. Additionally, the fluid should be able to be pumped and substantially non-reactive with the substrate holder material itself. The fluid can be any commercial heat transfer fluid selected for the desirable temperature range. As noted, the substrate holder and upper surface cools down or is heated up by way of the fluid. The fluid can traverse through the zones and can absorb thermal energy or release thermal energy by an external heat transfer device such as the one described below, but can be others.

In a specific embodiment, the substrate holder also includes a plurality of heating elements **607**. The heating elements can selectively heat one or more zones in a desirable manner. As shown in the "SIDE-VIEW B" diagram, each of the heating elements can be directed to a single zone **603**, which has an adjacent baffle **605**. Alternatively, the heating elements can be directed to multiple zones or other specific regions of the substrate and in particular the backside of the substrate according to some embodiments. The heating elements can be any suitable device for supplying heat energy to the fluid. The heat can be supplied by single or in combination using radiation, conduction, and convention. As merely an example, the heating element can be a resistive heating unit, an infrared heating unit, and others. Of course, the type of heating unit used depends highly upon the application. Alternatively, the heating unit can also be replaced by cooling units.

The present invention provides a substantially uniform temperature distribution along the upper surface **601** of the substrate holder. In a specific embodiment, the uniformity of the temperature is within one Degree Celsius along the entire surface which comes in contact with the object such as the wafer. Preferably, the wafer temperature also tracks the temperature uniformity of the upper surface. In other embodiments, the uniformity of the of the temperature is within one-tenth of a Degree Celsius along the entire surface which comes in contact with the object such as the wafer. Preferably, the wafer also has a uniform temperature distribution along the wafer.

The substrate has an upper surface, which holds an object in a secure manner during processing. The upper surface is generally made of a suitable material that has desirable heat transfer characteristics. In a specific embodiment, the upper surface is made using a low thermal mass, high conductivity material. As merely an example, the upper surface can be a diamond-like or diamond film overlying a copper or copper-like substrate. Of course, the type of surface used depends upon the application.

In a specific embodiment, the substrate holder also has temperature sensing units such as the one shown in "SIDE-VIEW C." The temperature sensing unit can be any suitable unit that is capable of being adapted to the upper surface of the substrate holder. Alternatively, the temperature sensing unit can measure the temperature of the fluid or lower surface of the substrate holder. As merely an example, the temperature sensing unit is a "fluro-optic" sensor unit made by a company called Luxtron in Santa Clara, California. Alternatively, the sensing unit can be an edge band IR sensor or the like. The sensing unit is capable of measuring a variety of spatial locations along the upper or lower surface of the substrate holder. The substrate holder can be implemented using a variety of systems for heating and/or cooling applications such as the one described below, but can be others.

FIG. **7** is a simplified diagram of a temperature control system **700** according to an embodiment of the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. Among other elements, the system **700** can be used to heat and/or cool the wafer chuck or substrate holder **701**. As shown, system **700** includes substrate holder **701**, which is coupled to a heating unit **705** by way of line **707**. Heating unit **705** is coupled to fluid reservoir **713** and pump **709** by way of line **711**.

Fluid from the fluid reservoir is pumped from the reservoir through the heating unit, which selectively sets the temperature of the fluid. The fluid leaves the heating unit at the selected temperature and traverses through the substrate holder, which can be similar to the one shown above, but can also be others. The fluid temperature selectively transfers energy in the form of heat to the wafer holder to a desirable temperature. Fluid leaves the substrate holder and traverses through node **721** and branch **719**. Fluid traverse through branch **719** and node **717**. Fluid leaves node **717** and returns back to the fluid reservoir via line **715**.

In an alternative embodiment, the fluid can also be cooled using a heat exchanger **723**. The fluid leaves the substrate holder and enters node **721**. Fluid then enters the heat exchanger and traverses through loop **725**. Thermal energy in the form of heat transfers to fluid in loop **723**, which is cooler in temperature and draws heat away from the heat in the fluid in loop **725**. In a specific embodiment, cooling fluid **727** enters and leaves the heat exchanger.

In a specific embodiment, system **700** operates in a manner to program a process temperature of the substrate holder. In this process, the reservoir with a suitable heat transfer fluid is maintained at a temperature below the desired process temperature. The fluid is circulated through the substrate holder or wafer chuck by the pump. The fluid line downstream of the pump is equipped with the electrical heater which is capable of heating the fluid to a desired temperature. The desired fluid temperature is determined by comparing the desired wafer or wafer chuck set point temperature to a measured wafer or wafer chuck temperature (this measurement can performed with a thermocouple, thermistor, pyrometer, fluor optic sensor or other sensing means). If the measured temperature of the wafer of chuck is below the desired temperature, a suitable control algorithm such as a proportional controller or a proportional-integral-derivative (i.e., PID) controller algorithm increases the temperature by supplying more power to the heater.

The temperature of fluid emerging from the chuck is also measured (normally there will be a small temperature difference since there is heat exchange between the fluid and chuck). If this temperature is above the desired fluid temperature the fluid stream is diverted to a heat exchanger via control valves **1** and **2**, which are respectively at nodes **721** and **717**. If this temperature is less than or equal to the desired fluid temperature the fluid stream can be made to bypass the heat exchanger, or optionally can be heated in a heat exchange system. Since the temperature of commonly used heat exchangers cannot be changed rapidly, the heat exchanger is usually maintained at a single temperature sufficiently below the lowest desired fluid temperature to achieve the lowest desired temperature to be attained. The heat exchanger, fluid flow rate, coolant-side fluid temperature, heater power, chuck, etc. should be designed using conventional means to permit the heater to bring the fluid to a setpoint temperature and bring the temperature of the chuck and wafer to predetermined temperatures within specified time intervals and within specified uniformity limits.

In a preferred embodiment, the present invention uses a microprocessor based system to oversee the operations of the system described above. The microprocessor based system can have input and output ports, which are coupled to each of the elements, e.g., pump, heater, fluid reservoir, substrate holder. The microprocessor based unit selectively turns ON and/or OFF one or more of the elements to control the temperature of the substrate holder to provide a uniform distribution of temperature across the surface of the substrate holder.

In an alternative embodiment, FIG. **8** is a simplified diagram of a multiple fluid reservoir system **800** according to an embodiment of the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. As shown, system **800** depicts an automatic system for agile temperature control of the substrate holder or wafer chuck **809** using two reservoirs **801**, **803**, but is not limited to two can be more than two, if desirable. The wafer chuck can be rapidly brought to temperature T1 by directing flow through proportional control valve V1 to the wafer chuck. Similarly, the chuck can be brought substantially to a temperature T2 by directing only a flow from the reservoir T2 to the wafer chuck. Temperature sensor TC1 measures the temperature of the heat transfer fluid entering the wafer chuck and sensor TC2 monitors temperature of fluid exiting the wafer chuck. Valves V1 and V2 are controlled by a control system which adjusts the total volumetric flow rate of fluid flowing into the wafer chuck as well as the ratio of fluid flowing through V1 and V2. The ratio is set so that the temperature monitored by TC1 is at a predetermined value selected to achieve a desired wafer chuck temperature. The flow rate of a fluid flowing from both reservoir 1 and 2 is metered by conventional means and set to fix the temperature difference measured between TC2 and TC2 at a pre-specified difference. This difference is selected to meet a temperature uniformity specification. The temperature difference allowed is chosen so that etching nonuniformities caused by temperature gradients are below a predetermined permissible level which includes an allowance for normal variability in measurements, sensor, the control system etc. The flows can be digitally controlled proportional metering values as illustrated or alternately they can be controlled by computer-controlled variable speed pumps, as will be well known to those skilled in the art. In addition to the sensors TC1 and TC2, it is convenient to monitor the top surface chuck temperature and the wafer temperature so that TC1 can be selected to maintain the wafer temperature within a specific amount of a wafer etching or CVD temperature (when the chuck and etching temperature are greater than the temperature of the chamber walls, the wafer temperature will generally be slightly less than the chuck temperature owing to heat transfer resistance between the chuck and wafer and thermal coupling between the wafer and surrounding chamber walls).

FIG. **9** is a simplified diagram of a simplified diagram of a semiconductor substrate **900** according to an embodiment of the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. As shown, the substrate is a stack of layers that is to be patterned. The stack includes a dielectric layer such as a thin 100 Å gate oxide layer **903** on a substrate (e.g., silicon wafer) **901** on which 2000 Å of tungsten silicide **907** or other material is deposited on the conductive layer, which can be polysilicon **905**. A masking layer such as 2 microns of photoresist **909** is spin coated over the tungsten silicide and patterned by conventional photolithography techniques. The patterned layer includes an opening **911**, which exposes the underlying tungsten silicide layer. It is desired to anisotropically etch the stack down to the silicon dioxide layer in order to define a patterned structure which can be an EEPROM device or other integrated circuit element. Although this can be accomplished by etching in a conventional parallel plate reactor using a chlorine bearing plasma, it can be difficult to avoid removing excessive polysilicon during the overetching period, which is required to assure that the polysilicon is completely removed from within the unmasked regions. Furthermore, the resist mask must generally be removed after etching this stack. Since the temperature for the stack etch (i.e., often 50° C. to 100° C. is too low to achieve an adequate resist stripping rate (generally a rate of a few microns per minute is desirable), stripping is often done in a separate chamber of in separate resist stripping equipment.

The temperature is programmed by use of this invention to achieve better control of the etching process as well as to permit stripping the resist in the same chamber and controlled by the same process program which is used for stack etching.

A process according to the present invention can be briefly outlined as follows:

(1) Provide patterned stack in chamber;

(2) Perform native oxide breakthrough using sulfur hexafluoride bearing plasma;

(3) Ignite chlorine bearing plasma;

(4) Etch tungsten silicide layer at a first substrate temperature;

(5) Detect polysilicon layer;

(6) Perform over etch to clear tungsten;

(7) Expose polysilicon;

(8) Etch polysilicon;

(9) Clear polysilicon to oxide;

(10) Stop chlorine bearing plasma;

(11) Feed oxygen;

(12) Ignite oxygen;

(13) Strip photoresist at a second substrate temperature; and

(14) Extinguish oxygen plasma

The above sequence of steps are merely examples to show an etching process that uses more than one temperature. Here, the etching process for tungsten silicide and polysilicon occurs at a first temperature and an ashing process occurs at a second temperature, where the first temperature is lower than the second temperature. By way of the present invention, multiple temperatures can be used in a single chamber to perform multiple processes. Details of the present invention are shown by way of FIG. **10**, for example.

FIG. **10** is a simplified flow diagram of a heating process according to the present invention. This diagram is merely an illustration and should not limit the scope of the claims herein. One of ordinary skill in the art would recognize other variations, modifications, and alternatives. As shown, an isotropic breakthrough step during which an SF_6 plasma is sued to remove very thin native oxide can be conducted at a low temperature such as room temperature. Ordinarily the breakthrough step is conducted at a high temperature. High temperatures have a serious disadvantage in that the etching rate of both oxide and tungsten silicide by SF_6 may be isotropic. Therefore the duration of the breakthrough step, especially if the native oxide layer is thin, must often be limited to a few seconds to avoid undesired undercut. At low temperature the etching rate is slower and therefore the extent to which materials under the native oxide are etched is easier to control.

At the end of the breakthrough step at time BB, the control program increases within several seconds to a higher steady state value at time C. The tungsten silicide is etched at this temperature until this layer is breached at random locations on the wafer. This endpoint is conveniently observed by a change in the slope of intensity of an optical light emission from the plasma such as optical emission at 530 nm (point C in FIG. 10). The complete removal of the unmasked tungsten silicide areas is similarly signaled by a change in light emission such as that shown at point D (at time D all "patches" of the tungsten silicide are "cleared" from unmasked polysilicon areas; the signal begins to rapidly decease at time D because at constant temperature, polysilicon consumes chlorine more rapidly than tungsten silicide (e.g. a faster etch rate) and optical emission at this wavelength originates from a chlorine species.

Since it is not practical to change chuck temperature, at this point the etch rate would increase rapidly. As a consequence it can often be difficult to detect and terminate the polysilicon etching step when the thin oxide layer is reached. Another problem associated with the use of a single temperature for both silicide and polysilicon layers is that chlorine etching processes often undercut (etch along the mask direction, sideways- e.g. the etch is partly isotropic) silicon at the elevated temperatures suitable for a low residue tungsten silicide etch. Therefore it is highly desirable and advantageous to reduce the etching temperature during the polysilicon etch. The wafer temperature is gradually reduced at point DD in order to achieve a slower and more anisotropic polysilicon etching step. The temperature necessary to etch tungsten silicide and during this temperature programmed sequence are compared in the FIG. The emission signal intensity increases when the temperature is lowered because the rate of consumption of chlorine species by the etching process is slowed (the rate decreases with decreasing temperature). Stopping the etch process at endpoint where all of the silicon has "cleared," denoted by E is also easier and less critical because attack on the oxide has also slowed.

At point H the stack etch is complete and the plasma is extinguished. The flow of feed gas comprising Cl_2 for etching is stopped and a flow of O_2 is started. A plasma discharge in oxygen at elevated temperatures will strip resist rapidly. At time I the wafer temperature is increased rapidly to a selected value in the range 180–220° C. and a plasma is ignited to remove the resist. After a selected interval the plasma is extinguished again and the chuck temperature rapidly lowered. These sequences of steps merely provide an example of the present invention. Other examples can also occur and the description above should not be limiting in any manner.

While the invention has been described with reference to specific embodiments, various alternatives, modifications, and equivalents may be used. In fact, the invention also can be applied to almost any type of plasma discharge apparatus. This discharge apparatus can include an apparatus for plasma immersion ion implantation or growing diamonds, TCPs, and others. This discharge apparatus can be used for the manufacture of flat panel displays, disks, integrated circuits, diamonds, semiconductor materials, bearings, raw materials, and the like.

Therefore, the above description should not be taken as limiting the scope of the invention which is defined by the appended claims.

What is claimed is:

1. A method of etching a substrate in the manufacture of a device, said method comprising steps of:

placing a substrate having a film thereon on a substrate holder in a chamber, said substrate holder having a selected thermal mass; and

performing a first etching of a first portion of said film at a first temperature and performing a second etching of a second portion of said film at a second temperature, said first temperature being different from said second temperature;

wherein said selected thermal mass allows a change from said first temperature to said second temperature within a characteristic time period to process said film.

2. The method of claim 1 wherein said first temperature is changed to said second temperature by a heat transfer means coupled to said substrate holder.

3. The method of claim 1 wherein said change in temperature is an insitu process during said first etching step and said second etching step.

4. The method of claim 1 wherein said first etching and said second etching are conducted in a substantially constant plasma environment.

5. The method of claim 1 wherein said first temperature is higher than said second temperature.

6. The method of claim 1 wherein said first temperature is lower than said second temperature.

7. The method of claim 1 wherein said first etching comprises radiation.

8. The method of claim 1 wherein said second etching comprises radiation.

9. The method of claim 1 wherein said first etching is an ion bombardment aided process.

10. The method of claim 1 wherein said second etching is an ion bombardment aided process.

11. The method of claim 1 wherein said first portion of said film is etched before said second portion of said film.

12. The method of claim 1 wherein said second portion of said film is etched before said first portion of said film.

* * * * *

CLAIMS

1. A method of etching a substrate in the manufacture of a device, said method comprising steps of:

placing a substrate having a film thereon on a substrate holder in a chamber, said substrate holder having a selected thermal mass; and

performing a first etching of a first portion of said film at a first temperature and performing a second etching of a second portion of said film at a second temperature, said first temperature being different from said second temperature;

wherein said selected thermal mass allows a change from said first temperature to said second temperature within a characteristic time period to process said film.

2. The method of claim 1 wherein said first temperature is changed to said second temperature by a heat transfer means coupled to said substrate holder.

3. The method of claim 1 wherein said change in temperature is an in–situ process during said first etching step and said second etching step.

4. The method of claim 1 wherein said first etching and said second etching are conducted in a substantially constant plasma environment.

5. The method of claim 1 wherein said first temperature is higher than said second temperature.

6. The method of claim 1 wherein said first temperature is lower than said second temperature.

7. The method of claim 1 wherein said first etching comprises radiation.

8. The method of claim 1 wherein said second etching comprises radiation.

9. The method of claim 1 wherein said first etching is an ion bombardment aided process.

10. The method of claim 1 wherein said second etching is an ion bombardment aided process.

[redacted]

11. The method of claim 1 wherein said first portion of said film is etched before said second portion of said film.

12. The method of claim 1 wherein said second portion of said film is etched before said first portion of said film.

13. (New) A method of etching a substrate in the manufacture of a device, said method comprising:

placing a substrate having a film thereon on a substrate holder in a chamber and providing a uniform temperature distribution along the surface of the substrate;

performing a first etching of a first portion of said film at a first substrate temperature and performing a second etching of a second portion of said film at a second substrate temperature, said first temperature being changed to said second temperature and said first temperature being different from said second temperature, whereupon said change from said first temperature to said second temperature occurs within a characteristic time period to process said film.

14. (New) The method of claim 13 wherein said first temperature has been changed to said second temperature within a selected period of time by at least heat transfer with the substrate using at least an electrostatic chuck.

15. (New) The method of claim 13 wherein said first temperature has been changed to said second temperature by transferring heat energy using at least a pressure of gas behind said substrate.

16. (New) The method of claim 13 wherein said first temperature has been changed to said second temperature by transferring energy using at least radiation.

17. (New) The method of claim 13 wherein said change in temperature is provided using an in-situ process during said first etching step and said second etching.

18. (New) The method of claim 13 wherein said first etching and said second etching are conducted in a substantially constant plasma environment.

19. (New) The method of claim 13 wherein said first temperature is higher than said second temperature.

20. (New) The method of claim 13 wherein said first temperature is lower than said second temperature.

[redacted]

21. (New) The method of claim 13 wherein said first etching comprises radiation.

22. (New) The method of claim 13 wherein said second etching comprises radiation.

23. (New) The method of claim 13 wherein said first etching comprises an ion bombardment aided process.

24. (New) The method of claim 13 wherein said second etching comprises an ion bombardment aided process.

25. (New) The method of claim 13 wherein said first portion of said film is etched before said second portion of said film.

26. (New) The method of claim 13 wherein said second portion of said film is etched before said first portion of said film.

27. (New) A method of processing a substrate during the manufacture of a device, said method comprising steps of:

placing said substrate having a film thereon on a substrate holder within a chamber of a plasma discharge apparatus, said plasma discharge apparatus comprising a substrate temperature sensor, a substrate temperature control system including a microprocessor, and heat transfer means; said substrate holder having a substrate holder temperature control system,

performing a first treatment of a first portion of said film at a selected first temperature;

changing the selected first temperature to a selected second temperature, the second temperature being different from the first temperature, wherein said substrate temperature control system and said substrate holder temperature control system and said heat transfer means control the change from said first substrate temperature to said second substrate temperature within a characteristic time period to process said film; and

performing a second treatment of a second portion of said film at said selected second temperature.

28. (New) The method of claim 26 wherein said substrate temperature control system comprises said substrate holder temperature controlling means.

29. (New) The method of claim 27 wherein said processing method comprises etching.

30. (New) The method of claim 27 wherein said first temperature has been changed to said second temperature by transferring heat using at least a pressure of gas behind said substrate.

31. (New) The method of claim 27 wherein said first temperature has been changed to said second temperature by transferring energy using at least radiation.

32. (New) A method of etching a substrate in the manufacture of a device, said method comprising steps of:

placing a substrate having a film thereon on a substrate holder in a processing chamber, said chamber comprising a substrate holder, a substrate temperature controlling system to control the temperature of said substrate, and

performing a first etching of a first portion of said film at a selected first temperature;

performing a second etching of a second portion of said film at a selected second temperature, said selected second temperature being different from said selected first temperature;

wherein said selected temperature controlling system allows a change from said first temperature to said second temperature within a characteristic time period to process said film.

33. (New) The method of Claim 32 wherein the time in which said change of temperature occurs subtends less than 40 percent of the total etching process time.

34. (New) The method of Claim 32 wherein the time in which said change of temperature occurs subtends less than 15 percent of the total etching process time.

35. (New) A method for processing layers which are included in a stack of layers positioned on a substrate, said method comprising steps of:

etching at least a first silicon-containing layer in a chamber, said substrate being maintained at a selected first temperature; and

etching a second silicon-containing layer in said chamber, said substrate being maintained at a selected distinct second temperature.

characterized in that the change from said first temperature to said second temperature occurs within a predetermined time, the predetermined time being less than an overall process time associated with etching the first silicon containing layer and the second silicon containing layer.

[redacted]

36. (New) The method of Claim 35 wherein the change of temperature occurs within less than 40 percent of the overall process time.

37. (New) The method of Claim 35 wherein at least one silicon-containing layer is etched in a chlorine-containing ambient.

38. (New) The method of claim 35 wherein at least one layer is etched in a chlorine-containing ambient;

said first layer is a polysilicon layer and said second layer is a silicide layer and said stack includes an oxide layer;

said second temperature is higher than said first temperature;

characterized in that at least one of said etching steps has high selectivity to said oxide layer.

39. (New) The method of Claim 38 wherein said first layer is etched before said second layer.

40. (New) The method of Claim 38 wherein said second layer is etched before said first layer.

41. (New) A method for manufacturing a device comprising an integrated circuit, said method comprising the steps of:

putting a silicide layer included in a stack of layers positioned on a substrate into a chamber,

processing the substrate in said chamber while the substrate is substantially maintained at a selected first temperature; and

processing the substrate in said chamber at a second temperature in order to etch said silicide layer.

42. (New) The method of claim 41 where the first temperature is less than 90 degrees centigrade and the silicide layer is etched at a selected temperature above 100 degrees centigrade.

43. (New) The method of claim 41 in which the change from said first temperature to said second temperature occurs within less than an overall time associated with processing said first and second layers.

44. (New) The method of claim 41 wherein said first temperature has been changed to said second temperature within a selected period of time by at least heat transfer

[redacted]

to the substrate using at least an electrostatic chuck.

45. (New) The method of claim 41 wherein said first temperature has been changed to said second temperature by transferring heat using at least a pressure of gas behind said substrate.

46. (New) The method of claim 41 wherein said first temperature has been changed to said second temperature by transferring energy using at least radiation.

47. (New) Apparatus for processing substrates in the manufacture of a device, said apparatus comprising:

a chamber;

a substrate holder having a selected thermal mass, the substrate holder disposed in said chamber,

whereupon said selected thermal mass of said substrate holder allows for a change from a first temperature to a second temperature within a characteristic time period to process a film.

48. (New) Apparatus of claim 47 further comprising a heat transfer means coupled to the substrate holder, the heat transfer means being adapted to change said first temperature to said second temperature within the characteristic time period.

49. (New) Apparatus of claim 47 wherein said change in temperature is provided in-situ within said characteristic time.

50. (New) Apparatus of claim 47 wherein said chamber provides a substantially constant plasma environment.

51. (New) Apparatus of claim 47 wherein said first temperature is higher than said second temperature.

52. (New) Apparatus of claim 47 wherein said first temperature is lower than said second temperature.

53. (New) Apparatus of claim 47 wherein said chamber provides for radiation.

54. (New) Apparatus of claim 47 wherein said chamber provides an ion bombardment aided process.

55. (<u>New</u>) The method of claim 47 wherein said substrate holder comprises an electrostatic chuck.

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US006231776B1

(12) **United States Patent**
Flamm

(10) **Patent No.: US 6,231,776 B1**
(45) **Date of Patent: May 15, 2001**

(54) **MULTI-TEMPERATURE PROCESSING**

(75) Inventor: **Daniel L. Flamm**, 476 Green View Dr., Walnut Creek, CA (US) 94596

(73) Assignee: **Daniel L. Flamm**, Walnut Creek, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/151,163**

(22) Filed: **Sep. 10, 1998**

Related U.S. Application Data

(63) Continuation-in-part of application No. 08/567,224, filed on Dec. 4, 1995, now abandoned.
(60) Provisional application No. 60/058,650, filed on Sep. 11, 1997.

(51) **Int. Cl.**[7] **H05H 1/00**
(52) **U.S. Cl.** **216/68**; 216/67; 216/74; 156/192.25; 156/345; 315/111.21; 437/225; 204/192.32
(58) **Field of Search** 216/68, 74, 67, 216/345; 156/192.25; 315/111.21; 437/225; 204/192.32; 438/710, 714

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,770,099 * 6/1998 Rice et al. 216/68
5,965,034 * 10/1999 Vinogradov et al. 216/68

* cited by examiner

Primary Examiner—Laurie Scheiner

(57) **ABSTRACT**

The present invention provides a technique, including a method and apparatus, for etching a substrate in the manufacture of a device. The apparatus includes a chamber and a substrate holder disposed in the chamber. The substrate holder has a selected thermal mass to facilitate changing the temperature of the substrate to be etched during etching processes. That is, the selected thermal mass of the substrate holder allows for a change from a first temperature to a second temperature within a characteristic time period to process a film. The present technique can, for example, provide different processing temperatures during an etching process or the like.

12 Claims, 15 Drawing Sheets

[redacted]

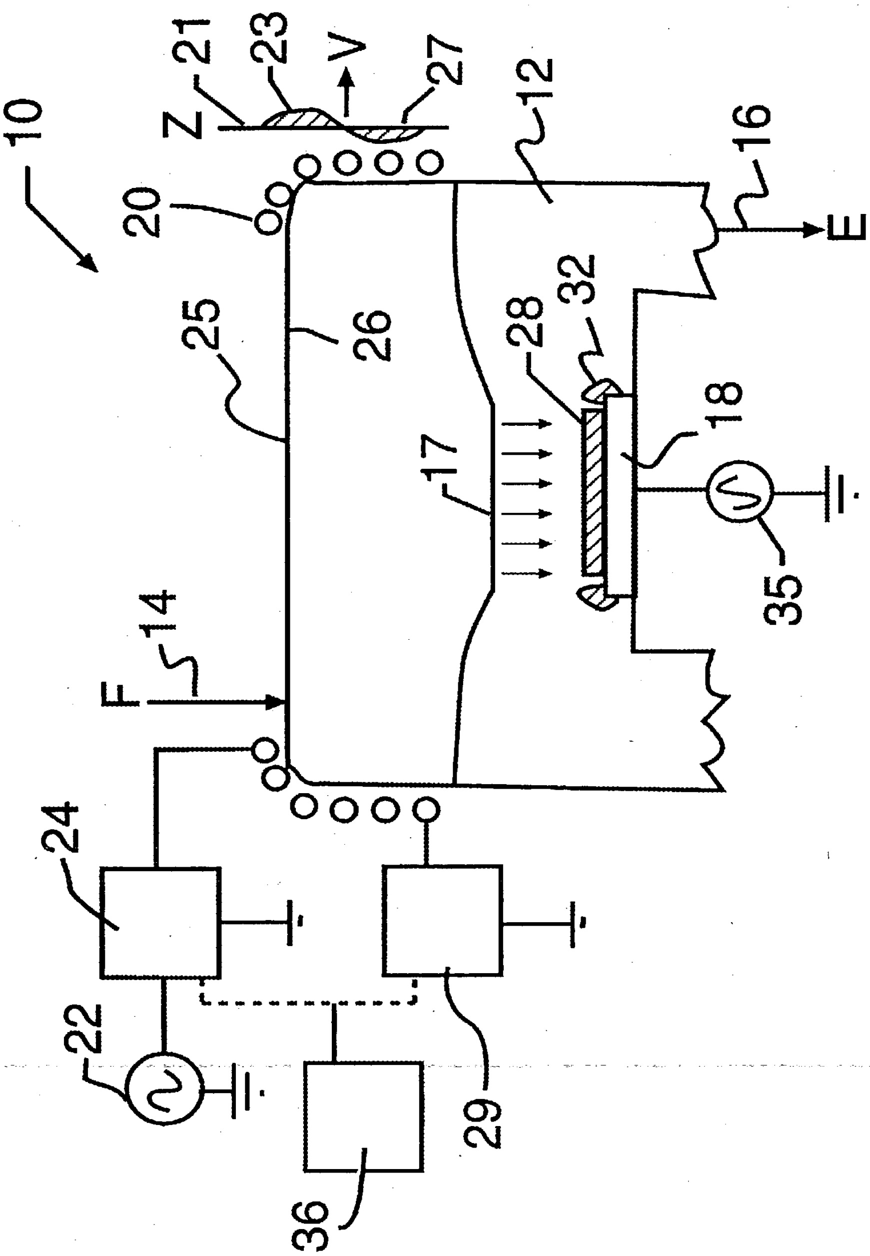


FIG. 1

[redacted]

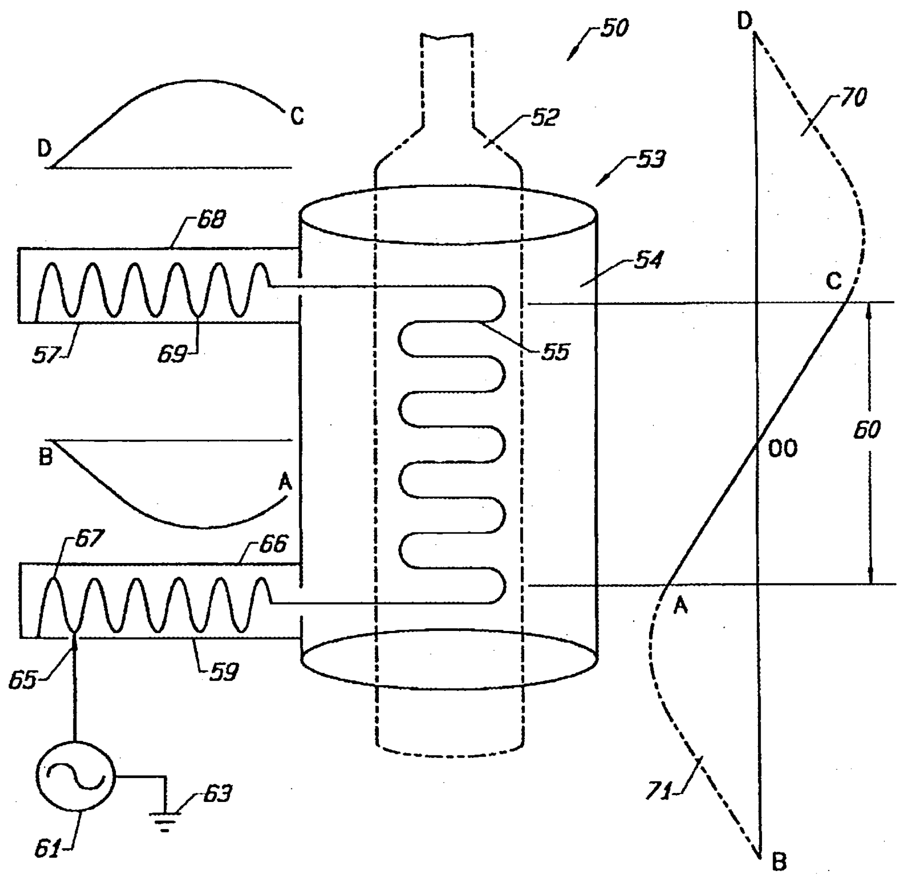


FIG. 2A

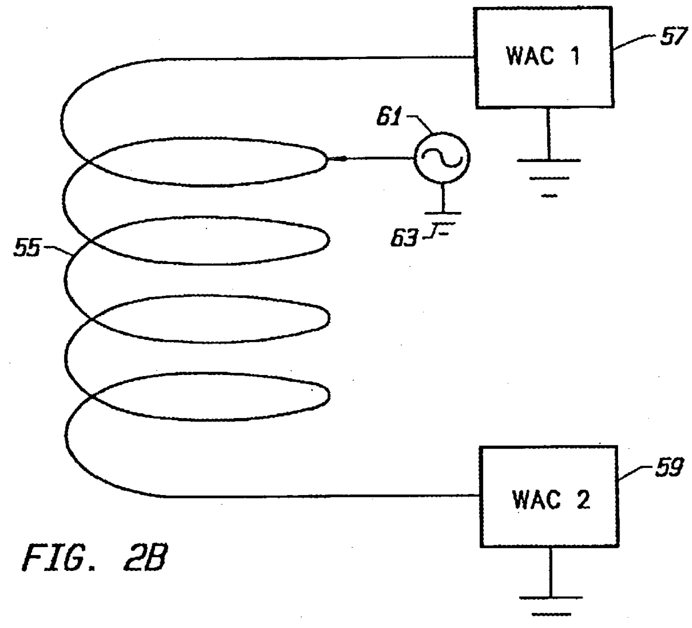


FIG. 2B

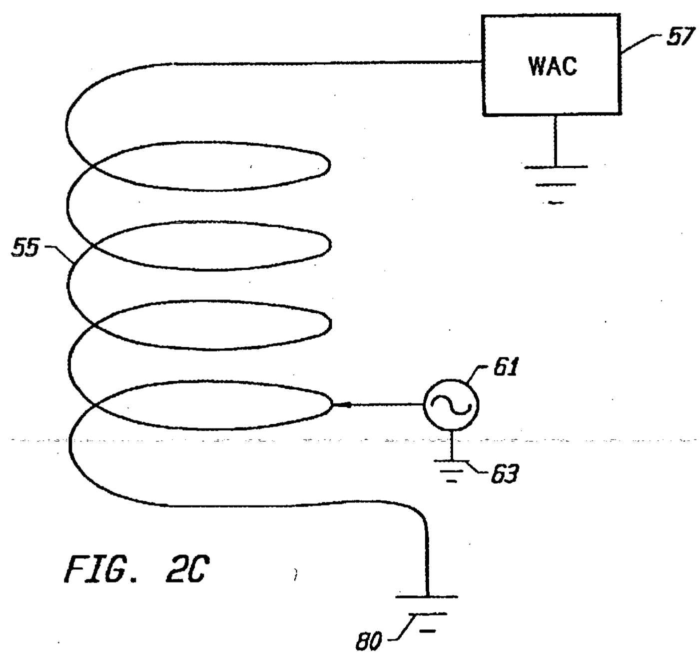
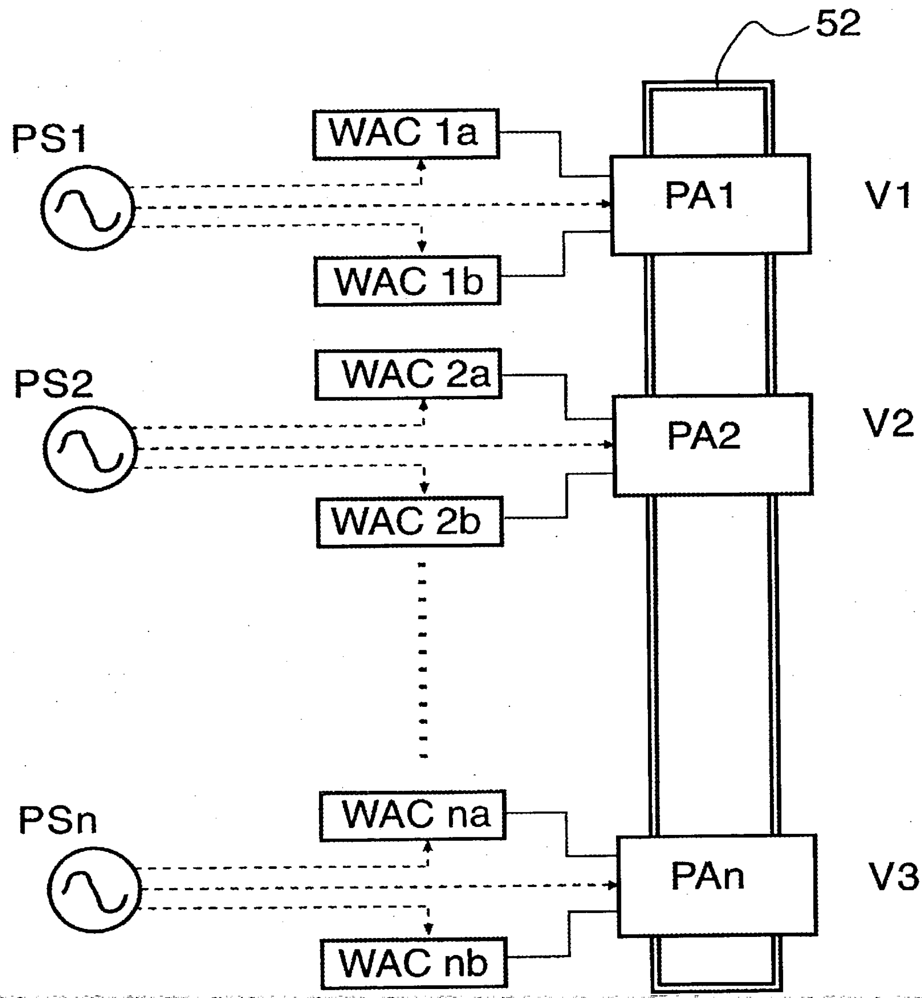


FIG. 2C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PS1
WAC 1a
PA1
V1
WAC 1b
PS2
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PA2
V2
WAC 2b
PSn
WAC na
PAn
V3
WAC nb

Fig. 2D

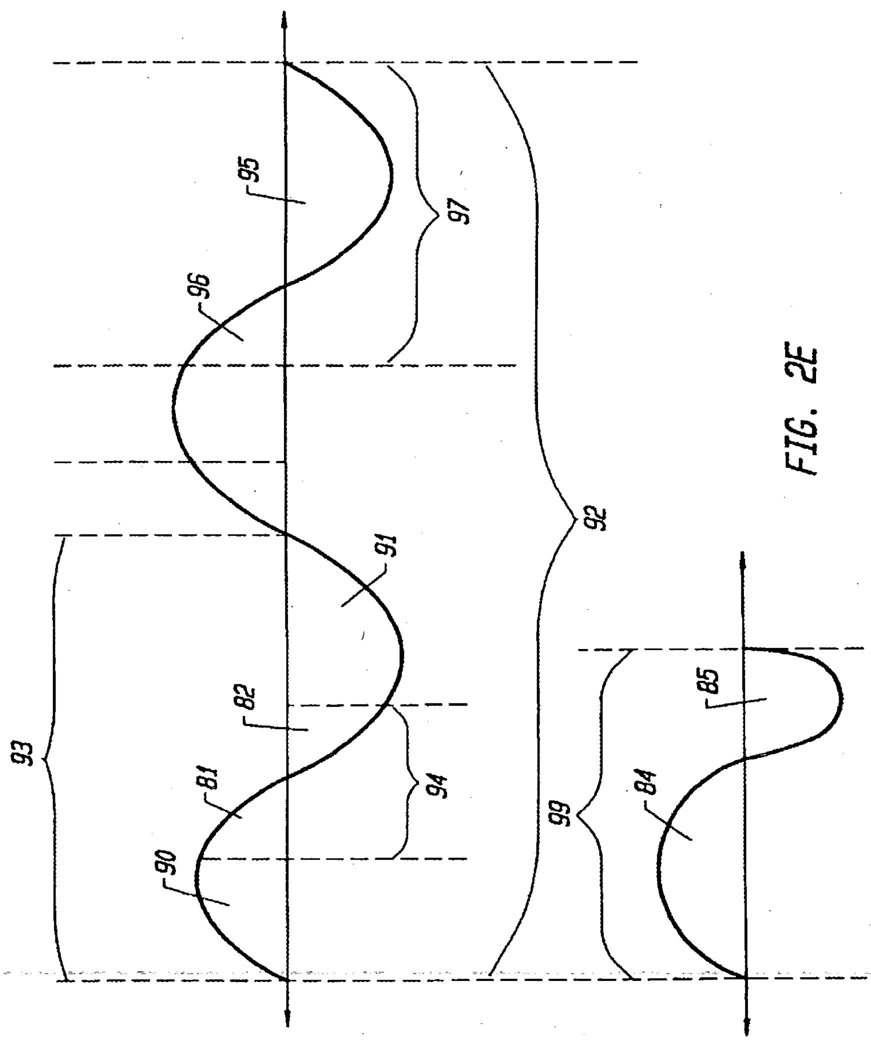
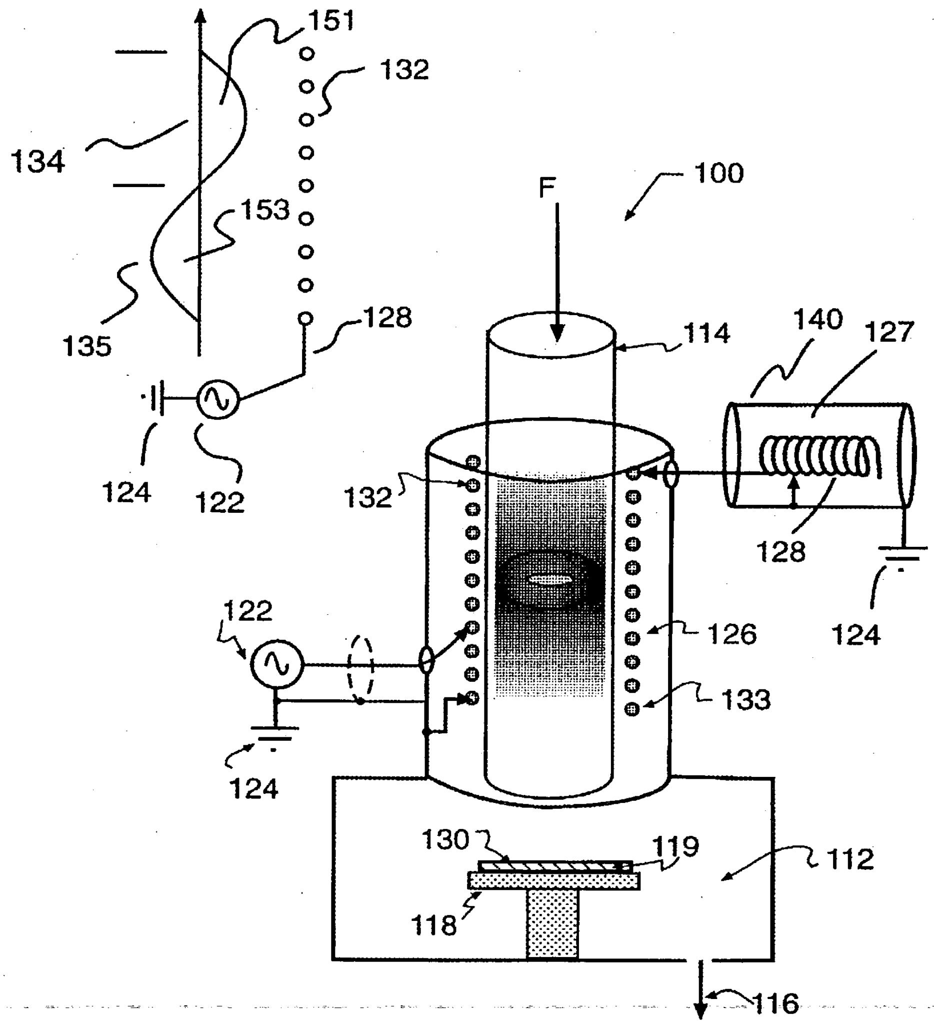


FIG. 2E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132
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122
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133
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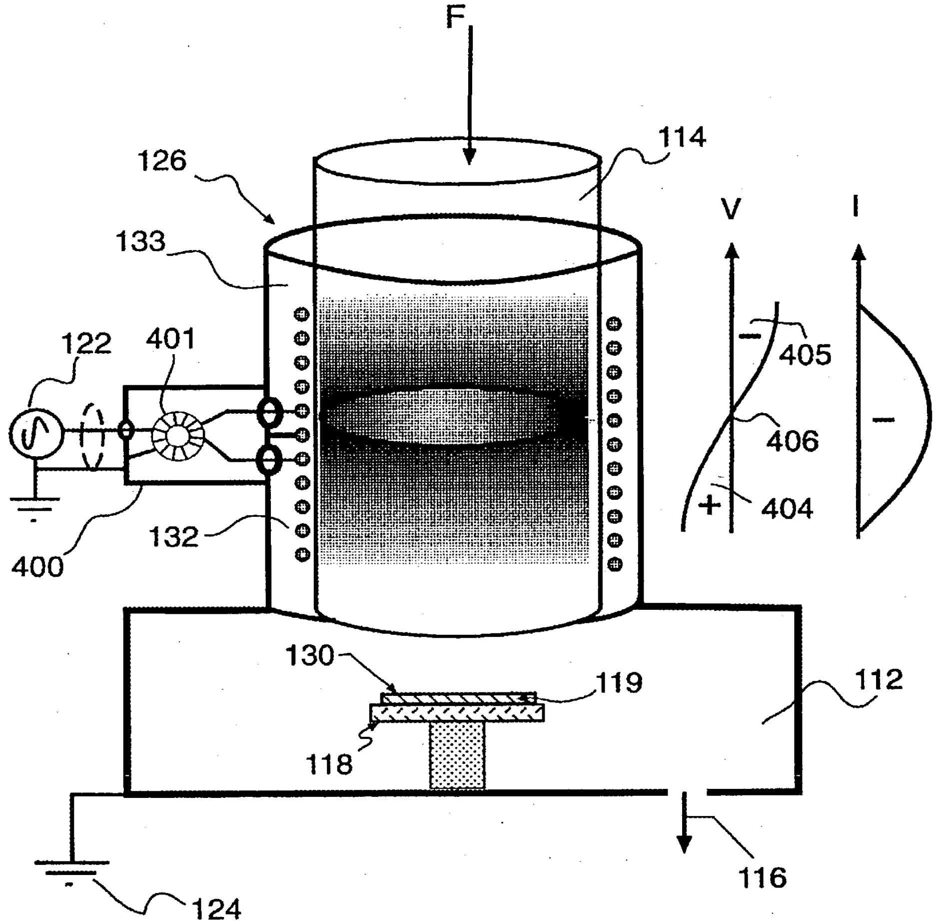
130
119
112
118
116

Fig. 3


F
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V
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122
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404
400
132
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119
112
118
116
124

Fig. 4

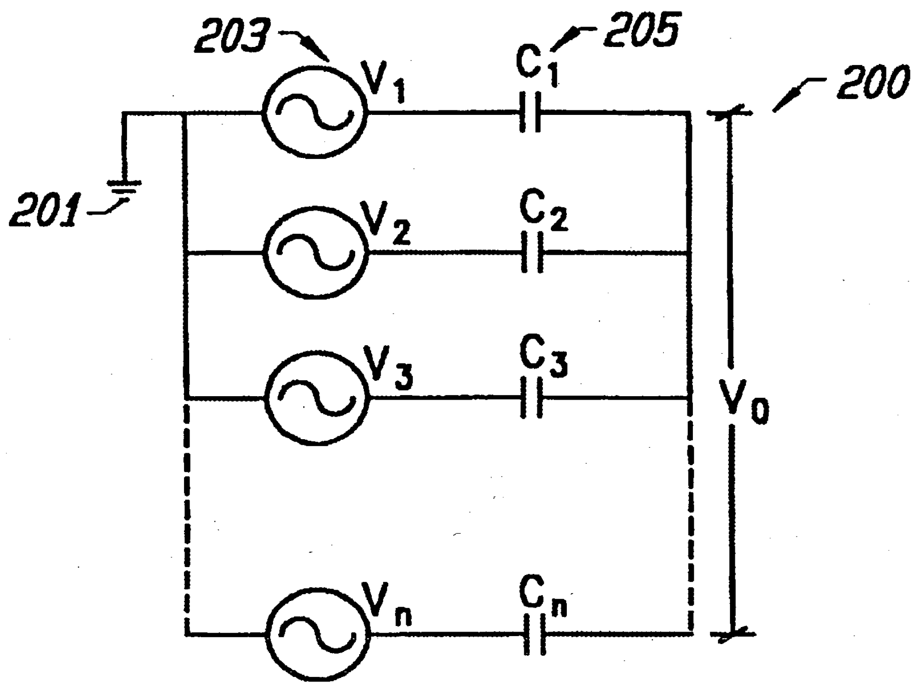


FIG. 5A

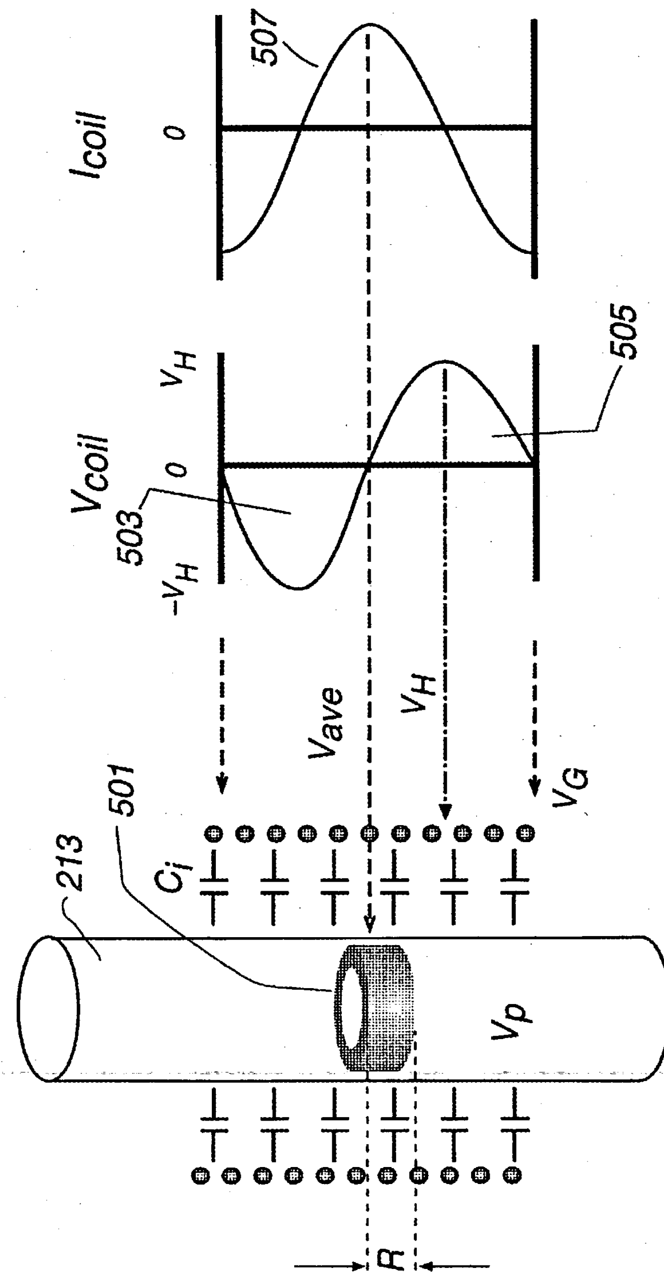


Fig. 5B

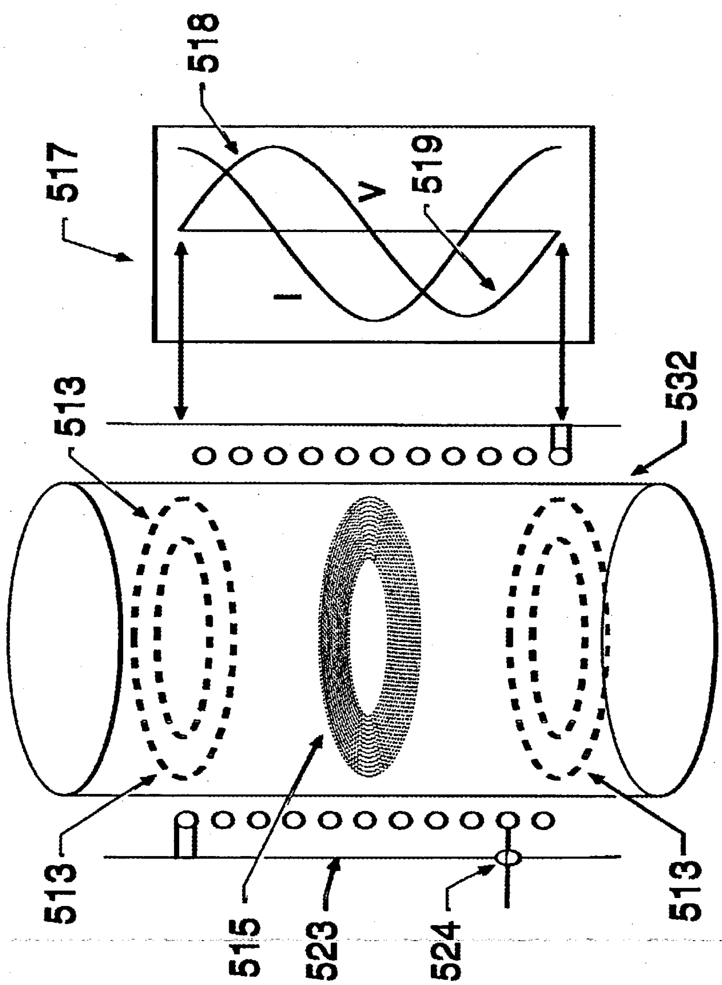


Fig. 5C

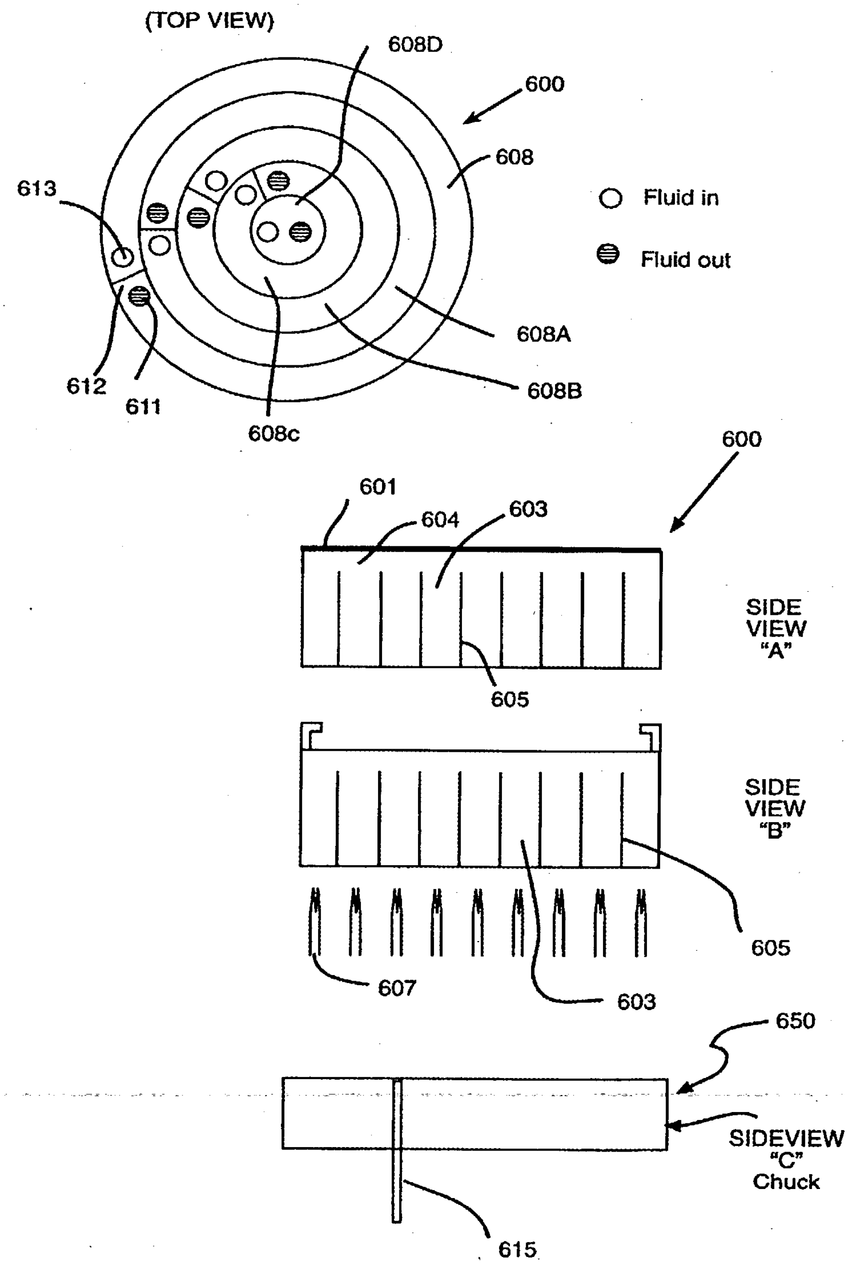
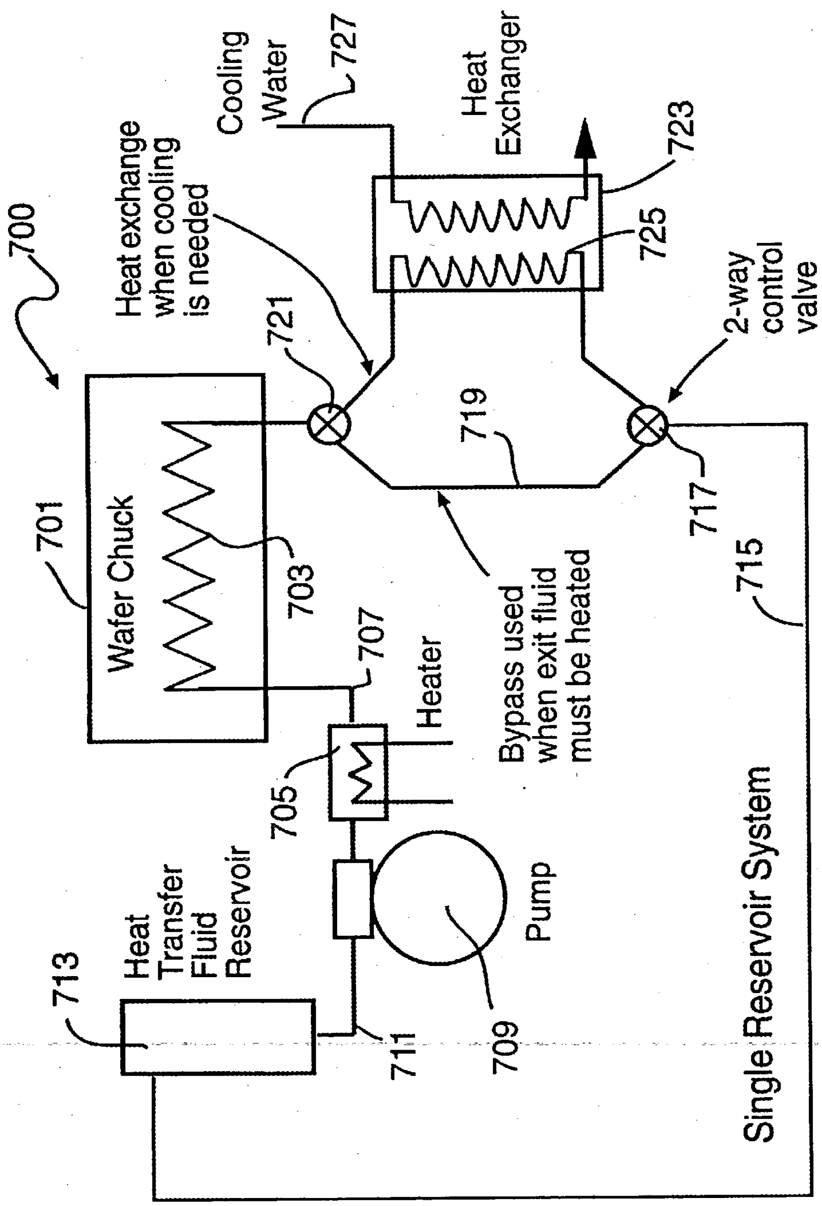

(TOP VIEW)
608D
600
608
613
Fluid in
Fluid out
608A
608B
612
611
608c
600
601
604
603
SIDE VIEW "A"
605
SIDE VIEW "B"
605
607
603
650
SIDEVIEW "C" Chuck
615

FIG. 6


700
Cooling Water
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Heat Exchanger
723
725
Heat exchange when cooling is needed
721
2-way control valve
719
717
715
701
Wafer Chuck
703
707
Heater
705
Bypass used when exit fluid must be heated
Pump
709
711
713
Heat Transfer Fluid Reservoir
Single Reservoir System

Fig. 7

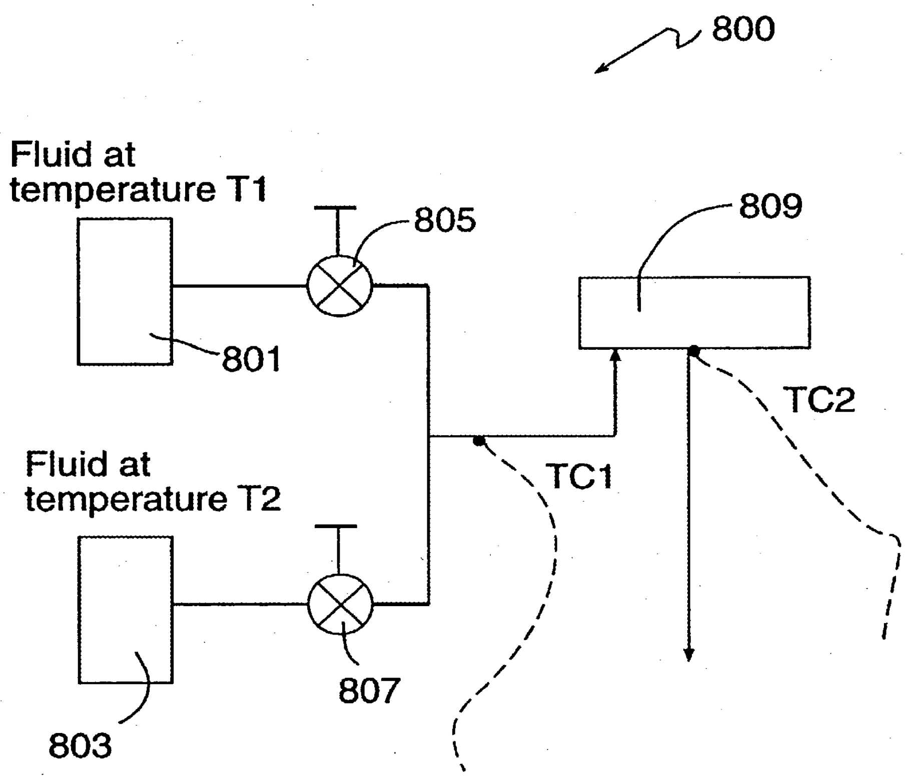

800
Fluid at
temperature T1
805
809
801
TC2
Fluid at
temperature T2
TC1
807
803

Fig. 8

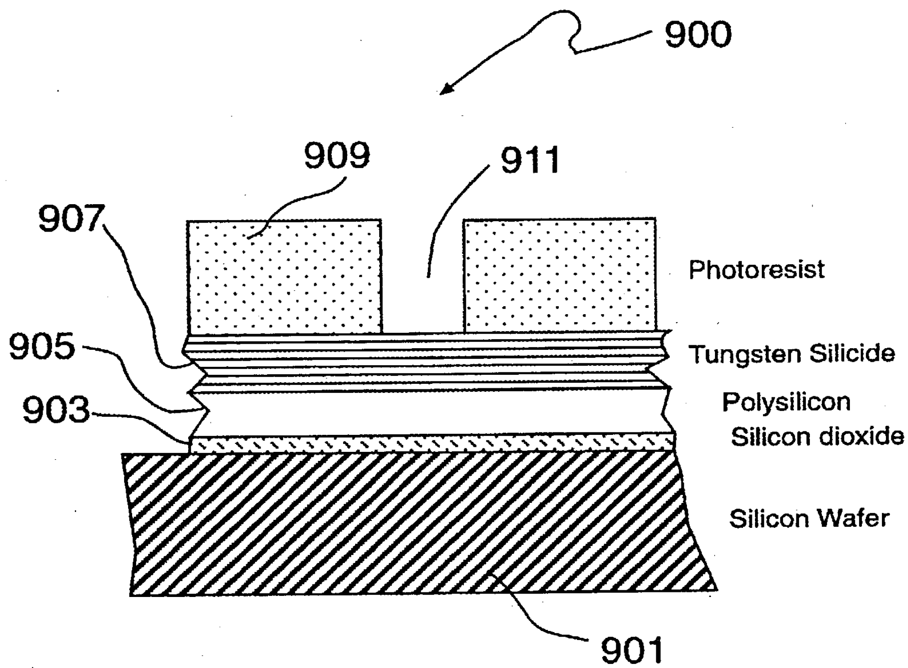
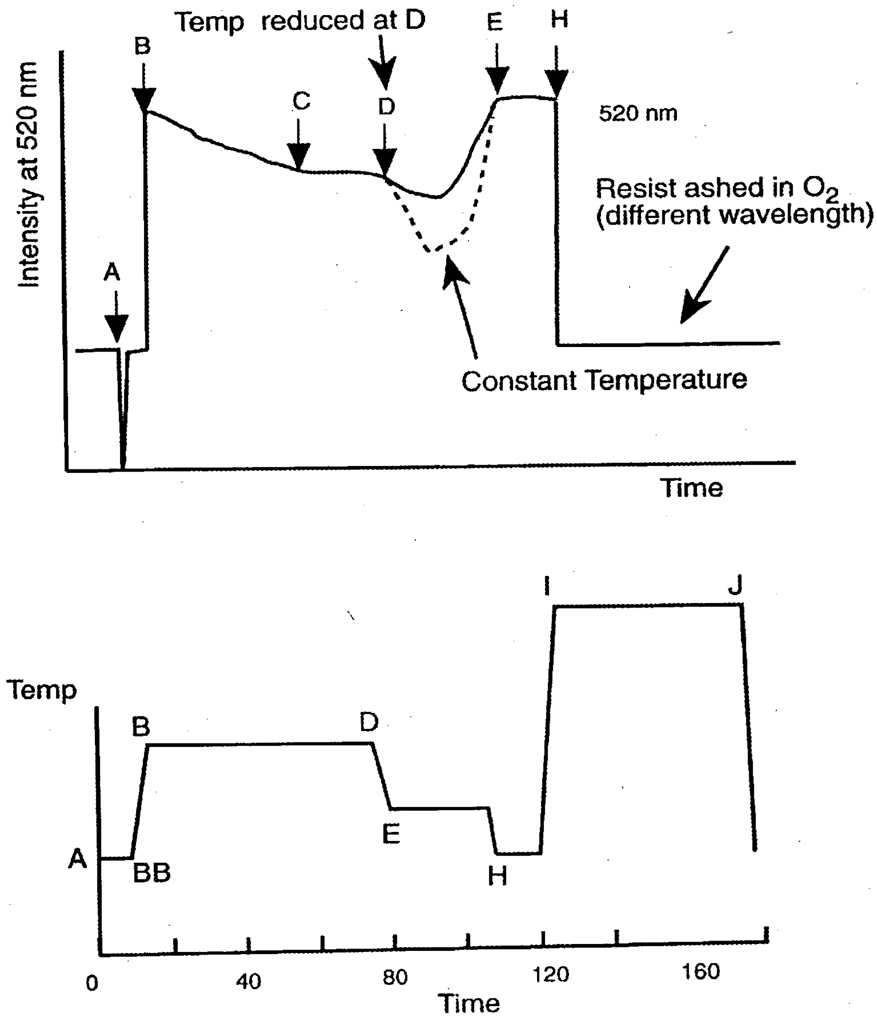

900
909
911
907
905
903
Photoresist
Tungsten Silicide
Polysilicon
Silicon dioxide
Silicon Wafer
901

Fig. 9



A. SF_6 native oxide "breakthrough"
B. Cl_2 plasma is ignited
C. WSi_x begins to clear (endpoint)
D. Polysilicon is exposed
E. Polysilicon cleared to oxide
H. Plasma extinguished and O2 feed gas flow is started
I. O_2 plasma is started
J O_2 plasma is extinguished.

Fig. 10

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PTO/SB/51 (02-01)
Approved for use through 03/31/2004. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

REISSUE APPLICATION DECLARATION BY THE INVENTOR	Docket Number (Optional) **[PLEASE ADD]**

As a below named inventor, I hereby declare that:
My residence, mailing address and citizenship are stated below next to my name.
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is described and claimed in patent number 6,231,776 B1, granted May 15 2001, and for which a reissue patent is sought on the invention entitled MULTI–TEMPERATURE PROCESSING,

the specification of which

☒ is attached hereto.

☐ was filed on ______________ as reissue application number ____________
and was amended on ______________ .
(If applicable)

I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I verily believe the original patent to be wholly or partly inoperative or invalid, for the reasons described below. (Check all boxes that apply.)

☐ by reason of a defective specification or drawing.

☒ by reason of the patentee claiming more or less than he had the right to claim in the patent.

☐ by reason of other errors.

At least one error upon which reissue is based is described below. If the reissue is a broadening reissue, such must be stated with an explanation as to the nature of the broadening:

One of the errors upon which this reissue is based is the error in claiming less than I had a right to claim in the original Letters Patent. It was discovered that the legal scope of protection afforded by the claims of the patent was not as great as it could have been if unnecessary features and details of the invention had not been included in the claims. More particularly, it was error for me to include for all claims a recitation that the method includes a substrate holder having a selected thermal mass, wherein said selected thermal mass allows a change from said first temperature to said second temperature within a characteristic time period to process said film. As I have now come to realize, my inventive contribution is not necessarily limited to what I believed to be a preferred embodiment at the time I filed the application. I now recognize that it was unnecessary to define my invention in such detail and that I unnecessarily limited the scope of protection to which I am entitled.

PTO/SB/51 (02-01)
Approved for use through 01/31/2004. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

(REISSUE APPLICATION DECLARATION BY THE INVENTOR, page 2)

Docket Number (Optional)

All errors corrected in this reissue application arose without any deceptive intention on the part of the applicant. As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the United States Patent and Trademark Office connected therewith.

Name(s) Registration Number

Correspondence Address: Direct all communications about the application to:

☐ Customer Number [ ] → Place Customer Number Bar Code Label here

OR *Type Customer Number here*

☒ Firm or Individual Name	Daniel L. Flamm				
Address	476 Green View Drive				
Address					
City	Walnut Creek	State	CA	ZIP	94596
Country	U.S.A.				
Telephone	(925)947-1909	Fax	(925) 937-2754		

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and imprisonment, or both, under 18 U.S.C. 1001, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this declaration is directed.

Full name of sole or first inventor (given name, family name) Daniel L. Flamm	
Inventor's signature Daniel L. Flamm	Date May 14, 2003
Residence 476 Green View Drive Walnut Creek, CA 94596	Citizenship U.S.A.
Mailing Address 476 Green View Drive Walnut Creek, CA 94596	

Full name of second joint inventor (given name, family name)	
Inventor's signature	Date
Residence	Citizenship
Mailing Address	

Full name of third joint inventor (given name, family name)	
Inventor's signature	Date
Residence	Citizenship
Mailing Address	

☐ Additional joint inventors are named on separately numbered sheets attached hereto.

PATENT APPLICATION SERIAL NO. ____________________

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

05/19/2003 HLE333 00000025 10439245

01 FC:2004 375.00 OP

PTO-1556
(5/87)

PATENT APPLICATION FEE DETERMINATION RECORD
Effective January 1, 2003

Application or Docket Number
10/439245

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	minus 20=	*
INDEPENDENT CLAIMS	minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐ OR OTHER THAN SMALL ENTITY

RATE	FEE		RATE	FEE
BASIC FEE	375.00	OR	BASIC FEE	750.00
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL		OR	TOTAL	

CLAIMS AS AMENDED - PART II

SMALL ENTITY OR OTHER THAN SMALL ENTITY

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

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X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

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X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 12/02) *U.S. Government Printing Office: 2003 — 498-278/69151 Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

CLAIMS ONLY

SERIAL NO.	FILING DATE
APPLICANT(S)	

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
1	1					
2						
3						
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47	1					
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50						
TOTAL IND.	1					
TOTAL DEP.	11					
TOTAL CLAIMS	12					

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	IND.	DEP.	IND.	DEP.	IND.	DEP.
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100						
TOTAL IND.	7					
TOTAL DEP.	48					
TOTAL CLAIMS	55					

* MAY BE USED FOR ADDITIONAL CLAIMS OR ADMENDMENTS

FORM PTO-2022 (1-98)

U.S.DEPARTMENT OF COMMERCE
Patent and Trademark Office

*U.S. GPO 1998-443-593/89152

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
ASSISTANT SECRETARY AND COMMISSIONER
OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY DOCKET NO

EXAMINER

ART UNIT | PAPER NUMBER

DATE MAILED:

NOTICE OF INSUFFICIENT FILING FEES

APPLICANT IS GIVEN 30 DAYS FROM THE DATE OF MAILING OF THIS NOTICE WITHIN WHICH TO SUBMIT THE BALANCE DUE. Extension of this 30 day period under 37 CFR 1.136(a) will not be permitted. Failure to respond within this period will result in the application becoming abandoned. 35 U.S.C. 133.

The filing fees submitted in connection with this application are insufficient. See the attached Patent Application Fee Determination Record (Form PTO-875). The balance due for additional claims and/or multiple dependent claims is summarized below:

☐ A. Filing Fees due upon filing the application

Total Filing Fees Due = $________

Less Filing Fees Submitted - $ (________)

BALANCE DUE = $________

☑ B. Fees due in connection with the amendment filed on ________

Total Fees Due = $ 567—

Less Fees Submitted - $ (0)

BALANCE DUE = $ 567—

____
Clerk of Group

ATTACHMENT: FORM PTO-875

APPLICANT: PLEASE COMPLETE THIS PORTION AND RETURN THIS NOTICE WITH PAYMENT

Fee submitted $________ Signature ________

CERTIFICATE OF MAILING

I hereby certify that this notice and the required additional fees are being deposited with the U.S. POSTAL SERVICE as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on (date) ________

Print Name: ________ Signature ________

PTOL-319 (REV. 7-92)