**AMENDMENTS TO THE CLAIMS:**

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

1. (Cancelled)

2. (Previously presented): The method of Claim 21, further including holding the temperature of the substrate substantially constant.

3. (Previously presented): The method of Claim 21, wherein applying pulsed DC power through the filter includes supplying up to about 10 kW of power at a frequency of between about 40 kHz and about 350 kHz and a reverse time pulse between about 1.3 and 5 μs.

4. (Previously presented): The method of Claim 21, wherein adjusting an RF bias power to the substrate includes supplying up to 1000 W of RF power to the substrate.

5. (Canceled).

6. (Previously presented): The method of claim 4, wherein the RF bias power is zero.

7. (Currently amended): The method of Claim 21, wherein ~~the film is an upper cladding layer of a waveguide structure and~~ the RF bias power is optimized to provide planarization.

8. (Previously presented): The method of Claim 21, wherein a process gas of the process gas flow includes a mixture of Oxygen and Argon.

9. (Previously presented): The method of Claim 8, wherein the mixture is adjusted to adjust the index of refraction of the film.

10. (Previously presented): The method of Claim 8, wherein the mixture further includes nitrogen.

11. (Previously presented): The method of Claim 21, wherein applying pulsed DC power to the target includes adjusting pulsed DC power to a target which has an area larger than that of the substrate.

12. (Previously presented): The method of Claim 21, further including uniformly sweeping the target with a magnetic field.

13. (Previously Presented): The method of Claim 12, wherein uniformly sweeping the target with a magnetic field includes sweeping a magnet in one direction across the target where the magnet extends beyond the target in the opposite direction.

14.-20. (Cancelled).

21. (Currently amended): A method of depositing [[a]] an oxide film on a substrate, comprising:

conditioning a target;

preparing the substrate;

adjusting an RF bias power to the substrate;

setting a process gas flow; and

applying pulsed DC power to the target through a filter such that the target voltage oscillates between positive and negative voltages to create a plasma and deposit the oxide film,

wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and sputtering with the target in poisonous mode to prepare the surface, and

wherein the filter is a band rejection filter at a frequency of the bias power.

22. (Previously Presented ): The method of Claim 21, wherein setting the process gas flow includes adjusting constituents in order to adjust the index of refraction of the film.

23. (Previously Presented): The method of Claim 21, wherein applying pulsed DC power includes setting the frequency in order to adjust the index of refraction of the film.

24. (Previously Presented): The method of Claim 21, further including adjusting a temperature of the substrate in order to adjust the index of refraction of the film.

25.-39. (Canceled).

40. (Previously presented): The method of claim 21, wherein the band rejection filter is a

narrow band-pass filter.

41. (Previously presented): The method of claim 21, wherein a bandwidth of the band rejection filter is about 100 kHz.

42. (Previously presented): The method of claim 21, wherein the frequency of the RF bias is about 2 MHz.

43. (Currently amended): A method of depositing [[a]] an oxide film on a substrate, comprising:

preparing the substrate;

adjusting an RF bias power to the substrate;

setting a process gas flow; and

applying pulsed DC power to a target through a band rejection filter at a frequency of the bias power such that the target voltage oscillates between positive and negative voltages and an oxide film is deposited on the substrate.

44. (Previously presented): The method of claim 43, wherein a bandwidth of the band rejection filter is about 100 kHz.

45. (Previously presented): The method of claim 43, wherein the frequency of the RF bias is about 2 MHz.

46. (Previously presented): The method of Claim 43, wherein applying pulsed DC power includes supplying up to about 10 kW of power at a frequency of between about 40 kHz and about 350 kHz and a reverse time pulse between about 1.3 and 5 μs.

47. (Previously presented): The method of Claim 43, further including holding the temperature of the substrate substantially constant.

48. (Previously presented): The method of Claim 43, wherein adjusting an RF bias power to the substrate includes supplying up to 1000 W of RF power to the substrate.

49. (Previously presented): The method of Claim 43, further including uniformly sweeping the target with a magnetic field.

50. (Previously presented): The method of Claim 49, wherein uniformly sweeping the target with a magnetic field includes sweeping a magnet in one direction across the target where the magnet extends beyond the target in the opposite direction.

51. (New): A method of depositing an oxide film on a substrate, comprising:

providing a process gas between the substrate and a target;

applying an RF bias power to the substrate;

applying pulsed DC power to the target such that the target voltage oscillates between positive and negative voltages; and

filtering the pulsed DC power through a narrow band rejection filter at a frequency of the bias power,

wherein the oxide film is deposited on the substrate.

52. (New): The method of claim 51, wherein the process gas includes one or more gasses chosen from the group consisting of Ar, $N_2$, $O_2$, $C_2F_6$, $CO_2$, CO, $NH_3$, NO, and halide containing gasses.

53. (New): The method of claim 51, wherein the target is a metallic target.

54. (New): The method of claim 51, wherein the target is an intermetllic target.

55. (New). The method of claim 51, further including sweeping the target with a magnetic field.

56. (New): The method of claim 51, wherein the pulsed DC power is supplied with a reverse time pulse between about 1.3 and 5 μs.

57. (New): The method of Claim 51, wherein applying an RF bias power to the substrate includes supplying up to 1000 W of RF power to the substrate.

58. (New) The method of claims 21, wherein applying pulsed DC power through the filter includes supplying pulsed DC power at a pulse frequency of between about 40 kHz and about 350 kHz.

59. (New) The method of claim 43, wherein applying pulsed DC power through the filter includes supplying pulsed DC power at a pulse frequency of between about 40 kHz and about

350 kHz.

60. (New) The method of claim 51, wherein applying pulsed DC power through the filter includes supplying pulsed DC power at a pulse frequency of between about 40 kHz and about 350 kHz.

## REMARKS

Claims 2-4, 6-14, and 21-50 are pending in this application. The Examiner has allowed claim 14 and rejected claims 2-4, 6-13, and 21-50. Applicants have canceled claim 14, amended claims 21 and 43, and added new claims 51-60.

## Examiner's Interview

Applicants wish to thank the Examiner for spending her time in an interview on January 18, 2007. In attendance at the Interview were Examiner Michelle Estrada, Applicant's counsel, Gary J. Edwards, and Inventors R. Ernest Demaray and Hongmei Zhang. Applicants substantially agree with the Examiner's Summary of the Interview mailed on January 23, 2007, and provide further discussion of the material discussed below.

During the interview, the inventors described to the Examiner the development of the invention, including the development of applicant's pulsed-DC processing technology, and the teachings of the cited references. In particular, the Smolanoff reference was discussed with respect to independent claims 21 and 43. Applicants discussed amending the claims to further clarify the distinctions between the claimed invention and the teachings of Smolanoff and other cited art. Those amendments are reflected in the amended claims above and in the newly added claims. The distinctions between the claimed invention and the cited prior art is further discussed below.

As pointed out to the Examiner during the interview, and as further discussed in the specification (see, e.g., Par. [0049]), the historical difficulty in deposition of insulating oxide layers is the formation of insulating layers on the target, which build up charges with the ultimate result of unwanted arcing. The arcing results in damaged power supplies and deposition of particulate matter, which degrades the properties of the resulting films deposited on the substrate.

Some embodiments of pulsed DC processing, as defined in the present application, can substantially eliminate this problem. As discussed, for example, in paragraph [0053] of Applicant's application, pulsed DC sputtering refers to a sputtering technique where the pulsed DC power supply oscillates between positive and negative potentials, driving the voltage of the target alternately to positive and negative potentials. Claims 21 and 43 of the present application have been amended to explicitly recite that "the target voltage oscillates between positive and negative voltages." New claim 51 also recites that "the target voltage oscillates between positive and negative voltages." The claims have also been amended to recite that the deposited films are oxide films. Applicants reserve the right to pursue allowable claims to the subject matter disclosed in the present application in continuation applications.

In order to further improve the quality of the deposited film, Applicant's apply a combination of pulsed DC power to the target and RF bias to the substrate. As is discussed, for example, in paragraph [0057] of the specification, application of RF bias to the substrate results in a densification of the deposited film. In order to supply both a pulsed DC power to the target and an RF bias to the substrate, a narrow band rejection filter is coupled between the pulsed DC power supply and the target. The band rejection filter is arranged to reject RF power at the frequency of the RF bias to the substrate. Applicants discovered that the use of pulsed DC power to the target and RF bias to the substrate resulted in catastrophic failure of the pulsed DC power supply due to transmission of the RF power into the pulsed DC power supply. However, a conventional high or low pass filter blocks a portion of the pulsed DC frequency to the target and therefore the benefits of using pulsed DC power are lost. Applicants discovered that a narrow band rejection filter, an embodiment of which is described in the specification at paragraph [0056], both protects the DC power supply from the RF bias power and passes the pulsed DC

frequencies which form the square pulse of the pulsed DC power to the target so that the benefits of pulsed DC deposition with RF bias can be realized. The elimination of a narrow band of frequencies about a single frequency in a narrow band rejection filter has a small effect on the square shape of the pulsed DC pulse. However, elimination of either all higher frequencies or all lower frequencies from the single frequency effectively destroys the shape of the square pulse and eliminates control of both the magnitude and duration of the positive portion of the pulse.

During prosecution of this application, several prior art publications have been raised, including Smolanoff (U.S. Patent 6,117,279) and Le (U.S. Publication No. 2003/0077914). Smolanoff was discussed during the Interview. Both publications are discussed below in particular. Neither of these references, either separately or in combination, teaches the combination of pulsed-DC deposition, where the target voltage oscillates between positive and negative voltages, and an RF bias. As a summary, Smolanoff teaches sputtering of a conducting or metallic layer and does not teach deposition of an "oxide layer," as is recited in each of claims 21, 43, and 51 above. Additionally, Smolanoff does not teach "applying pulsed DC power to the target . . . such that the target voltage oscillates between positive and negative voltages," as is recited in each of claims 21, 43 and 51. Further, although Smolanoff teaches a filter between a DC power supply and the target, Smolanoff does not teach a "narrow band rejection filter" as is recited in each of claims 21, 43, and 51.

Le does not cure the defects in the teachings of Smolanoff. Le teaches "a method of depositing a titanium oxide layer on a substrate" utilizing pulsed DC voltage. (Le, Abstract) However, Le does not teach applying an RF bias to the substrate or a band rejection filter coupled between the pulsed DC power supply and the target. Further, one skilled in the art would not be motivated to combine the teachings of Smolanoff, which is directed toward

deposition of metallic layers, with the teachings of Le, which is directed toward deposition of a titanium oxide layer.

As is further discussed below, claims 2-13, 21-24, and 40-60 are allowable over the cited prior art.

## Claim Rejections under 35 U.S.C. § 103[1]

The Examiner has rejected claims 2-4, 6-13, and 21-50 over combinations of Fu and Le with Smolanoff. As discussed below, claims 2-4, 6-13, and 21-50, as amended, are allowable over the cited references.

### Claims 10-13, 21, and 40-45

The Examiner has rejected claims 10-13, 21, and 40-45 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,117,279 ("Smolanoff et al.") in view of U.S. Patent No. 6,306,265 ("Fu et al."). However, Smolanoff does not teach "applying pulsed DC power to the target . . . such that the target voltage oscillates between positive and negative voltages," as is recited in claims 21 and 43. Additionally, Smolanoff does not teach "a band rejection filter at a frequency of the bias power," as is recited in claims 21 and 43. Further, Smolanoff does not teach deposition of "an oxide film," as is recited in claims 21 and 43.

I. Smolanoff does not teach "applying pulsed DC power to the target . . . such that the target voltage oscillates between positive and negative voltages," as is recited in claims 21 and 43.

[1] The Examiner has made multiple characterizations of the claims, the cited art, and application of legal principles to those characterizations. Applicants shall not be deemed to agree with or to acquiesce in the Examiner's statements by not specifically addressing these characterizations in this response.

Smolanoff teaches that "[t]he target power supply 21 is usually a source of constant or pulsed DC power and is connected between the cathode assembly 17 and some element such as the chamber wall 13 which is at ground potential and serves as the system anode." (Smolanoff, col. 5, lines 51-54). Additionally, Smolanoff teaches that "[p]ower from the steady or pulsed DC power supply 21 and/or RF generator 24 produces a negative potential on the target 16." (Smolanoff, col. 5, line 66, through col. 6, line 1).

Applicants have explicitly defined pulsed DC power to refer to power that oscillates between positive and negative voltages. (*See*, application, par. [0053]). As described in the specification, the positive voltage period allows an insulating layer deposited on the target to discharge, resulting in an arc free deposition process. (*See,* application, par. [0053]). However, a second definition of "pulsed DC power" was also in use at the time, and the second definition is apparently the definition utilized in Smolanoff. In this second definition, which is also referred to as unipolar pulsed DC, the DC power supplied to the target is grounded on occasion, either periodically or when an impending discharge is detected. The DC power can be shunted to ground so that the voltage on the target was brought from a high negative voltage to near ground voltage until the arc condition was dissipated, while the negative voltage power supply was protected from the discharge. This process was also referred to as "pulsed DC power," but, in Smolanoff, the target remains at a negative voltage throughout the deposition.[2]

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[2] Applicant has submitted three articles that explain various aspects of pulsed-dc technology in the Information Disclosure Statement that accompanies this amendment: *See, e.g.,* Richard A. Scholl, "Power Systems for Reactive Sputtering of Insulating Films," Advanced Energy Industries, Inc., While Paper, September, 2001, page 3, paragraph 3; *See also,* Richard A. Scholl, "Advanced Supplies for Pulsed Plasma Technologies: State-Of-The-Art and Outlook," Advanced Energy Industries, Inc., White Paper, 1999; ; and A. Belkind, et al., "Pulsed-DC Reactive

(continued...)

The process of pulsed DC power as claimed in claims 21 and 43, where "the target voltage oscillates between positive and negative voltages," then, differs from the teachings of Smolanoff at least in that Smolanoff teaches that the target remains at a negative potential. Such pulses occur only, generally, when an impending discharge from the target is sensed and may not be periodic. Therefore, Smolanoff does not teach "that the target voltage oscillates between positive and negative voltages," as is recited in claims 21 and 43.

II. Smolanoff does not teach "a band rejection filter at a frequency of the bias power," as is recited in claims 21 and 43.

Smolanoff does not teach "a band rejection filter at a frequency of the bias power," as is recited in claims 21 and 43. Smolanoff teaches that "[t]he power supply 21 preferably is connected to the cathode assembly 17 through an RF filter 22." (Smolanoff, col. 5, lines 56-58). However, no further description of filter 22 is provided. Therefore, Smolanoff does not teach "a band rejection filter at a frequency of the bias power," as is recited in claims 21 and 43.

The Examiner has commented that "using an specific type of filter is a matter of design choice depending on the quality of product needed, and it is obvious that the filter is going to work at certain frequencies." (OA, page 2). Additionally, the Examiner commented that "the limitation 'the filter is a band rejection filter at a frequency of the bias power' is a structural limitation in a method claim, so no matter what filter is used, as long as the same result is achieved." (OA, page 2). Applicants disagree.

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(...continued)
Sputtering of Dielectrics: Pulsing Parameter Effects," Society of Vacuum Coaters 43rd Annual Technical Conference Proceedings, Denver, CO, April 15-20, 2000.

Although it is true that "the filter is going to work at certain frequencies," as suggested by the Examiner, the recited "band rejection filter" works at the frequency of the RF bias supply and blocks only a narrow band of frequencies around the frequency of the RF bias supply. This allows the square wave pulse of the DC power, which is formed of all frequencies both higher and lower than the biased frequency, to be transmitted through the filter to the target. Otherwise, the pulse that would reach the target is distorted so that the benefits of the pulsed DC power are not realized. Therefore, utilization of a band rejection filter at the frequency of the bias power is neither taught nor obvious from the teachings of Smolanoff. Furthermore, use of a band rejection filter at the frequency of the bias power places a distinct limitation on the claim.

Therefore, Smolanoff does not teach "applying pulsed DC power to the target through a filter . . . wherein the filter is a band rejection filter at a frequency of the bias power," as is recited in claims 21, or "applying pulsed DC power to a target through a band rejection filter at a frequency of the bias power," as is recited in claim 43.

III. Smolanoff teaches deposition of metallic films and does not teach "an oxide film," as is recited in claims 21 and 43.

Smolanoff teaches "a sputter coating apparatus" that is generally directed to deposition of conducting films. In particular, Smolanoff "relates to sputter coating, and more particularly, to the Ionized Physical Vapor Deposition (IPVD) of coating material onto substrates." (Smolanoff, col. 1, lines 6-8). Smolanoff teaches that

> For some sputtering processes, such as those used for coating contacts at the bottoms of high aspect ratio holes and other features on the substrate 15 and for metallizing such holes by filling them with sputtered conductive material, it is highly preferred in VLSI semiconductor device manufacturing that the particles impinge onto the substrate 15 in a narrow angular distribution around the

> normal to the substrate so that they can proceed directly into the features and onto the feature bottoms without striking or being shadowed by the feature sides.

(Smolanoff, col. 6, lines 34-43).

As stated in Smolanoff,

> The present invention is further predicated in part upon a principle that a substantial loss of positive ions from a secondary plasma and a resulting reduction in the ionization fraction of sputtered ions by the secondary plasma, are prevented when electrically conductive shields employed in ionized physical deposition processes on the periphery of the secondary plasma used for the ionization of the puttered material are prevented from developing a substantial negative DC potential. The invention is further predicated in part upon the concept that the existence of conductive shields or chamber walls bounding the secondary plasma, if prevented from developing a strongly negative DC potential or if kept far from the center of the chamber, will reduce the steering of positive ions from the secondary plasma into the walls or shields, and decrease the width of the plasma sheath. The invention is particularly predicated on the concept of providing these effects while maintaining an RF shield that will allow effective and efficient coupling of energy into the secondary plasma.

Further, Smolanoff teaches that

> For sputter processing, the gas from the supply 40 is typically an inert gas such as argon. For reactive processes, additional gases, such as nitrogen, hydrogen, ammonia, oxygen or other gas, can be introduced through auxiliary flow controllers.

(Smolanoff, col. 7, lines 23-26). Further, Smolanoff teaches that "[a] metal shield positioned inside of the window shields the window from the deposition of conductive sputtered material thereon which, if permitted to accumulate on the window, would isolate the chamber from the coil." (Smolanoff, col. 4, lines 19-22). Additionally, Smolanoff teaches that

> While the window 60 itself is not electrically conductive, it is susceptible to the accumulation of a coating of conductive material sputtered from the target 16. . . .
>
> To prevent such buildup of conductive sputtered material on the window 60, a shield 70 is provided in the vacuum of the

> chamber 12 between the space 11 and the window 60, in close proximity to the inside surface of the window 60.

(Smolanoff, col. 7, line 61, -col. 8, line 9).

As indicated in Smolanoff, and discussed above, the shield taught in Smolanoff can not be made insulating and must remain electrically conducting in order for the Smolanoff invention to function. Any deposition of insulating material, which would occur during deposition of an oxide material, would cause the invention taught in Smalanoff to become nonfunctional. Smolanoff, therefore, teaches away from deposition of dielectric materials such as oxide materials. Therefore Smolanoff teaches sputtering of conductive materials and does not teach deposition of oxide materials.

IV. Fu does not cure the defects in the teachings of Smolanoff.

As discussed above, Smolanoff teaches deposition of conducting films and does not teach "applying pulsed DC power to the target . . . such that the target voltage oscillates between positive and negative voltages," as is recited in claims 21 and 43. Additionally, Smolonoff does not teach "a band rejection filter at a frequency of the bias power," as is recited in claims 21 and 43. Fu does not cure the defects in the teachings of Smolonoff.

Fu teaches "sputtering of materials." (Fu, col. 1, line 13). As shown in Figure 1, Fu teaches applying DC power to the target. (*See*, Fu, Fig. 1; col. 1, lines 30-32). However, Fu does not teach "applying pulsed DC power to the target . . . such that the target voltage oscillates between positive and negative voltages," as is recited in claims 21 and 43. Therefore, Fu does not teach the combination of "applying pulsed DC power to the target through a filter . . . wherein the filter is a band rejection filter at a frequency of the bias power," as is recited in claim 21, or "applying pulsed DC power to a target through a band rejection filter at a frequency of the

bias power," as is recited in claim 43. Although Fu mentions that oxygen can be supplied to the reactor to produce oxides such as $Al_2O_3$ (*See*, Fu, col. 1, lines 39-40), Fu concentrates on ionized metal deposition (*See, e.g.,* Fu, title).

Therefore, claims 21 and 43 are allowable over the combination of Fu and Smolanoff. Claims 10-13 and 40-42 depend from claim 21 and are allowable over the combination of Fu and Smolanoff for at least the same reasons as is claim 21. Claims 44-45 depend from claim 43 and are allowable over the combination of Fu and Smolanoff for at least the same reasons as is claim 43.

**Claims 2-4, 5, and 22-24**

The Examiner has rejected claims 2-4, 6, and 22-24 under 35 U.S.C. § 103(a) as being unpatentable over Smolanoff et al. in view of Fu et al. as applied to claims 8, 10-13, and 21, and further in view of the Examiner's comments.

However, claims 2-4, 6, and 22-24 depend from claim 21, which is allowable over the combination of Fu and Smolanoff as discussed above. Therefore, claims 2-4, 6, and 22-24 are allowable over the combination of Fu and Smolanoff for at least the same reasons as is claim 21.

The Examiner's comments regarding the prima facie obviousness of claiming different ranges are not appropriate with regard to claims 2-4, 6, and 22-24 because the recited ranges are directed to the process claimed, which as discussed above is allowable over the cited prior art. Therefore, the recited ranges in claims 2-4, 6, and 22-24 are not related to the ranges provided in the prior art, which is directed towards different processes.

**Claims 7 and 9**

The Examiner has rejected claims 7 and 9 under 35 U.S.C. § 103(a) as being unpatentable over Smolanoff et al. in view of Fu et al. as applied to claims 8, 10-13, and 21, and further in view of U.S. Application No. 2003/0077914 ("Le et al.").

As discussed above with respect to claim 21, the combination of Smolanoff and Fu does not teach "applying pulsed DC power to the target . . . such that the target voltage oscillates between positive and negative voltages" and "a band rejection filter at a frequency of the bias power," as is recited in claims 21. Le does not cure the defects in the teachings of Smolanoff and Fu.

Le teaches "a method of depositing a titanium oxide layer on a substrate" utilizing pulsed DC voltage. (Le, Abstract) However, Le does not teach applying an RF bias to the substrate or a band rejection filter coupled between the pulsed DC power supply and the target. Therefore, Le does not teach "applying pulsed DC power to the target . . . such that the target voltage oscillates between positive and negative voltages" and "a band rejection filter at a frequency of the bias power," as is recited in claims 21.

Further, one skilled in the art would not be motivated to combine the teachings of Smolanoff, which is directed toward deposition of metallic layers, with the teachings of Le, which is directed toward deposition of a titanium oxide layer. In fact, as discussed above, Smolanoff teaches away from the deposition of oxide layers because deposition of an oxide layer on the shield, which would occur during deposition of an oxide layer, would cause the Smolanoff invention to not function.

Therefore, claims 7 and 9, which depend from claim 21, are allowable for at least the same reason as is claim 21.

**New Claims**

Applicants have added new claims 51-60. Independent claim 51 includes the limitations of "an oxide film," "applying pulsed DC power to the target such that the target voltage oscillates between positive and negative voltages," and "filtering the pulsed DC power through a narrow band rejection filter at a frequency of the bias power," which are the limitations that were discussed with the Examiner during the Interview of January 18, 2007. Claim 51 includes limitations similar to those recited in claims 21 and 43 and discussed above. Therefore, claim 51 is allowable over the cited prior art. Claims 52-57 and claim 60, which depend from claim 51, are therefore allowable over the cited prior art for at least the same reasons as is claim 51. Claim 58 depends from claim 21 and is therefore allowable over the prior art for at least the same reasons as is claim 21. Claim 59 depends from claim 43 and is allowable over the prior art for at least the same reasons as is claim 43.

Support for claims 51-60 can be found throughout the specification. Claim 51 includes limitations similar to claims 21 and 43. Claim 52 is disclosed, for example, in paragraph [0015] and paragraph [0073]. Claims 53 and 54 are disclosed, for example, in paragraph [0062]. Claim 55 is similar to claim 12. Claim 56 includes limitations from claim 3. Claim 57 is similar to claim 4. Claims 58-60 include limitations from claim 3.

## Conclusion

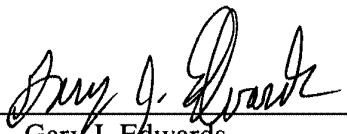
In view of the foregoing remarks, Applicants submit that this claimed invention, as amended, is neither anticipated nor rendered obvious in view of the prior art references cited against this application. Applicants therefore request the entry of this Amendment, the Examiner's reconsideration and reexamination of the application, and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: February 6, 2007

By: 
Gary J. Edwards
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PATENT
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Attorney Docket No. 9140.0016-00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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|---|---|---|
| In re Application of: | ) | |
| | ) | |
| ZHANG, Hongmei et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| | ) | |
| Filed: March 16, 2002 | ) | |
| | ) | |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | Confirmation No.: 6938 |

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

Sir:

**TWELFTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(c)**

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(c), Applicant brings to the attention of the Examiner the documents on the attached listing. This Information Disclosure Statement is being filed after the events recited in Section 1.97(b) but, to the undersigned's knowledge, before the mailing date of either a Final action, Quayle action, or a Notice of Allowance. Under the provisions of 37 C.F.R. § 1.97(c), the Commissioner is hereby authorized to charge the fee of $180.00 as specified by Section 1.17(p) to Deposit Account No. 06-0916.

Copies of the listed foreign and non-patent literature documents are attached. Copies of the U.S. patents and patent publications are not enclosed.

Applicant respectfully requests that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claim in the application and Applicant determines that the cited documents do not constitute "prior art" under United States law, Applicant reserves the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

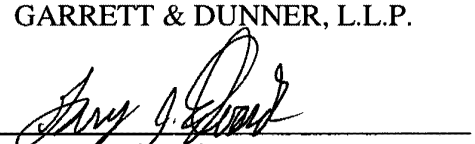
Applicant further reserves the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: February 6, 2007

By: 
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IDS Form PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

Sheet 1 of 3

| Complete if Known | |
|---|---|
| *Application Number* | 10/101,863 |
| *Filing Date* | March 16, 2002 |
| *First Named Inventor* | ZHANG, Hongmei |
| *Art Unit* | 2823 |
| *Examiner Name* | ESTRADA, Michelle |
| *Attorney Docket Number* | 9140.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] *(if known)* | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US-6,088,492 | 07-11-2000 | Kaneko et al. | |
| | | US-6,154,582 | 11-28-2000 | Bazylenko et al. | |
| | | US-2002/0191916 A1 | 12-19-2002 | Frish et al. | |
| | | US-2003/0044118 A1 | 03-06-2003 | Zhou et al. | |
| | | US 2003/0143853 A1 | 07-31-2003 | Celii et al. | |
| | | US 2005/0175287 A1 | 08-11-2005 | Pan et al. | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

## 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 | Translation[6] |
|---|---|---|---|---|---|---|
| | | KR 2003-0088236 | 11-19-2003 | Hyundai Motor Co Ltd | | Abstract |
| | | WO 01/82297 A1 | 11-01-2001 | Koninklijke Philips Electronics N.V. | | |

## NON PATENT LITERATURE DOCUMENTS

| Examiner Initials | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| | | BELKIND, A. et al., "Pulsed-DC Reactive Sputtering of Dielectrics: Pulsing Parameter Effects," 43rd Annual Technical Conference Proceedings-Denver: 86-90 (April 15-20, 2000). | |
| | | SCHOLL, R., "Power Supplies for Pulsed Plasma Technologies: State-Of-The-Art And Outlook," Advances Energy Industries, Inc., pages 1-8 (1999). | |
| | | SCHOLLI, R., "Power Systems for Reactive Sputtering of Insulating Films," Advances Energy Industries, Inc., pages 1-8 (August 2001). | |
| | | Final Office Action dated October 12, 2006, in U.S. Application No. 10,291,179 (Attorney Docket No. 9140.0001-00). | |
| | | Response to Final Office Action dated November 3, 2006, in U.S. Application No. 10,291,179 (Attorney Docket No. 9140.0001-00). | |
| | | Office Action dated December 1, 2006, in U.S. Application No. 10,291,179 (Attorney | |

| Examiner Signature | | Date Considered | |
|---|---|---|---|

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**EXPRESS MAIL LABEL NO. EV 955594467 US**

| IDS Form PTO/SB/08: Substitute for form 1449A/PTO | | | | Complete if Known | |
|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | Application Number | 10/101,863 |
| | | | | Filing Date | March 16, 2002 |
| | | | | First Named Inventor | ZHANG, Hongmei |
| | | | | Art Unit | 2823 |
| *(Use as many sheets as necessary)* | | | | Examiner Name | ESTRADA, Michelle |
| Sheet | 2 | of | 3 | Attorney Docket Number | 9140.0016-00 |

| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | Docket No. 9140.0001-00). | |
| | | Amendment dated October 19, 2006, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Office Action dated December 18, 2006, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Response to Office Action dated September 11, 2006 in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Office Action dated December 1, 2006, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Office Action dated October 31, 2006, in Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Response to Office Action dated December 6, 2006, in Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Supplemental Preliminary Amendment dated February 6, 2007, in U.S. Application No. 11/228,834 (Attorney Docket No. 9140.0016-02). | |
| | | Supplemental Preliminary Amendment dated February 6, 2007, in U.S. Application No. 11/191,643 (Attorney Docket No. 9140.0016-04). | |
| | | Final Office Action dated October 19, 2006, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| | | Voluntary Amendment dated July 26, 2006 in TW Appl. No. 92123625 (Attorney Docket No. 9140.0025-00270). | |
| | | Response to Final Office Action dated August 3, 2006, in U.S. Application No. 10/789,953 (Attorney Docket No. 9140.0030-00). | |
| | | Notice of Allowance dated October 23, 2006, in U.S. Application No. 10/789,953 (Attorney Docket No. 9140.0030-00). | |
| | | Office Action dated October 12, 2006, for U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| | | Response to Office Action dated December 21, 2006, in U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| | | Office Action dated September 22, 2006 from Korean Patent Office in Appl. No. 10-2005-7016055 (Attorney Docket No. 9140.0030-00202). | |
| | | Response to Office Action dated November 8, 2006, to the Korean Patent Office in Application No. 10-2005-7016055 (Attorney Docket No. 9140.0030-00202). | |
| | | Response to Office Action from Singapore Patent Office in Appl. No. 200505388-9, dated August 11, 2006 (Attorney Docket No. 9140.0030-00256). | |
| | | Final Office Action dated October 26, 2006, in U.S. Application No. 10/851,542 (Attorney Docket No. 9140.0033-00). | |

| Examiner Signature | | Date Considered | |
|---|---|---|---|

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|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | *Application Number* | 10/101,863 |
| | | | | *Filing Date* | March 16, 2002 |
| | | | | *First Named Inventor* | ZHANG, Hongmei |
| *(Use as many sheets as necessary)* | | | | *Art Unit* | 2823 |
| | | | | *Examiner Name* | ESTRADA, Michelle |
| Sheet | 3 | of | 3 | *Attorney Docket Number* | 9140.0016-00 |



| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | Response to Office Action dated January 26, 2007, in U.S. Application No. 10/851,542 (Attorney Docket No. 9140.0033-00). | |
| | | Preliminary Amendment dated July 21, 2006, in U.S. Application No. 11/297,057 (Attorney Docket No. 9140.0042-00). | |
| | | Supplemental Preliminary Amendment, Substitute Specification with Markings, Substitute Specification without Markings, and Replacement Drawing Sheets dated December 6, 2006 in U.S. Application No. 11/297,057 (Attorney Docket No. 9140.0042-00). | |
| | | Continuation application and Preliminary Amendment dated December 13, 2006 (Attorney Docket No. 9140.0042-01). | |
| | | Voluntary Amendment dated August 15, 2006 in TW Appl. No. 94143175 (Attorney Docket No. 9140.0042-00270). | |
| | | PCT International Search Report and Written Opinion for Application No. PCT/US05/44781 dated October 3, 2006 (Attorney Docket No. 9140.0042-00304). | |

| Examiner Signature | | Date Considered | |
|---|---|---|---|

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**EXPRESS MAIL LABEL NO. EV 955594467 US**

0014040325
WPI Acc no: 2004-222504/200421
**Flywheel for radiating heat and increasing rigidity**
Patent Assignee: HYUNDAI MOTOR CO LTD (HYUN-N)
Inventor: SONG J H
Patent Family: 2 patents, 1 countries

| Patent Number | Kind | Date | Application Number | Kind | Date | Update | Type |
|---|---|---|---|---|---|---|---|
| **KR 2003088236** | **A** | **20031119** | **KR 200226187** | **A** | **20020513** | **200421** | **B** |
| KR 507142 | B | 20050809 | KR 200226187 | A | 20020513 | 200662 | E |

Priority Applications (no., kind, date): KR 200226187 A 20020513

Patent Details

| Patent Number | Kind | Lan | Pgs | Draw | Filing Notes | |
|---|---|---|---|---|---|---|
| KR 2003088236 | A | KO | 1 | 10 | | |
| KR 507142 | B | KO | | | Previously issued patent | KR 2003088236 |

**Alerting Abstract** KR A
NOVELTY - A flywheel for radiating and reinforcing is provided to prevent crack by absorbing burst force with elastic force and radiating friction heat in operating the clutch because the flywheel is divided into plural portions and manufactured with different materials.
DESCRIPTION - A flywheel(10) is composed of a support plate(10a) combined with a crankshaft with pressing and fitting a ring gear(11); a cover plate(10b) fixed to the support plate and bent to form the storage space; an insert plate(10c) fastened inside the cover plate; and a friction plate(10d) contacted to the insert plate and inserted to the cover plate to receive clamping load from a clutch plate in operating the clutch. The durability is improved by preventing crack from burst force in the flywheel and radiating friction heat from clamping load.

(19)대한민국특허청(KR)
(12) 공개특허공보(A)

(51) 。Int. Cl.[7]
F16F 15/30

(11) 공개번호 특2003-0088236
(43) 공개일자 2003년11월19일

(21) 출원번호 10-2002-0026187
(22) 출원일자 2002년05월13일

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경기도안양시만안구박달2동139-101

(74) 대리인 한양특허법인

심사청구 : 있음

# (54) 방열과 강성 강화용 플라이 휠

요약

본 발명은 방열과 강성 강화용 플라이 휠에 관한 것으로, 플라이휠을 서로 결합되는 여러 부분으로 분리해 제작하면서 그 재질을 달리해 버스트포스를 자체적인 탄성을 통해 흡수하면서 클러치의 조작에 의한 마찰열의 방열성도 향상시켜 균열을 방지함에 그 목적이 있다.

상기와 같은 목적을 달성하기 위한 본 발명은, 플라이휠(10)이 링기어(11)가 외주 측에 압입되면서 크랭크축(5)에 결합되는 지지플레이트(10a)와, 이 지지플레이트(10a)에 일단이 고정되면서 절곡된 내부로 수용공간을 형성하는 커버플레이트(10b), 이 커버플레이트(10b)의 안쪽에서 고정되는 인서트플레이트(10c) 및 이 인서트플레이트(10c)에 접촉됨과 더불어 커버플레이트(10b)내에 삽입· 고정되어 클러치 조작에 따라 클러치플레이트(22)로부터 클램핑 로드(F')를 받는 마찰플레이트(10d)로 이루어진 것을 특징으로 한다.

대표도

도 4

명세서

도면의 간단한 설명

도 1은 일반적인 엔진의 구성도

도 2는 종래에 따른 플라이 휠부위의 구성도

도 3은 종래에 따른 플라이휠의 구성 단면도

도 4는 본 발명에 따른 플라이휠의 구성 단면도

<도면의 주요부분에 대한 부호의 설명>

1 : 실린더 2 : 피스톤

3 : 커넥팅 로드 5 : 크랭크축

6 : 워터펌프 7 : 밸브기구

8 : 크랭크풀리 9 : 타이밍 기어

10 : 플라이휠 10a : 지지플레이트

10b : 커버플레이트 10c : 인서트플레이트

10d : 마찰플레이트 10d' : 슬랏

11 : 링기어 20 : 클러치어셈블리

21 : 클러치커버 22 : 클러치플레이트

H : 휠하우징

F' : 클랭핑로드 K : 갭

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 방열과 강성 강화용 플라이 휠에 관한 것으로, 보다 상세하게는 엔진의 회전력에 의한 균열을 방지하도록 강성을 강화함과 더불어 클러치와의 마찰에 의한 마찰열의 방열성도 향상할 수 있도록 된 방열과 강성 강화용 플라이 휠에 관한 것이다.

일반적으로 엔진은 도 1에 도시된 바와 같이 실린더(1) 내에서 혼합 가스가 폭발하여 피스톤(2)이 왕복 운동되고, 상기 피스톤(2)과 커넥팅 로드(3)로 연결된 크랭크축(5)이 회전 운동되면서 회전 동력이 발생하게 된다.

또한, 상기 크랭크축(5)에는 그 선단측에 워터펌프(6) 및 밸브기구(7)를 작동하기 위한 크랭크풀리(8) 및 타이밍기어(9)가 설치되어 있고, 반대쪽에는 하우징(H)내로 수용되어 엔진의 초기 시동시에 스타트 모터의 피니언 기어와 맞물려 회전력을 전달받는 링기어(11)가 외주 측에 열 박음으로 압입되면서 클러치와 변속기에 회전 동력을 전달하는 플라이휠(10)이 설치되어 있다.

여기서, 상기 플라이휠(10)은 도 2에 도시된 바와 같이, 링기어(11)가 압입된 반대측으로 클러치페달에 의해 플라이휠(10)과 마찰되는 클러치플레이트(22)를 감싸는 클러치커버(21)로 이루어져 엔진과 변속기사이의 회전 전달을 분리 · 연결하는 클러치어셈블리(20)가 구비되어진다.

이러한 플라이휠(10)은 엔진의 4행정 중에서 폭발행정에서 얻어진 토크(Torque)를 흡입· 압축· 배기 행정에 고르게 분배하여 승차감 및 차량 출발성에 맞춘 형상으로 설계됨은 물론 엔진과 변속기를 연결하는 역할로 클러치의 용량에 맞게 설계됨은 물론이다.

그러나, 이와 같은 플라이휠(10)은 도 3에 도시된 바와 같이 크랭크축(5)에 보올트등을 매개로 고정된 상태에서 엔진의 회전력을 변속기로 전달하기 위해 고속으로 회전하면서, 또한 클러치의 조작에 따라 클러치플레이트(22)와 서로 강하게 마찰되면서 엔진의 회전력을 단속하는데 이에 따라, 포트(Port)형 클러치인 경우에는 클러치플레이트(22)의 취부면과 플라이휠(10)좌면 사이의 노치(C : Notch)부위가 회전에 따른 버스트 포스(Burst Force)에 의해 균열(Crack)이 발생될 소지가 있는 문제가 있게 된다.

또한, 트럭과 버스와 같이 대형 디젤엔진을 사용하는 경우에는 플라이휠(10)의 형상도 이너시아(Inertia)값이 매우 큰 형상으로 주철로 제조되는데 특히, 이와 같은 경우에는 빈번하면서 장시간동안 클러치를 조작하는 경우 클러치에서 발생되는 약 250 - 300℃ 정도의 고온에 의해 플라이휠(10)의 열변형을 가져오고 이에 따른 강도 저하는 물론 균열을 발생시킬 수 있는 문제가 있게 된다.

발명이 이루고자 하는 기술적 과제

이에 본 발명은 상기와 같은 점을 감안하여 발명된 것으로, 플라이휠을 서로 결합되는 여러 부분으로 분리해 제작하면서 그 재질을 달리해 버스트포스를 자체적인 탄성을 통해 흡수하면서 클러치의 조작에 의한 마찰열의 방열성도 향상시켜 균열을 방지함에 그 목적이 있다.

상기와 같은 목적을 달성하기 위한 본 발명은, 플라이휠이 링기어가 외주 측에 압입되면서 크랭크축에 결합되는 지지플레이트와, 이 지지플레이트에 일단이 고정되면서 절곡된 내부로 수용공간을 형성하는 커버플레이트, 이 커버플레이트의 안쪽에서 고정되는 인서트플레이트 및 이 인서트플레이트에 접촉됨과 더불어 커버플레이트내에 삽입· 고정되어 클러치 조작에 따라 클러치플레이트로부터 클램핑 로드를 받는 마찰플레이트로 이루어진 것을 특징으로 한다.

발명의 구성 및 작용

이하 본 발명의 실시예를 첨부된 예시도면을 참조로 상세히 설명한다.

도 4는 본 발명에 따른 플라리휠의 구성 단면도를 도시한 것인바, 본 발명은 피스톤(2)의 왕복 운동을 회전운동으로 변환하는 크랭크축(5)에 결합되면서 클러치어셈블리(20)가 장착되는 플라이휠(10)이 초기 시동시에 스타트 모터의 피니언 기어와 맞물려 회전력을 전달받는 링기어(11)가 외주 측에 열 박음으로 압입됨과 더불어 보올트등의 고정부재를 통해 크랭크축(5)에 결합되는 지지플레이트(10a)와, 이 지지플레이트(10a)에 보올트등의 고정부재를 통해 고정된 일단으로부터 서로 간격을 두도록 절곡되어 그 내부로 수용공간을 형성하는 컵 형상의 커버플레이트(10b), 이 커버플레이트(10b)의 안쪽에서 보올트등의 고정부재를 통해 고정되는 인서트플레이트(10c) 및 이 인서트플레이트(10c)에 접촉됨과 더불어 커버플레이트(10b)내에 삽입· 고정되어 클러치 조작 시 클러치어셈블리(20)의 클러치플레이트(22)와 접촉되어 클램핑로드(F')가 작용되는 마찰플레이트(10d)로 이루어진다.

여기서, 상기 지지플레이트(10a)와 인서트플레이트(10c)는 주철로 이루어지는 반면, 상기 커버플레이트(10b)는 강(Steel)재질로 이루어져 플라이휠(10)에 작용하는 버스트 포스(F)를 자체적인 탄성력을 통해 흡수· 완화시켜주게 된다.

또한, 상기 인서트플레이트(10c)는 클러치 조작에 따라 마찰플레이트(10d)에서 발생되는 마찰열의 전달시 열팽창에 의해 커버플레이트(10b)와의 간섭을 방지하도록 약 1.00 - 1.50mm 정도의 갭(K)을 유지하게 된다.

그리고, 상기 마찰플레이트(10d)는 클러치 조작에 따른 클러치플레이트(22)와의 마찰열을 외부로 발산하도록 그 측면 테두리를 따라 다수의 슬릿(10d')이 형성되어진다.

이하 본 발명의 작동을 첨부된 도면을 참조로 상세히 설명한다.

본 발명은 플라이휠(10)이 일체로 이루어지는 대신 여러 부품들로 이루어지는데 즉, 지지플레이트(10a)에 초기 시동시에 스타트 모터의 피니언 기어와 맞물려 회전력을 전달받는 링기어(11)를 열 박음으로 압입시킨 상태에서 커버플레이트(10b)의 안쪽으로 보올트등의 고정부재를 이용해 인서트플레이트(10c) 와 마찰플레이트(10d) 순차적으로 고정한 후, 상기 커버플레이트(10b)와 지지플레이트(10a)를 보올트등의 고정부재를 매개로 결합시킨 상태에서 크랭크축(5)에 결합하여 플라이휠(10)을 조립하게 된다.

이때, 상기 지지플레이트(10a)와 크랭크축(5)사이에는 파이롯 베어링(Pilot Bearing)이 개재됨은 물론이다.

이어, 상기 플라이휠(10)에 클러치어셈블리(20)를 결합하여 클러치 조작시 클러치플레이트(22)에 의해 플라이휠(10)의 마찰플레이트(10d)쪽으로 강하게 작용하는 클램핑로드(F')를 통해 엔진과 변속기사이의 회전력을 단속하게 된다.

이때, 본 발명의 플라이휠(10)은 클러치의 조작에 따라 야기되는 엔진의 회전에 의해 플라이휠(10)에 발생되는 버스트 포스(F)가 강재질로 이루어진 커버플레이트(10b)의 탄성력에 의해 흡수· 완화되거나 또는 제거되고 이로 인해, 상기 커버플레이트(10b)의 모서리부위인 노치 부위로 집중되는 버스트 포스(F)에 의한 균열의 발생을 예방할 수 있게 된다.

또한, 본 발명의 플라이휠(10)은 클러치의 빈번한 조작에 의한 클램핑로드(F')에 의해 클러치플레이트(22)와 마찰플레이트(10d)사이에서 마찰열이 발생되면, 상기 마찰플레이트(10d)에 접촉된 인서트플레이트(10c)로 전달됨과 더불어 마찰플레이트(10d)의 측면 테두리를 따라 형성된 다수의 슬릿(10d')을 통해 보다 빠른 열의 방출이 이루어지게 된다.

이때, 상기 인서트플레이트(10c)로 전달된 마찰열이 방열되는 것보다 적층되는 것이 클 경우에는 인서트플레이트(10c)가 팽창하게 되지만, 이때 상기 인서트플 레이트(10c)가 이를 수용한 커버플레이트(10b)내에서 약 1.00 - 1.50mm 정도의 갭(K)을 유지하므로 열팽창에 의한 커버플레이트(10b)와의 간섭을 방지할 수 있게 됨은 물론이다.

발명의 효과

이상 설명한 바와 같이 본 발명에 의하면, 플라이휠이 링기어가 외주 측에 압입되면서 크랭크축에 결합되는 부분과 클러치 조작에 따라 클러치플레이트로부터 클램핑 로드를 받는 부분으로 분리 제작한 후 서로 조립· 결합시켜, 플라이휠이 적용되는 차종에 관계없이 플라이휠에서 발생되는 버스트포스에 의한 크랙과 클램핑로드에 따른 마찰열의 방열성을 향상시킬 수 있어 내구성을 강화할 수 있는 효과가 있게 된다.

(57) 청구의 범위

**청구항 1.**
링기어(11)가 압입되어 크랭크축(5)에 결합되는 지지플레이트(10a)와, 이 지지플레이트(10a)에 고정된 일단으로부터 절곡되어 그 내부로 수용공간을 형성하는 커버플레이트(10b), 이 커버플레이트(10b)의 안쪽에서 보고정되는 인서트플레이트(10c) 및 상기 커버플레이트(10b)내에 삽입· 고정되어 클러치 조작 시 클러치어셈블리(20)의 클러치플레이트(22)와 접촉되어 마찰력을 발생하는 마찰플레이트(10d)로 이루어진 방열과 강성 강화용 플라이 휠.

**청구항 2.**
제 1항에 있어서, 상기 지지플레이트(10a)와 인서트플레이트(10c)는 주철로 이루어지는 반면, 상기 커버플레이트(10b)는 탄성을 갖는 강재질로 이루진 것을 특징으로 하는 방열과 강성 강화용 플라이 휠.

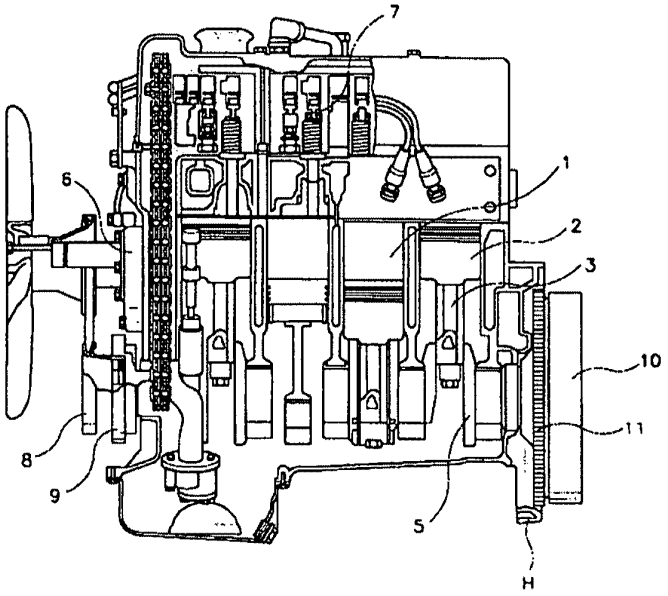
**청구항 3.**
제 1항에 있어서, 상기 인서트플레이트(10c)는 열팽창에 의해 커버플레이트(10b)와의 간섭을 방지하도록 갭(K)을 형성하는 것을 특징으로 하는 방열과 강성 강화용 플라이 휠.

**청구항 4.**
제 3항에 있어서, 상기 갭(K)은 약 1.00 - 1.50mm 정도인 것을 특징으로 하는 방열과 강성 강화용 플라이 휠.

**청구항 5.**
제 1항에 있어서, 상기 마찰플레이트(10d)는 클러치 조작에 따른 클러치플레이트(22)와의 마찰열을 외부로 발산하도록 그 측면 테두리를 따라 다수의 슬릿(10d')이 형성되어진 것을 특징으로 하는 방열과 강성 강화용 플라이 휠.

도면

도면1

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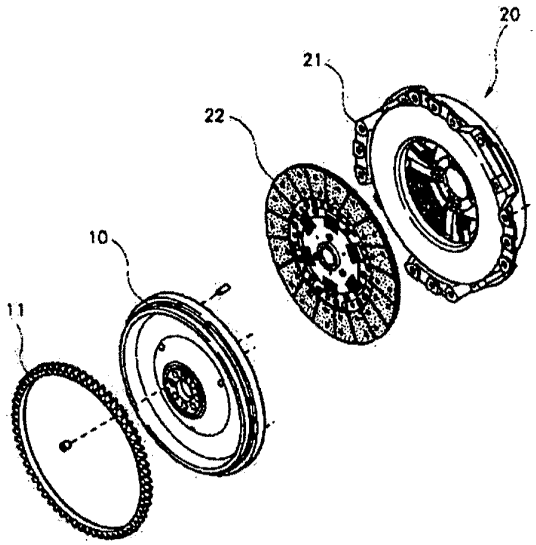
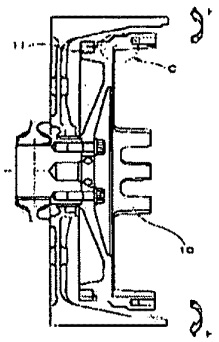
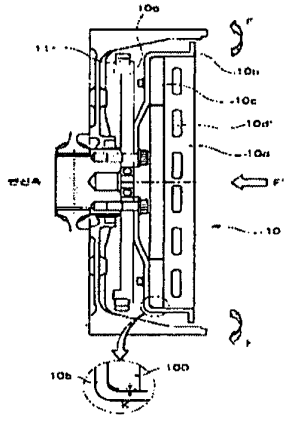


도면3



도면4



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 November 2001 (01.11.2001)

PCT

(10) International Publication Number
WO 01/82297 A1

(51) International Patent Classification[7]: G11B 7/24

(21) International Application Number: PCT/EP01/04028

(22) International Filing Date: 9 April 2001 (09.04.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
00201488.4 20 April 2000 (20.04.2000) EP

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(81) Designated States *(national)*: CA, CN, JP, KR, MX, RU.

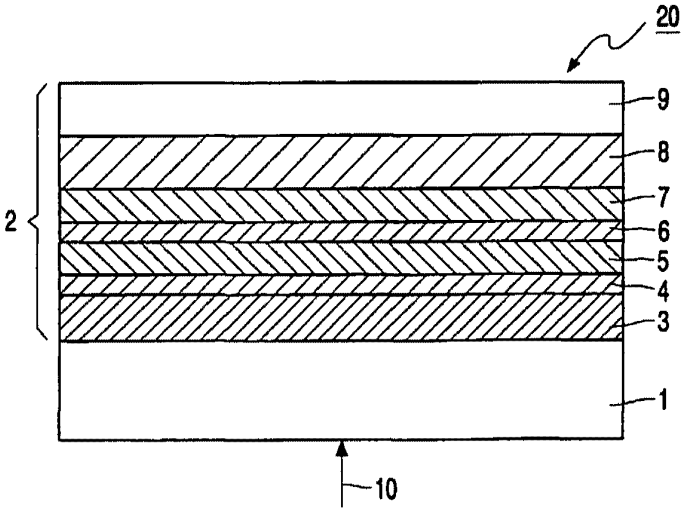
(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

**Published:**
— *with international search report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*



(54) Title: OPTICAL RECORDING MEDIUM AND USE OF SUCH OPTICAL RECORDING MEDIUM




(57) Abstract: The optical recording medium (20) has a substrate (1) and a stack (2) of layers provided thereon. A phase change recording layer (5), having a melting point $T_{mp}$ is sandwiched between a first (3) and a second (7) dielectric layer. A crystallization-accelerating layer (4, 6) is being interposed in contact with the recording layer (5). Further a reflective layer (8) is present and an optional cover layer (9). The crystallization-accelerating layer (4, 6) consists of a binary metal alloy or a semiconductor and has a melting point $T_{mg}$ at least 250 °C higher than the melting point $T_{mp}$ of the recording layer (5) and has a crystal structure similar to the crystalline state of the recording layer (5).

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Optical recording medium and use of such optical recording medium

The invention relates to an optical recording medium having a substrate and a stack of layers provided thereon, the stack comprising a recording layer, having a melting point $T_{mp}$ and being able to change between an amorphous and a crystalline state, sandwiched between a first and a second dielectric layer, the first being adjacent to the substrate, a crystallization accelerating layer being interposed in contact with the recording layer, and a reflective layer.

The invention also relates to the use of such an optical recording medium.

An optical recording medium of the type mentioned in the opening paragraph is known from Japanese patent application JP-09161316 A. In the known medium the state of the recording layer locally changes from crystalline to amorphous when data are optically recorded.

Optical data storage based on the phase change principle is attractive, because it combines the possibilities of direct overwrite (DOW) and high storage density with easy compatibility with read-only optical data storage systems. Phase-change optical recording involves the formation of submicrometer-sized amorphous recording marks in a crystalline film using a focused relatively high power laser-light beam. During recording information, the medium is moved with respect to the focused laser-light beam that is modulated in accordance with the information to be recorded. Due to this, quenching takes place in the phase-change recording layer and causes the formation of amorphous information bits in the exposed areas of the recording layer that remains crystalline in the unexposed areas. Erasure of written amorphous marks is realized by recrystallizing through heating with the same laser at an intermediate power level, without melting the recording layer. The amorphous marks represent the data bits, which can be read, e.g. via the substrate, by a low-power focused laser-light beam. Reflection differences of the amorphous marks with respect to the crystalline recording layer bring about a modulated laser-light beam which is subsequently converted by a detector into a modulated photocurrent in accordance with the recorded digital information.

One of the most important demands in phase-change optical recording is a high data rate, which means that data can be written in and read from the medium with a rate of at least 30Mbits/s. A high data rate requires the recording layer to have a high crystallization rate, i.e. a short crystallization time. To ensure that the previously recorded amorphous marks can be crystallized during direct overwrite, the recording layer should have a proper crystallization time to match the velocity of the medium relative to the laser-light beam. If the crystallization speed is not high enough to match the velocity of the medium relative to the laser-light beam the amorphous marks from the previous recording, representing old data, cannot be completely erased, meaning recrystallized, during DOW. This causes a high noise level. A high crystallization speed is particularly required in high-density recording and high data rate applications, such as disc-shaped DVD+RW, DVR-red and blue which are abbreviations of new generation high density Digital Versatile Disc+RW, where RW refers to the rewritability of such discs, and Digital Video Recording optical storage discs, where red and blue refer to the used laser wavelength. For these new discs the complete erasure time (CET) has to be at most 60 ns. CET is defined as the minimum duration of the erasing pulse for complete crystallization of a written amorphous mark in a crystalline environment, which is measured statically. For DVD+RW, which has a 4.7 GB recording density per 120 mm disk, a user data bit rate of 33 Mbits/s is needed, and for DVR-red said rate is 35 Mbits/s. For rewritable phase change optical recording systems such as DVR-blue, a user data rate higher than 50 Mbits/s is required.

The known medium of the phase-change type comprises a disc-shaped substrate carrying a stack of layers consisting, in succession, of a first dielectric layer, a $Sb_2Te_3$ layer as crystallization accelerating layer, a Sb layer as a composition correcting layer, a recording layer of a phase-change $Sb_{72}Te_{28}$ alloy, a second dielectric layer and a metal reflective layer. Such a stack of layers can be referred to as an INP'PIM structure, wherein M represents a reflective or mirror layer, I represents a dielectric layer and P represents a phase-change recording layer while P' represents a composition correction layer which mixes with the recording layer at first recording. A crystallization accelerating layer N of $Sb_2Te_3$, has been arranged between the first dielectric layer and the correction and the recording layer to achieve a fast crystallization of the medium during erasing information in the medium by means of a laser-light beam. In the known recording medium the N layer has a melting point of 618°C, only 68°C higher than the melting point 550°C of the P layer. The melting point of the known N layer is relatively close to the melting point of the P layer causing the N layer to dissolve in the correction and recording layer P'P after one or at best a few recording/erasure

cycles, whereafter the crystallization accelerating layer N is no longer present and its crystallization-accelerating action is lost.

For complete erasure of an amorphous mark, two processes occur, i.e. nucleation and grain (crystallite) growth. An investigation of the known recording medium has revealed that the known crystallization-accelerating layer N is merely a nucleation-promoting layer.

It is a disadvantage of the known medium that its crystallization accelerating layer only functions for at most a few recording and erasing cycles. This is not sufficient for modern erasable media, which require a stable performance for at least a thousand of recording and erasing cycles.

It is an object of the invention to provide an optical recording medium of the kind described in the opening paragraph, which is suitable for high speed rewritable optical recording, having a CET-value of at most 60 ns.

It is another object of the invention to provide an optical recording medium of the kind described in the opening paragraph, which is suitable for rewritable optical recording, having a stable performance for at least $10^3$ recording and erasing cycles.

This object is achieved in accordance with the invention by an optical recording medium as described in the opening paragraph, which is characterized in that the crystallization accelerating layer

- comprises a material selected from the group consisting of binary metal alloys, semiconductors elements and semiconductor alloys and
- has a melting point $T_{mg}$ at least 250°C higher than the melting point $T_{mp}$ of the recording layer and
- has a crystal structure similar to the crystalline state of the recording layer.

The crystallization accelerating layer according to the invention, which will also be abbreviated as G, yields a high crystallization speed of the recording layer because the amorphous marks of the recording layer are in contact with the G-layer. This accelerates the crystallite growth process, leading to a higher crystallization speed. Especially because the crystal structure of the G-layer is similar to, or even the same as, the structure of the crystalline state of the recording layer the crystallization rate of amorphous marks is advantageously increased. The crystal structure of the G-layer then serves as a very good grain growth initialization or nucleation layer for crystallite growth in the recording layer.

The G-layer is always present adjacent to a thermally isolating layer, here the first or second dielectric layer, because a stack having a G-layer between the recording layer and the substrate or the reflection layer cannot realize the desired thermal properties.

An advantage of the G-layer, comprising a material selected from the group consisting of binary metal alloys, semiconductors and semiconductor alloys, is that it has a high melting point. This counteracts dissolving of the G-layer in the recording layer and maintenance of the crystalline structure for a large number of recording and erasing cycles. During recording, the maximum temperature in the recording layer is about 800°C, which is about 1.4 times $T_{mp}$ for a recording layer with a $T_{mp}$ of 550°C. This may be deduced from a temperature calculation based on the presented laser energy during recording and the physical properties of the stack. The melting temperature $T_{mg}$ of the G-layer has to be above this maximum temperature so that the G-layer remains in crystalline state when the recording layer is melted.

Therefore, the melting temperature difference between recording layer and G-layer should be 250°C or larger, but preferably 300°C or larger, taking into consideration a safety margin.

Preferred materials, which may be used as G-layer, are PbTe, $Ag_2Te$, CrTe, Ge and Si.

In an embodiment of the recording medium the G-layer is arranged between the recording layer and the second dielectric layer. The thickness of the G-layer may be chosen between 0.1 and 10 nm. The thermal conductivity of the crystallization-accelerating layer is generally comparable to that of the recording layer, which is an alloy of metals. However this only has a small effect on the thermal behaviour of the stack because the thickness of the G-layer is generally relatively small compared to the other layers in the stack. This facilitates the thermal design of the stack.

In another embodiment the crystallization time is reduced further in that a second G-layer is arranged between the recording layer and the first dielectric layer. Thus a G-layer is arranged on both sides of the recording layer. The second G-layer may be of a material similar or identical to the material of the other G-layer. The crystallization time is reduced because now a crystalline layer, which accelerates the crystallite growth process, is present against the recorded amorphous mark on both sides. The thicknesses of the G-layers are between 0.1 and 10nm, preferably lower than 5 nm.

In a specific embodiment the two G-layers present on either side of the recording layer are substantially equal both in thickness and in composition. Equal in

thickness means to within 10% of each other. The equality of the thicknesses is advantageous in the manufacturing of the medium. In general the stack is deposited by evaporation or by sputtering in a vacuum chamber, where substrates move stepwise along a series of stations having targets of different compositions. The dwell time at each station is about equal, and the thickness of the layer deposited at a station is determined in part by switching the deposition process on and off. Consequently, the deposition of a relatively thin layer may require less time than available at a station, whereas the deposition of a relatively thick layer may even require two adjacent stations having the same target. It is therefore advantageous to choose to replace a relatively thick layer and a relatively thin layer by two layers of about equal thickness and composition, thereby reducing the number of deposition stations and the manufacturing time of a stack.

In a specific embodiment the recording layer comprises an alloy of Q, In, Sb and Te, wherein Q is selected from the group consisting of Ag and Ge.

The preferred composition comprises $Q_a\ In_b\ Sb_c\ Te_d$ (in atomic percentages), wherein Q is selected from the group consisting of Ag and Ge;

$2 \leq a \leq 9$

$0 < b \leq 6$

$55 \leq c \leq 80$

$16 \leq d \leq 30$; $a + b + c + d = 100$.

In another specific embodiment the recording layer comprises a compound of Ge, Sb and Te. The preferred composition of this compound is defined by the formula $Ge_{50x}Sb_{40-40x}Te_{60-10x}$ (in atomic percentages), wherein $0.166 \leq x \leq 0.444$;

the recording layer having a thickness of 5 to 35 nm;

This composition exists on a part of the line connecting the compounds GeTe and $Sb_2Te_3$ in the triangular Ge-Sb-Te composition diagram and includes the stoichiometric compounds $Ge_2Sb_2Te_5$ (x = 4/9), $GeSb_2Te_4$ (x = 2/7) and $GeSb_4Te_7$ (x = 1/6). Especially these ternary stoichiometric compounds are preferred, because these materials crystallize rapidly since no segregation is required during crystallization.

The first and second dielectric layers are preferably made of a mixture of ZnS and $SiO_2$, e.g. $(ZnS)_{80}(SiO_2)_{20}$. The layers may alternatively be made of $SiO_2$, $TiO_2$, $Ta_2O_5$, ZnS, AlN and/or $Si_3N_4$. The dielectric layer through which the laser light enters the stack preferably has a thickness of 70 to $(70+\lambda/2n)$ nm wherein n is the refractive index of the first dielectric layer and $\lambda$ is the wavelength of the read/write laser-light beam. If the total

thickness is smaller than 70 nm, the cyclability is reduced considerably. The cyclability is measured by the relative change of the optical contrast $M_0$ after a large number of DOW-cycles, e.g. $10^3$. The optical contrast $M_0$ is defined as $|R_C-R_A|/R_C$, where $R_C$ and $R_A$ are the reflections of the recording material in the crystalline and amorphous state respectively. Another way to define cyclability is related to jitter increase of the medium. Jitter is a measure of the distortion of the shape of a recording mark, and is measured as a time shift of rising and falling edges in the information signal. The jitter of the medium should be at a low, constant level during at least $10^3$ DOW-cycles.

As mentioned above the total thickness of the first dielectric layer is preferably smaller than $(70+\lambda/2n)$ nm. A larger total thickness does not further increase the cyclability and is more expensive to make. If for example the wavelength is equal to 630 nm and the refractive index is 1.5, the thickness range extends from 70 nm to 280 nm.

The dielectric layer, which is closest to the reflective layer, has a thickness of 10 to 40 nm. Preferably the thickness of the dielectric layer adjacent to the reflective layer is larger than or equal to 15 nm. A smaller thickness results in an increased cooling rate of the recording layer and, consequently, an undesirable increase in the write power. The thickness is preferably smaller than 40 nm. A larger thickness decreases the thermal contact between the recording layer and the reflective layer too much, resulting in too low a cooling rate of the recording layer and a worse recording performance.

The reflective layer may comprise metals such as Al, Ti, Au, Ni, Cu, Ag and Cr, and alloys of these metals. The reflective layer preferably has a thickness of 60 to 120 nm.

Both the reflective layers and the dielectric layers generally have been provided by vapour deposition or sputtering.

Optionally an outermost layer may be present on the stack as a cover layer that protects the underlying layers from the environment. The cover layer is made of, for example, an UV light-cured poly(meth)acrylate.

Another specific embodiment is characterized in that the reflective layer is present between the substrate and the first dielectric layer. Optionally a cover layer, that is transparent for laser-light and has a surface which allows optical recording of information into and reading of information from the underlying recording layer with a focused laser-light beam is present on top of the stack. Thus in this embodiment the optical recording medium is written in and read out through the cover layer. This method is used in the new DVR discs that were mentioned above. The cover layer of a DVR disc has a thickness of about 100

micrometers. This cover layer allows the use, in optical disc recorders, of a read/write lens with a high numerical aperture that is necessary for high density recording and reading. Because the laser light enters the medium through the cover layer it may be necessary to adjust the thicknesses of the layers of the stack in order to optimize for optimal optical contrast between recorded and unrecorded areas.

The term high-speed recording, which was mentioned above, is to be understood to mean in this context a linear velocity of the medium relative to the laser-light beam of at least 7.2 m/s, which is six times the speed according to the Compact Disc standard. The use of an optical recording medium according to the invention is therefore advantageous because the crystallization rate is fast enough to permit at least this recording velocity. The important parameter is the CET (in ns), which is defined above. The CET is inversely proportional to the crystallization rate.

The substrate of the information medium generally is transparent to the laser wavelength, and is made, for example, of polycarbonate, polymethyl methacrylate (PMMA), amorphous polyolefin or glass. In a typical example, the substrate is disc-shaped and has a diameter of 120 mm and a thickness of 1.2 mm, 0.6 mm or 0.1 mm for respectively low, medium and high information density applications.

Alternatively, the substrate may be in the form of a synthetic resin flexible tape, made e.g. from a polyester film. This flexible tape, with a stack of layers deposited thereon, is called an optical tape and can be suited for use in an optical tape recorder, which is for example based on a fast spinning polygon. In such a device the reflected laser-light beam scans transversely across the tape surface.

The surface of the disc-shaped substrate on the side of the recording layer is, preferably, provided with a servotrack that can be scanned optically. This servotrack is often constituted by a spiral-shaped groove and is formed in the substrate by means of a mould during injection moulding or pressing. This groove can be alternatively formed in a replication process in a synthetic resin layer, for example, of an UV light-cured layer of acrylate, which is separately provided on the substrate. In high-density recording such a groove has a pitch e.g. of 0.5 - 0.8 μm and a width of about half the pitch.

High-density recording and erasing can be achieved by using a short-wavelength laser, e.g. with a wavelength of 675 nm or shorter (red to blue).

The phase change recording layer as well as the G-layer can be applied by vapour depositing or sputtering of a suitable target. The recording layer thus deposited is amorphous and exhibits a low reflection. In order to constitute a suitable recording layer

having a high reflection, this layer must first be completely crystallized, which is commonly referred to as initialization. For this purpose, the recording layer can be heated in a furnace to a temperature just above the crystallization temperature of the e.g. Ge-In-Sb-Te or Ge-Sb-Te compound, e.g. 200°C. A synthetic resin substrate, such as polycarbonate, to which a high temperature may cause damage, can alternatively be heated by a laser-light beam of sufficient power. This can be realized, e.g. in a recorder, in which case a laser beam scans the moving recording layer. The amorphous layer is then locally heated to the temperature required for crystallizing the layer, without the substrate being subjected to a disadvantageous heat load.

If desired, an additional, optically transparent, metal layer M' can be interposed in the stack, thereby forming a so called MIRIM'-structure, wherein R represents a layer stack comprising a recording layer and at least one crystallization accelerating layer according to the present invention. Although the structure becomes more complicated, the additional metal layer increases the cooling rate of the recording layer as well as the optical contrast $M_0$.

Embodiments of the optical recording medium of the invention will be described with reference to the drawings.

In the drawings:

Fig. 1 shows a schematic cross sectional view of a first embodiment of the optical recording medium.

Fig. 2. shows a view as shown in FIG.1 of a second embodiment.

Fig. 3 shows a view as in FIG.2 of a third embodiment.

In Fig. 1 the optical recording medium 20 has a substrate 1 and a stack 2 of layers provided thereon. The substrate 1 may be made of, for example, a sheet of plastic, e.g. polycarbonate, or glass. In Fig. 1 the stack 2 comprises a phase change recording layer 5, having a melting point $T_{mp}$ and being able to change between an amorphous and a crystalline state, that is sandwiched between a first 3 and a second 7 dielectric layer, the first 3 being adjacent to the substrate 1. In this embodiment both the first dielectric layer 3 and the second dielectric layer 7 are made of the material $(ZnS)_{80}(SiO_2)_{20}$ and have a thickness of 125 nm and 20 nm respectively. A crystallization accelerating layer 6, abbreviated as G-layer, is interposed in contact with the recording layer 5, which comprises an alloy of Q, In, Sb and

Te, wherein Q is selected from the group consisting of Ag and Ge. A reflective layer 8 is present on top of the stack 2. Reflective layer 8 is a 100 nm layer of Al or an aluminium alloy, e.g. AlCr or AlTi. The crystallization accelerating layer 6 comprises a binary metal alloy or a semiconductor element or semiconductor alloy and has a melting point $T_{mg}$ at least 250°C higher than the melting point $T_{mp}$ of the recording layer 5. The crystal structure of these materials is similar to the crystalline state of the recording layer 5. In this embodiment the recording layer 5 is made of $Ge_{6.2}In_{3.2}Sb_{71.1}Te_{19.6}$, which has a thickness of 12 nm. The embodiment shown has a cover layer 9 that may be made of an organic material, e.g. a UV-cured resin. A focused laser-light beam with a wavelength $\lambda$=405 nm enters the medium through the substrate 1. This beam is diagrammatically illustrated by means of an arrow 10 in Fig. 1.

In this embodiment, when using PbTe as G-layer, which has a thickness of 3 nm, the CET has been measured to be equal to 40 ns, which is sufficiently short to allow high-speed recording. When no G-layer is present a minimal CET value of 48 ns can be obtained. Other preferred materials as G-layer are $Ag_2Te$, CrTe, Ge or Si. The melting points $T_{mg}$ of bulk PbTe, $Ag_2Te$, CrTe, Ge and Si are 914, 960, 1292, 936 and 1414°C respectively. The write power for the medium is relatively low and is 9 mW at the entrance face of the medium at a relative speed between the radiation beam and the medium of 7.2 m/s. The $R_A$ and $R_C$ are measured to be 4.3% and 23% respectively.

The cyclability is measured as the number of rewrite cycles where the jitter has increased to 12% of the clock time $T_C$. The jitter is the standard deviation of the difference between the rising and falling edges in the information signal and the data clock recovered from the information signal. As an example, for a standard CD format written with the so-called EFM code at the CD speed of 1.2 m/s and clock time of 230 ns, the jitter should be lower than 28 ns. The number of overwrite cycles before deterioration of the medium becomes noticeable, e.g. the jitter has increased to 12% of the clock time, is larger than $10^3$. The jitter of a pattern read from the medium as a function of the overwrite cycle does not show a large overshoot.

During writing, the recording layer 5 of $Ge_{6.2}In_{3.2}Sb_{71.1}Te_{19.6}$ is heated to a temperature of about 750°C, well above its melting temperature, which is about 550°C. The temperature during recording is below the melting temperature of the G-layer 6 comprising PbTe. The high melting temperature of the material used for the G-layer neighbouring the recording layer 5 therefore results in an increased cyclability of the recording medium.

In application JP-09161316 A the crystallization accelerating layer N of $Sb_2Te_3$, which has a melting point of 618°C, is thus heated above its melting temperature, causing the atoms in the layer to become mobile. These atoms are then able to diffuse into the recording layer. The properties of the recording layer are affected by the influx of foreign atoms, resulting in a deterioration of the recording process.

In Fig. 2 and Fig. 3 corresponding reference numerals denote the same layers as in Fig. 1.

In Fig. 2 a second crystallization accelerating layer 4 similar to the crystallization accelerating layer 6 is arranged between the recording layer 5 and the first dielectric layer 3. Now G-layers 4, 6 are present on both sides adjacent to the recording layer 5. The G-layer 6 is made of PbTe and has a thickness of 1.5 nm. The second G-layer 4 is substantially equal both in thickness and in composition to the G-layer 6. The recording layer 5 has a thickness of 10 nm. Further the characteristics of the stack 2 are the same as in Fig. 1. The CET is measured to be 36 ns. The CET in this embodiment is smaller than in the embodiment with only one G-layer. The $R_A$ and $R_C$ are measured to be 4.6% and 22% respectively.

In Fig. 3 the reflective layer 8 is present between the substrate 1 and the first dielectric layer 3. In this embodiment the laser light 10 is entering the stack 2 through the cover layer 9 which has a thickness of 100 μm. The cover layer 9 has a uniform thickness, thereby improving the optical read and write performance in underlying recording layers when the read or write laser beam passes through said cover layer 9. For example a 100 μm cover layer 9 is used for the new 60 mm radius Digital Video Recording (DVR) disc. This disc is recorded in and read out through this cover layer 9, which therefore has to be of good optical quality. Preferably, the cover layer 9 is 100+/-3 μm thick up to radius 58.5 mm. The cover layer 9 is made from a UV-cured resin. Dielectric layer 3 and 7 have a thickness of 20 nm and 125 nm respectively and are made of the same dielectric material as in Fig. 1. G-layer 4, 6 are made of the same material as in Fig. 2 and both have a thickness of 1.5 nm. Recording layer 5 has a thickness of 10 nm. For characteristics that are not specifically mentioned reference is made to the description of Fig. 1.

Preferably, for all embodiments, the surface of the disc-shaped substrate 1 on the side of the stack 2 is provided with a servotrack that can be scanned optically. This servotrack is often constituted by a spiral-shaped groove and is formed in the substrate by means of a mould during injection moulding or pressing. This groove can be alternatively formed in a replication process in a synthetic resin layer, for example, of an UV light-cured

layer of acrylate, which is separately provided on the substrate 1. In high-density recording such a groove has a pitch e.g. of 0.5 - 0.8 μm and a width of about half the pitch.

In a modification of the recording medium of Fig. 3, the recording layer 5 comprises an alloy of Ge, Sb and Te, e.g. $Ge_2Sb_2Te_5$.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

According to the invention an optical recording medium is provided, which is suitable for high speed recording, e.g. with a possible data rate higher than 50 Mbits/s, and which is suitable for direct overwrite for a least $10^3$ times.

CLAIMS:

1. An optical recording medium (20) having a substrate (1) and a stack (2) of layers provided thereon, the stack comprising a recording layer (5), having a melting point $T_{mp}$ and being able to change between an amorphous and a crystalline state, sandwiched between a first (3) and a second (7) dielectric layer, the first (1) being adjacent to the substrate (1), a crystallization accelerating layer (4, 6) being interposed in contact with the recording layer (5), and a reflective layer (8), characterized in that the crystallization accelerating layer (4, 6)

- comprises a material selected from the group consisting of binary metal alloys, semiconductors elements and semiconductor alloys and
- has a melting point $T_{mg}$ at least 250°C higher than the melting point $T_{mp}$ of the recording layer (5) and
- has a crystal structure similar to the crystalline state of the recording layer (5).

2. An optical recording medium (20) as claimed in Claim 1 characterized in that the crystallization accelerating layer (4, 6) comprises a material selected from the group consisting of PbTe, $Ag_2Te$, CrTe, Ge and Si.

3. An optical recording medium (20) as claimed in any of Claims 1 or 2, characterized in that the crystallization accelerating layer (6) is arranged between the recording layer (5) and the second dielectric layer (7).

4. An optical recording medium (20) as claimed in Claim 3, characterized in that a second crystallization accelerating layer (4) similar to the crystallization accelerating layer (6) is arranged between the recording layer (5) and the first dielectric layer (3).

5. An optical recording medium (20) as claimed in Claim 4, characterized in that the second crystallization accelerating layer (4) is substantially equal both in thickness and in composition to the crystallization accelerating layer (6).

6. An optical recording medium (20) as claimed in Claim 1, characterized in that the recording layer (5) comprises an alloy of Q, In, Sb and Te, wherein Q is selected from the group consisting of Ag and Ge

7. An optical recording medium (20) as claimed in Claim 1, characterized in that the recording layer (5) comprises an alloy of Ge, Sb and Te.

8. An optical recording medium (20) as claimed in Claim 1, characterized in that the reflective layer (8) is present between the substrate (1) and the first dielectric layer (3).

9. The use of an optical recording medium (20), which medium is claimed in any one of the preceding claims, characterized in that the linear velocity of the medium relative to a laser-light beam (10) is at least 7.2 m/s.

1/1

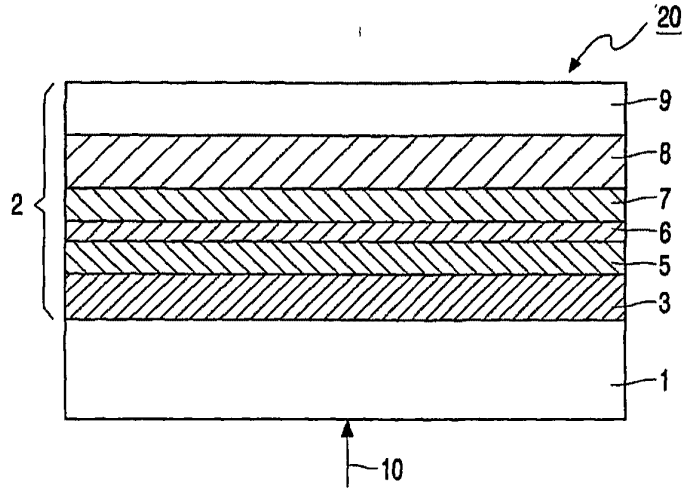


FIG. 1

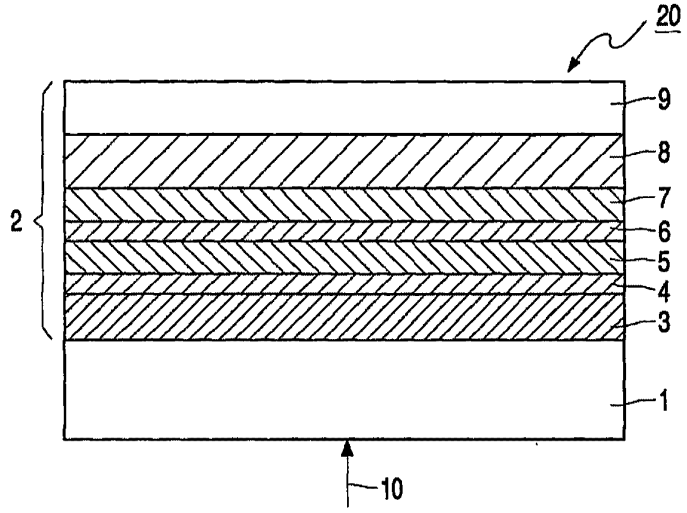


FIG. 2

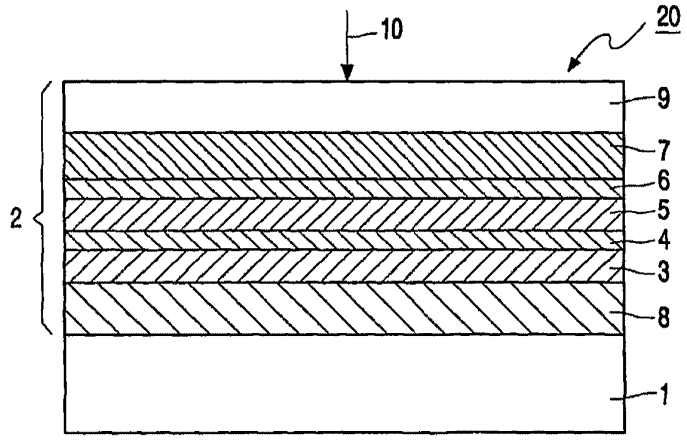


FIG. 3

# INTERNATIONAL SEARCH REPORT

Ir tional Application No
PCT/EP 01/04028

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G11B7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | EP 0 980 068 A (ASAHI CHEMICAL IND)<br>16 February 2000 (2000-02-16)<br>abstract<br>paragraph '0012! - paragraph '0019!<br>paragraph '0038!; figure 1 | 1,2,7 |
| Y | | 8 |
| A | | 3,4,9 |
| Y | EP 0 431 489 A (HITACHI LTD)<br>12 June 1991 (1991-06-12)<br>column 16, line 28 - line 56; figure 18 | 8 |

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 8 August 2001 | 16/08/2001 |

| Name and mailing address of the ISA | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL – 2280 HV Rijswijk<br>Tel. (+31–70) 340–2040, Tx. 31 651 epo nl,<br>Fax: (+31–70) 340–3016 | Annibal, P |

Form PCT/ISA/210 (second sheet) (July 1992)

## INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 01/04028

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category ° | Citation of document, with indication,where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | EP 0 945 860 A (MATSUSHITA ELECTRIC IND CO LTD) 29 September 1999 (1999-09-29) abstract paragraph '0017! paragraph '0018! paragraph '0034! paragraph '0035! paragraph '0050! paragraph '0084!; figures 1,2 --- | 1,3-7,9 |
| X | PATENT ABSTRACTS OF JAPAN vol. 018, no. 552 (P-1815), 20 October 1994 (1994-10-20) & JP 06 195747 A (NEC CORP), 15 July 1994 (1994-07-15) abstract --- | 1,7,9 |
| X | PATENT ABSTRACTS OF JAPAN vol. 017, no. 384 (P-1575), 19 July 1993 (1993-07-19) -& JP 05 062249 A (MATSUSHITA ELECTRIC IND CO LTD), 12 March 1993 (1993-03-12) abstract --- | 1,7,9 |
| X | EP 0 843 874 A (PHILIPS ELECTRONICS NV) 27 May 1998 (1998-05-27) column 25, line 10 -column 26, line 38; examples 10,11 ----- | 1,7 |

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 01/04028

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| EP 0980068 A | 16-02-2000 | AU 724629 B | 28-09-2000 |
| | | AU 6851698 A | 11-11-1998 |
| | | CN 1252885 T | 10-05-2000 |
| | | WO 9847142 A | 22-10-1998 |
| EP 0431489 A | 12-06-1991 | JP 2804130 B | 24-09-1998 |
| | | JP 3198224 A | 29-08-1991 |
| | | AU 3684393 A | 17-06-1993 |
| | | AU 6770890 A | 29-08-1991 |
| | | CA 2031672 A,C | 07-06-1991 |
| | | DE 69032001 D | 05-03-1998 |
| | | DE 69032001 T | 18-06-1998 |
| | | EP 0802530 A | 22-10-1997 |
| | | US 5583840 A | 10-12-1996 |
| EP 0945860 A | 29-09-1999 | CN 1233042 A | 27-10-1999 |
| | | JP 11339311 A | 10-12-1999 |
| | | TW 419654 B | 21-01-2001 |
| JP 06195747 A | 15-07-1994 | NONE | |
| JP 05062249 A | 12-03-1993 | JP 3049864 B | 05-06-2000 |
| EP 0843874 A | 27-05-1998 | WO 9745830 A | 04-12-1997 |
| | | JP 11509941 T | 31-08-1999 |
| | | TW 419645 B | 21-01-2001 |
| | | US 6009384 A | 28-12-1999 |

Form PCT/ISA/210 (patent family annex) (July 1992)

PATENT
Customer No. 22,852
Attorney Docket No. 9140.0016-00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|---|---|---|
| In re Application of: | ) | |
| | ) | |
| ZHANG, Hongmei et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| | ) | |
| Filed: March 16, 2002 | ) | |
| | ) | |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | Confirmation No.: 6938 |

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

Sir:

**PETITION FOR EXTENSION OF TIME**

Applicant petitions for a two month extension of time to reply to the Office action of September 9, 2006. The Commissioner is hereby authorized to charge the fee of $450.00 to Deposit Account No. 06-0916.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: February 6, 2007

By: _____
Gary J. Edwards
Reg. No. 41,008

**EXPRESS MAIL LABEL NO.**
**EV 955594467 US**

02/12/2007 EFLORES 00000096 060916 10101863
01 FC:1252 450.00 DA

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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# PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

| Application or Docket Number | Filing Date | ☐ To be Mailed |
|---|---|---|
| 10/101,863 | 03/16/2002 | |

## APPLICATION 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), (b), or (c)) | N/A | N/A | N/A | | | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | | | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | | | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | | OR | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | | | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

| AMENDMENT 02/06/2007 | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE ($) | SMALL ENTITY ADDITIONAL FEE ($) | OR | OTHER THAN SMALL ENTITY RATE ($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * 36 | Minus | ** 39 | = 0 | X $25 = | 0 | OR | X $ = | |
| Independent (37 CFR 1.16(h)) | * 3 | Minus | ***5 | = 0 | X $100 = | 0 | OR | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | TOTAL ADD'L FEE | 0 | OR | TOTAL ADD'L FEE | |

| AMENDMENT | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) | OR | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | | OR | X $ = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | | OR | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | 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.

Legal Instrument Examiner:
Stella Little

PATENT
Customer No. 22,852
Attorney Docket No. 9140.0016-00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|---|---|---|
| In re Application of: | ) | |
| ZHANG, Hongmei et al. | ) | Group Art Unit: 2823 |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| Filed: March 16, 2002 | ) | |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | Confirmation No.: 6938 |

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

Sir:

**TWELFTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(c)**

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(c), Applicant brings to the attention of the Examiner the documents on the attached listing. This Information Disclosure Statement is being filed after the events recited in Section 1.97(b) but, to the undersigned's knowledge, before the mailing date of either a Final action, Quayle action, or a Notice of Allowance. Under the provisions of 37 C.F.R. § 1.97(c), the Commissioner is hereby authorized to charge the fee of $180.00 as specified by Section 1.17(p) to Deposit Account No. 06-0916.

Copies of the listed non-patent literature documents are attached. A copy of the U.S. patent publications is not enclosed.

Applicant respectfully requests that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claim in the application and Applicant determines that the cited documents do not constitute "prior art" under United States law, Applicant reserves the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

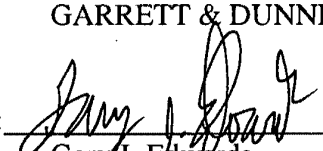
Applicant further reserves the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: March 19, 2007

By: 
Gary J. Edwards
Reg. No. 41,008

**EXPRESS MAIL LABEL NO.**
**EV 977728611 US**

IDS Form PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

Sheet 1 of 1

| Complete if Known | |
|---|---|
| *Application Number* | 10/101,863 |
| *Filing Date* | March 16, 2002 |
| *First Named Inventor* | ZHANG, Hongmei |
| *Art Unit* | 2823 |
| *Examiner Name* | ESTRADA, Michelle |
| *Attorney Docket Number* | 9140.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] *(if known)* | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US-2001/0034106 A1 | 10-25-2001 | Moise et al. | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

## NON PATENT LITERATURE DOCUMENTS

| Examiner Initials | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| | | Response to Office Action and Terminal Disclaimer dated March 1, 2007, in U.S. Application No. 10/291,179 (Attorney Docket No. 9140.0001-00). | |
| | | Response to Office Action dated March 1, 2007, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Office Action dated March 14, 2007, in Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Response to Office Action dated February 20, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| | | Office Action dated March 6, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| | | Notice of Allowance dated February 21, 2007, in U.S. Application No. 10/789,953 (Attorney Docket No. 9140.0030-00). | |
| | | Notice of Allowance dated February 22, 2007, in U.S. Application No. 10/851,542 (Attorney Docket No. 9140.0033-00). | |

| Examiner Signature | | Date Considered | |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO. EV 977728611 US**

04-02-07

IFW

2823

PATENT
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Attorney Docket No. 9140.0016-00

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| ZHANG, Hongmei et al. | ) | Group Art Unit: 2823 |
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P.O. Box 1450
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Sir:

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Pursuant to 37 C.F.R. §§ 1.56 and 1.97(c), Applicant brings to the attention of the Examiner the documents on the attached listing. This Information Disclosure Statement is being filed after the events recited in Section 1.97(b) but, to the undersigned's knowledge, before the mailing date of either a Final action, Quayle action, or a Notice of Allowance. Under the provisions of 37 C.F.R. § 1.97(c), the Commissioner is hereby authorized to charge the fee of $180.00 as specified by Section 1.17(p) to Deposit Account No. 06-0916.

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Applicant further reserves the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: March 30, 2007

By: _____
Gary J. Edwards
Reg. No. 41,008

**EXPRESS MAIL LABEL NO.**
**EV 977728497 US**

IDS Form PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

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| Application Number | 10/101,863 |
| Filing Date | March 16, 2002 |
| First Named Inventor | ZHANG, Hongmei |
| Art Unit | 2823 |
| Examiner Name | ESTRADA, Michelle |
| Attorney Docket Number | 9140.0016-00 |

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| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US-6,391,166 B1 | 05-21-2002 | Wang | |
| | | US-20070053139 A1 | 03-08-2007 | Zhang et al. | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

## NON PATENT LITERATURE DOCUMENTS

| Examiner Initials | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| | | Response to Office Action dated March 19, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Response to Office Action dated March 30, 2007, 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Notice of Allowance dated March 26, 2007, in U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| | | Supplemental Notice of Allowance dated March 15, 2007, in U.S. Application No. 10/851,542 (Attorney Docket No. 9140.0033-00). | |
| | | Voluntary Amendment dated March 8, 2007, in TW Appl. No. 93114518 (Attorney Docket No. 9140.0033-00270). | |
| | | Application filed March 22, 2007 (Attorney Docket No. 9140.0033-01). | |

| Examiner Signature | | Date Considered | |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO. EV 977728497 US**

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

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 9140.0016-00 | 6938 |

22852 7590 05/02/2007

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

| EXAMINER | |
|---|---|
| ESTRADA, MICHELLE | |
| **ART UNIT** | **PAPER NUMBER** |
| 2823 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 05/02/2007 | 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.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/101,863 | ZHANG ET AL. | |
| | Examiner | Art Unit | |
| | Michelle Estrada | 2823 | |

*-- 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 *06 February 2007*.

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) *2-13,21-24 and 40-60* 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) *2-13,21-24 and 40-60* 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/SB/08) Paper No(s)/Mail Date *2/6/07,3/30/07,3/19/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *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 10-13, 21, 40-45 and 51-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smolanoff et al. (6,117,279) in view of Fu et al. (6,306,265).

With respect to claims 21, 40, 43 and 52, Smolanoff et al. disclose providing pulsed DC power (21) through a filter (22) to a target (16) (Col. 5, lines 50-55); providing RF bias power to a substrate (15) positioned opposite the target (Col. 5, lines 60-65); providing process gas between the target and the substrate (Col. 7, lines 25-28); wherein the filter protects a pulsed DC power supply (21) from the bias power, and wherein a plasma is created by application of the pulsed DC power to the target (Col. 6, lines 8-13) such that the target voltage opscillates between positive and negative voltages; and wherein the film is deposited by exposure of the substrate to the plasma (Col. 6, lines 30-33); using an specific type of filter is a matter of design choice depending on the quality of product needed, and it is obvious that the filter is going to work at certain frequencies. Furthermore, the limitation "the filter is a band rejection filter at a frequency of the bias power" is a structural limitation in a method claim, so no matter what filter is used, as long as the same result is achieved, as explained above.

Smolanoff et al. do not clearly disclose wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and sputtering with the target in a poisonous mode to prepare the surface.

Fu et al. disclose wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and sputtering with the target in a poisonous mode to prepare the surface (Col. 19, lines 35-40).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Smolanoff et al. and Fu et al. to enable the conditioning step of Smolanoff et al. to be performed according to the teachings of Fu et al. because one of ordinary skill in the art would have been motivated to look to alternative suitable methods of performing the disclosed conditioning step of Smolanoff et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. See MPEP 2144.07.

With respect to claims 8 and 52, Smolanoff et al. disclose wherein the process gas includes a mixture of oxygen and argon (Col. 7, lines 21-27).

With respect to claim 10, Smolanoff et al. disclose wherein the process gas further includes nitrogen (Col. 7, lines 25-26).

With respect to claim 11, Smolanoff et al. disclose wherein providing pulsed DC power to a target includes providing pulsed DC power to a target which has an area larger than that of the substrate (See fig. 1).

With respect to claims 12, 49 and 55, Smolanoff et al. disclose further including uniformly sweeping the target with a magnetic field (Col. 6, lines 1-7).

With respect to claims 13 and 50, Smolanoff et al. disclose wherein uniformly sweeping the target with a magnetic field includes sweeping a magnet in one direction across the target where the magnet extends beyond the target in the opposite direction (Col. 6, lines 1-6).

With respect to claims 56-60, One of ordinary skill in the art would have been led to the recited time pulse, bias power and frequency to routine experimentation to achieve a desire layer thickness, device dimension, device associated characteristics and device density on the finished wafer in view of the range of values disclosed.

In addition, the selection of time pulse, bias power and frequency, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and In re Aller, 105 USPQ 233

(CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Note that the specification contains no disclosure of either the critical nature of the claimed time pulse, bias power and frequency or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen time pulse, bias power and frequency or upon another variable recited in a claim, the Applicant must show that the chosen time pulse, bias power and frequency are critical. *In re Woodruf*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Claims 2-4, 6 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smolanoff et al. in view of Fu et al. as applied to claims 8, 10-13 and 21 above, and further in view of the following comments.

With respect to claims 2-4, 6 and 22-24, 41, 42, 44-48, One of ordinary skill in the art would have been led to the recited temperature, DC power, gas flow, time pulse and bias power to routine experimentation to achieve a desire layer thickness, device dimension, device associated characteristics and device density on the finished wafer in view of the range of values disclosed.

In addition, the selection of temperature, DC power, gas flow, time pulse and bias power, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935,

1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and In re Aller, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Note that the specification contains no disclosure of either the critical nature of the claimed temperature, DC power, gas flow, time pulse and bias power or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen temperature, DC power, gas flow, time pulse and bias power or upon another variable recited in a claim, the Applicant must show that the chosen temperature, DC power, gas flow, time pulse and bias power are critical. *In re Woodruf*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Claims 7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smolanoff et al. in view of Fu et al. as applied to claims 8, 10-13 and 21 above, and further in view of Le et al. (2003/0077914).

The combination of Smolanoff et al. and Fu et al. does not disclose wherein the film is an upper cladding layer of a waveguide structure and the bias power is optimized to provide planarization.

With respect to claim 7, Le et al. disclose wherein the film is an upper cladding layer of a waveguide structure and the bias power is optimized to provide planarization Page 5, Paragraph [0075].

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Smolanoff et al., Fu et al. and Le et al. to enable the film material of Smolanoff et al. to be the same according to the teachings of Le et al. because one of ordinary skill in the art would have been motivated to look to alternative suitable film materials for the disclosed film formation step of Smolanoff et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. See MPEP 2144.07.

With respect to claim 9, Le et al. disclose wherein the oxygen flow is adjusted to adjust the index of refraction of the film (Page 5, Paragraph [0076]).

***Response to Arguments***

Applicant's arguments filed 2/6/07 have been fully considered but they are not persuasive. Applicant argues that Smolanoff et al. do not disclose a target voltage that oscillates between positive and negative voltages. However, Smolanoff is using and RF bias power, which will make the voltage to oscillate between positive and negative voltages, it doesn't matter if they are using just the negative voltage it will oscillate.

Applicant argues that Smolanoff et al. is directed to deposit conducing layers. However, Applicant claim is directed to an oxide, it doesn't say it can't be a conducting

oxide. Therefore, the process suggested by Smolanoff et al. with the remaining references is encompassed by the instant claims.

***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 Michelle Estrada whose telephone number is 571-272-1858. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2800.

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).

Michelle Estrada
Primary Examiner
Art Unit 2823

ME
April 30, 2007

IDS Form PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

Sheet 1 of 3



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| Filing Date | March 16, 2002 |
| First Named Inventor | ZHANG, Hongmei |
| Art Unit | 2823 |
| Examiner Name | ESTRADA, Michelle |
| Attorney Docket Number | 9140.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| MR | | US-6,088,492 | 07-11-2000 | Kaneko et al. | |
| | | US-6,154,582 | 11-28-2000 | Bazylenko et al. | |
| | | US-2002/0191916 A1 | 12-19-2002 | Frish et al. | |
| | | US-2003/0044118 A1 | 03-06-2003 | Zhou et al. | |
| | | US 2003/0143853 A1 | 07-31-2003 | Celii et al. | |
| MR | | US 2005/0175287 A1 | 08-11-2005 | Pan et al. | |

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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 | Translation[6] |
|---|---|---|---|---|---|---|
| MR | | KR 2003-0088236 | 11-19-2003 | Hyundai Motor Co Ltd | | Abstract |
| MR | | WO 01/82297 A1 | 11-01-2001 | Koninklijke Philips Electronics N.V. | | |

## NON PATENT LITERATURE DOCUMENTS

| Examiner Initials | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| MR | | BELKIND, A. et al., "Pulsed-DC Reactive Sputtering of Dielectrics: Pulsing Parameter Effects," 43rd Annual Technical Conference Proceedings-Denver: 86-90 (April 15-20, 2000). | |
| | | SCHOLL, R., "Power Supplies for Pulsed Plasma Technologies: State-Of-The-Art And Outlook," Advances Energy Industries, Inc., pages 1-8 (1999). | |
| | | SCHOLLI, R., "Power Systems for Reactive Sputtering of Insulating Films," Advances Energy Industries, Inc., pages 1-8 (August 2001). | |
| | | Final Office Action dated October 12, 2006, in U.S. Application No. 10,291,179 (Attorney Docket No. 9140.0001-00). | |
| | | Response to Final Office Action dated November 3, 2006, in U.S. Application No. 10,291,179 (Attorney Docket No. 9140.0001-00). | |
| MR | | Office Action dated December 1, 2006, in U.S. Application No. 10,291,179 (Attorney | |

| Examiner Signature | Michelle Estrada | Date Considered | 4/26/07 |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO. EV 955594467 US**

| IDS Form PTO/SB/08: Substitute for form 1449A/PTO | | | | Complete if Known | |
|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | Application Number | 10/101,863 |
| | | | | Filing Date | March 16, 2002 |
| | | | | First Named Inventor | ZHANG, Hongmei |
| | | | | Art Unit | 2823 |
| *(Use as many sheets as necessary)* | | | | Examiner Name | ESTRADA, Michelle |
| Sheet | 2 | of | 3 | Attorney Docket Number | 9140.0016-00 |

OIPE FEB 06 2007 PATENT & TRADEMARK OFFICE IAP2

| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | Docket No. 9140.0001-00). | |
| MR | | Amendment dated October 19, 2006, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Office Action dated December 18, 2006, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Response to Office Action dated September 11, 2006 in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Office Action dated December 1, 2006, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Office Action dated October 31, 2006, in Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Response to Office Action dated December 6, 2006, in Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Supplemental Preliminary Amendment dated February 6, 2007, in U.S. Application No. 11/228,834 (Attorney Docket No. 9140.0016-02). | |
| | | Supplemental Preliminary Amendment dated February 6, 2007, in U.S. Application No. 11/191,643 (Attorney Docket No. 9140.0016-04). | |
| | | Final Office Action dated October 19, 2006, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| | | Voluntary Amendment dated July 26, 2006 in TW Appl. No. 92123625 (Attorney Docket No. 9140.0025-00270). | |
| | | Response to Final Office Action dated August 3, 2006, in U.S. Application No. 10/789,953 (Attorney Docket No. 9140.0030-00). | |
| | | Notice of Allowance dated October 23, 2006, in U.S. Application No. 10/789,953 (Attorney Docket No. 9140.0030-00). | |
| | | Office Action dated October 12, 2006, for U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| MR | | Response to Office Action dated December 21, 2006, in U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| no translation | | ~~Office Action dated September 22, 2006 from Korean Patent Office in Appl. No. 10-~~ 2005-7016055 (Attorney Docket No. 9140.0030-00202). | |
| MR | | Response to Office Action dated November 8, 2006, to the Korean Patent Office in Application No. 10-2005-7016055 (Attorney Docket No. 9140.0030-00202). | |
| | | Response to Office Action from Singapore Patent Office in Appl. No. 200505388-9, dated August 11, 2006 (Attorney Docket No. 9140.0030-00256). | |
| MR | | Final Office Action dated October 26, 2006, in U.S. Application No. 10/851,542 (Attorney Docket No. 9140.0033-00). | |

| Examiner Signature | Michelle Estrada | Date Considered | 4/26/07 |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO. EV 955594467 US**

| IDS Form PTO/SB/08: Substitute for form 1449A/PTO | | | | Complete if Known | |
|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | Application Number | 10/101,863 |
| | | | | Filing Date | March 16, 2002 |
| | | | | First Named Inventor | ZHANG, Hongmei |
| | | | | Art Unit | 2823 |
| *(Use as many sheets as necessary)* | | | | Examiner Name | ESTRADA, Michelle |
| Sheet | 3 | of | 3 | Attorney Docket Number | 9140.0016-00 |



| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | Response to Office Action dated January 26, 2007, in U.S. Application No. 10/851,542 (Attorney Docket No. 9140.0033-00). | |
| | | Preliminary Amendment dated July 21, 2006, in U.S. Application No. 11/297,057 (Attorney Docket No. 9140.0042-00). | |
| | | Supplemental Preliminary Amendment, Substitute Specification with Markings, Substitute Specification without Markings, and Replacement Drawing Sheets dated December 6, 2006 in U.S. Application No. 11/297,057 (Attorney Docket No. 9140.0042-00). | |
| | | Continuation application and Preliminary Amendment dated December 13, 2006 (Attorney Docket No. 9140.0042-01). | |
| | | Voluntary Amendment dated August 15, 2006 in TW Appl. No. 94143175 (Attorney Docket No. 9140.0042-00270). | |
| | | PCT International Search Report and Written Opinion for Application No. PCT/US05/44781 dated October 3, 2006 (Attorney Docket No. 9140.0042-00304). | |

| Examiner Signature | Michelle Estrada | Date Considered | 4/26/07 |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO. EV 955594467 US**

IDS Form PTO/SB/08 Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

| Complete if Known | |
|---|---|
| Application Number | 10/101,863 |
| Filing Date | March 16, 2002 |
| First Named Inventor | ZHANG, Hongmei |
| Art Unit | 2823 |
| Examiner Name | ESTRADA, Michelle |
| Attorney Docket Number | 9140.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| /ME/ | | US-6,391,166 B1 | 05-21-2002 | Wang | |
| /ME/ | | US-20070053139 A1 | 03-08-2007 | Zhang et al. | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

## NON PATENT LITERATURE DOCUMENTS

| Examiner Initials | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| /ME/ | | Response to Office Action dated March 19, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| /ME/ | | Response to Office Action dated March 30, 2007, 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| /ME/ | | Notice of Allowance dated March 26, 2007, in U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| /ME/ | | Supplemental Notice of Allowance dated March 15, 2007, in U.S. Application No. 10/851,542 (Attorney Docket No. 9140.0033-00). | |
| /ME/ | | Voluntary Amendment dated March 8, 2007, in TW Appl. No. 93114518 (Attorney Docket No. 9140.0033-00270). | |
| /ME/ | | Application filed March 22, 2007 (Attorney Docket No. 9140.0033-01). | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 04/26/2007 |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO. EV 977728497 US**

IDS Form PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

Sheet 1 of 1

| Complete if Known | |
|---|---|
| *Application Number* | 10/101,863 |
| *Filing Date* | March 16, 2002 |
| *First Named Inventor* | ZHANG, Hongmei |
| *Art Unit* | 2823 |
| *Examiner Name* | ESTRADA, Michelle |
| *Attorney Docket Number* | 9140.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials* | Cite No.[1] | Document Number Number-Kind Code[2] *(if known)* | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US-2001/0034106 A1 | 10-25-2001 | Moise et al. | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

## NON PATENT LITERATURE DOCUMENTS

| Examiner Initials* | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| | | Response to Office Action and Terminal Disclaimer dated March 1, 2007, in U.S. Application No. 10/291,179 (Attorney Docket No. 9140.0001-00). | |
| | | Response to Office Action dated March 1, 2007, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Office Action dated March 14, 2007, in Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Response to Office Action dated February 20, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| | | Office Action dated March 6, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| | | Notice of Allowance dated February 21, 2007, in U.S. Application No. 10/789,953 (Attorney Docket No. 9140.0030-00). | |
| | | Notice of Allowance dated February 22, 2007, in U.S. Application No. 10/851,542 (Attorney Docket No. 9140.0033-00). | |

| Examiner Signature | Michelle Estrada | Date Considered | 4/24/07 |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO.**
**EV 977728611 US**

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 10101863 | ZHANG ET AL. |
| | Examiner | Art Unit |
| | Estrada, Michelle | 2823 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

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

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 04/30/2007 | | | | | | | | |
| | 1 | - | | | | | | | | |
| | 2 | ✓ | | | | | | | | |
| | 3 | ✓ | | | | | | | | |
| | 4 | ✓ | | | | | | | | |
| | 5 | ✓ | | | | | | | | |
| | 6 | ✓ | | | | | | | | |
| | 7 | ✓ | | | | | | | | |
| | 8 | ✓ | | | | | | | | |
| | 9 | ✓ | | | | | | | | |
| | 10 | ✓ | | | | | | | | |
| | 11 | ✓ | | | | | | | | |
| | 12 | ✓ | | | | | | | | |
| | 13 | ✓ | | | | | | | | |
| | 14 | - | | | | | | | | |
| | 15 | - | | | | | | | | |
| | 16 | - | | | | | | | | |
| | 17 | - | | | | | | | | |
| | 18 | - | | | | | | | | |
| | 19 | - | | | | | | | | |
| | 20 | - | | | | | | | | |
| | 21 | ✓ | | | | | | | | |
| | 22 | ✓ | | | | | | | | |
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| | 25 | - | | | | | | | | |
| | 26 | - | | | | | | | | |
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| | 32 | - | | | | | | | | |
| | 33 | - | | | | | | | | |
| | 34 | - | | | | | | | | |
| | 35 | - | | | | | | | | |
| | 36 | - | | | | | | | | |

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 10101863 | ZHANG ET AL. |
| | Examiner | Art Unit |
| | Estrada, Michelle | 2823 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

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

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 04/30/2007 | | | | | | | | |
| | 37 | - | | | | | | | | |
| | 38 | - | | | | | | | | |
| | 39 | - | | | | | | | | |
| | 40 | ✓ | | | | | | | | |
| | 41 | ✓ | | | | | | | | |
| | 42 | ✓ | | | | | | | | |
| | 43 | ✓ | | | | | | | | |
| | 44 | ✓ | | | | | | | | |
| | 45 | ✓ | | | | | | | | |
| | 46 | ✓ | | | | | | | | |
| | 47 | ✓ | | | | | | | | |
| | 48 | ✓ | | | | | | | | |
| | 49 | ✓ | | | | | | | | |
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| | 51 | ✓ | | | | | | | | |
| | 52 | ✓ | | | | | | | | |
| | 53 | ✓ | | | | | | | | |
| | 54 | ✓ | | | | | | | | |
| | 55 | ✓ | | | | | | | | |
| | 56 | ✓ | | | | | | | | |
| | 57 | ✓ | | | | | | | | |
| | 58 | ✓ | | | | | | | | |
| | 59 | ✓ | | | | | | | | |
| | 60 | ✓ | | | | | | | | |


PATENT
Customer No. 22,852
Attorney Docket No. 10655.0016-00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| In re Application of: | ) |
| | ) |
| ZHANG, Hongmei et al. | ) Group Art Unit: 2823 |
| | ) |
| Application No.: 10/101,863 | ) Examiner: ESTRADA, Michelle |
| | ) |
| Filed: March 16, 2002 | ) |
| | ) Confirmation No.: 6938 |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) |

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

Sir:

**INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(b)**

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(b), Applicants bring to the attention of the Examiner the document on the attached listing. This Information Disclosure Statement is being filed before the mailing date of a first Office Action after the filing of a Request for Continued Examination in the above-referenced application.

Copies of the listed foreign document and non-patent literature documents are attached.

Applicants respectfully request that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claim in the application and Applicants determine that the cited documents do not constitute

"prior art" under United States law, Applicants reserve the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

Applicants further reserve the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: October 2, 2007

By: _____
Gary J. Edwards
Reg. No. 41,008

**EXPRESS MAIL LABEL NO.
EM 100825487 US**

10-04-07 RCE & IDS

# REQUEST FOR CONTINUED EXAMINATION (RCE) TRANSMITTAL


Address to:
**Mail Stop RCE**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

| Application Number: 10/101,863 | Confirmation Number: 6938 |
|---|---|
| Filing Date: March 16, 2002 | |
| First Named Inventor: ZHANG, Hongmei | |
| Group Art Unit: 2823 | |
| Examiner: ESTRADA, Michelle | |
| Attorney Docket Number: 10655.0016-00 | |

**This is a Request for Continued Examination (RCE) under 37 C.F.R. § 1.114 of the above-identified application.**

Request for Continued Examination (RCE) practice under 37 C.F.R. § 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application.

1. **Submission required under 37 C.F.R. § 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.**

   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. ☐ **DO NOT ENTER** the amendment(s) previously filed on _____. An alternate submission is attached.

   c. ☒ Enclosed submission: .

      i. ☒ Amendment/Reply  iii. ☒ Information Disclosure Statement

      ii. ☐ Affidavit(s)/Declaration(s)  iv. ☐ Other _____

2. Miscellaneous

   a. ☐ Suspension of action on the above-mentioned application is requested under 37 C.F.R. § 1.103(c) for a period of [number] months. (Period of suspension shall not exceed 3 months; fee under 37 C.F.R. § 1.17(i) required.)

   b. ☐ Other _____

3. Fees

   a. ☒ The filing fee is calculated as follows:

      i. ☒ $810.00 RCE fee required under 37 C.F.R. § 1.17(e)

      ii. ☒ Petition for extension of time for (2 Months) $460.00

      iii. ☐ Other _____

   b. ☒ The Commissioner is hereby authorized to charge the fee of $1,270.00 to deposit account no. 06-0916.

   c. ☒ The Commissioner is authorized to charge any deficiencies in the filing fees, and/or credit any overpayments to Deposit Account 06-0916.

**Signature of Applicant, Attorney, or Agent Required**

| Name: Gary J. Edwards | Reg. No.: 41,008 |
|---|---|
| Signature: Gary J. Edwards | Date: October 2, 2007 |

**EXPRESS MAIL LABEL NO.**
**EM 100825487 US**

10/05/2007 TNGUYEN2 00000052 060916 10101863

01 FC:1801 810.00 DA

PATENT
Customer No. 22,852
Attorney Docket No. 10655.0016-00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|---|---|---|
| In re Application of: | ) | |
| | ) | |
| ZHANG, Hongmei et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| | ) | |
| Filed: March 16, 2002 | ) | |
| | ) | |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | Confirmation No.: 6938 |

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

Sir:

**PETITION FOR EXTENSION OF TIME**

Applicants petition for a two-month extension of time to reply to the Final Office Action of May 2, 2007. The Commissioner is hereby authorized to charge the fee of $460.00 to Deposit Account No. 06-0916.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

10/05/2007 TNGUYEN2 00000052 060916 10101863
02 FC:1252 460.00 DA

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: October 2, 2007

By: _____
Gary J. Edwards
Reg. No. 41,008

**EXPRESS MAIL LABEL NO.**
**EM 100825487 US**

**RESPONSE UNDER 37 C.F.R. § 1.116**
**EXPEDITED PROCEDURE REQUESTED**
**EXAMINING GROUP 2820**
PATENT
Customer No. 22,852
Attorney Docket No. 10655.0016-00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| In re Application of: | ) | |
| | ) | |
| ZHANG, Hongmei et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| | ) | |
| Filed: March 16, 2002 | ) | Confirmation No.: 6938 |
| | ) | |
| For: BIASED PULSE DC REATIVE SPUTTERING OF OXIDE FILMS | ) | |

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

Sir:

## AMENDMENT

This response is being filed with a Request for Continued Examination and is in reply to the Final Office Action mailed May 2, 2007, the period for response having been extended to October 2, 2007, by a request for extension of two months with authorization for the Commissioner to charge the fee to Deposit Account No. 06-0916. Applicant amends the application as follows:

**Amendments to the Claims** are reflected in the listing of claims in this paper beginning on page 2.

**Remarks/Arguments** follow the amendment sections of this paper beginning on page 7.

**AMENDMENTS TO THE CLAIMS:**

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

1. (Cancelled)

2. (Previously presented): The method of Claim 21, further including holding the temperature of the substrate substantially constant.

3. (Previously presented): The method of Claim 21, wherein applying pulsed DC power through the filter includes supplying up to about 10 kW of power at a frequency of between about 40 kHz and about 350 kHz and a reverse time pulse between about 1.3 and 5 μs.

4. (Previously presented): The method of Claim 21, wherein adjusting an RF bias power to the substrate includes supplying up to 1000 W of RF power to the substrate.

5. (Canceled).

6. (Previously presented): The method of claim 4, wherein the RF bias power is zero.

7. (Previously presented): The method of Claim 21, wherein the RF bias power is optimized to provide planarization.

8. (Previously presented): The method of Claim 21, wherein a process gas of the process gas flow includes a mixture of Oxygen and Argon.

9. (Previously presented): The method of Claim 8, wherein the mixture is adjusted to adjust the index of refraction of the film.

10. (Previously presented): The method of Claim 8, wherein the mixture further includes nitrogen.

11. (Previously presented): The method of Claim 21, wherein applying pulsed DC power to the target includes adjusting pulsed DC power to a target which has an area larger than that of the

substrate.

12. (Previously presented): The method of Claim 21, further including uniformly sweeping the target with a magnetic field.

13. (Previously presented): The method of Claim 12, wherein uniformly sweeping the target with a magnetic field includes sweeping a magnet in one direction across the target where the magnet extends beyond the target in the opposite direction.

14.-20. (Cancelled).

21. (Currently amended): A method of depositing an oxide film on a substrate, comprising:

conditioning a target;

preparing the substrate;

adjusting an RF bias power to the substrate;

setting a process gas flow; and

applying pulsed DC power to the target ~~through a filter~~ such that ~~the~~ a target voltage oscillates between positive and negative voltages to create a plasma and deposit the oxide film; and

band rejection filtering the DC power at a frequency of the bias power before applying the DC power to the target,

wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and sputtering with the target in poisonous mode to prepare the surface~~, and~~

~~wherein the filter is a band rejection filter at a frequency of the bias power~~.

22. (Previously presented ): The method of Claim 21, wherein setting the process gas flow includes adjusting constituents in order to adjust the index of refraction of the film.

23. (Previously presented): The method of Claim 21, wherein applying pulsed DC power includes setting the frequency in order to adjust the index of refraction of the film.

24. (Previously presented): The method of Claim 21, further including adjusting a temperature of the substrate in order to adjust the index of refraction of the film.

25.-39. (Canceled).

40. (Currently amended): The method of claim 21, wherein band rejection filtering utilizes the band rejection filter is a narrow band-pass filter.

41. (Currently amended): The method of claim 21, wherein a bandwidth of the narrow band rejection filter is about 100 kHz.

42. (Previously presented): The method of claim 21, wherein the frequency of the RF bias is about 2 MHz.

43. (Currently amended): A method of depositing an oxide film on a substrate, comprising:

preparing the substrate;

adjusting an RF bias power to the substrate;

setting a process gas flow; ~~and~~

applying pulsed DC power to a target ~~through a band rejection filter at a frequency of the bias power~~ such that ~~the~~ a target voltage oscillates between positive and negative voltages and an oxide film is deposited on the substrate; and

band rejection filtering the DC power at a frequency of the bias power before applying the DC power to the target.

44. (Previously presented): The method of claim 43, wherein band rejection filtering the DC power includes utilizing a band rejection filter with a bandwidth of ~~the band rejection filter is~~ less than about 100 kHz.

45. (Previously presented): The method of claim 43, wherein the frequency of the RF bias is about 2 MHz.

46. (Previously presented): The method of Claim 43, wherein applying pulsed DC power includes supplying up to about 10 kW of power at a frequency of between about 40 kHz and about 350 kHz and a reverse time pulse between about 1.3 and 5 μs.

47. (Previously presented): The method of Claim 43, further including holding the temperature

of the substrate substantially constant.

48. (Previously presented): The method of Claim 43, wherein adjusting an RF bias power to the substrate includes supplying up to 1000 W of RF power to the substrate.

49. (Previously presented): The method of Claim 43, further including uniformly sweeping the target with a magnetic field.

50. (Previously presented): The method of Claim 49, wherein uniformly sweeping the target with a magnetic field includes sweeping a magnet in one direction across the target where the magnet extends beyond the target in the opposite direction.

51. (Currently amended): A method of depositing an oxide film on a substrate, comprising:

providing a process gas between the substrate and a target;

applying an RF bias power to the substrate;

applying pulsed DC power to the target such that ~~the~~ a target voltage oscillates between positive and negative voltages; and

narrow band rejection filtering the pulsed DC power ~~through a narrow band rejection filter~~ at a frequency of the bias power before applying pulsed DC power to the target,

wherein the oxide film is deposited on the substrate.

52. (Previously presented): The method of claim 51, wherein the process gas includes one or more gasses chosen from the group consisting of Ar, $N_2$, $O_2$, $C_2F_6$, $CO_2$, CO, $NH_3$, NO, and halide containing gasses.

53. (Previously presented): The method of claim 51, wherein the target is a metallic target.

54. (Previously presented): The method of claim 51, wherein the target is an intermetllic target.

55. (Previously presented). The method of claim 51, further including sweeping the target with a magnetic field.

56. (Previously presented): The method of claim 51, wherein the pulsed DC power is supplied with a reverse time pulse between about 1.3 and 5 μs.

57. (Previously presented): The method of Claim 51, wherein applying an RF bias power to the substrate includes supplying up to 1000 W of RF power to the substrate.

58. (Currently amended) The method of claims 21, wherein applying pulsed DC power ~~through the filter~~ includes supplying pulsed DC power at a pulse frequency of between about 40 kHz and about 350 kHz.

59. (Currently amended) The method of claim 43, wherein applying pulsed DC power ~~through the filter~~ includes supplying pulsed DC power at a pulse frequency of between about 40 kHz and about 350 kHz.

60. (Currently amended) The method of claim 51, wherein applying pulsed DC power ~~through the filter~~ includes supplying pulsed DC power at a pulse frequency of between about 40 kHz and about 350 kHz.

## REMARKS

Claims 2-13, 21-24, and 40-60 are pending in this application. The Examiner has rejected claims 2-13, 21-24, and 40-60. Applicants herein have amended claims 21, 40, 43-44, 51, and 58-60 in order to further clarify the invention. No new matter has been added in this Amendment.

### Claim Rejections Under 35 U.S.C § 103(a)1

To establish a *prima facie* case of obviousness the prior art reference (or references when combined) must teach or suggest all the claim limitations. *See* MPEP § 2142, 8th Ed., Rev. 5 (August 2006). Moreover, "in formulating a rejection under 35 U.S.C. § 103(a) based upon a combination of prior art elements, it remains necessary to identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claimed." USPTO Memorandum from Margaret A. Focarino, Deputy Commissioner of Patent Operations, May 3, 2007, page 2. As further discussed below, the Examiner has not established a *prima facia* case of obviousness at least because the prior art fails to teach all of the elements of each of the rejected claims.

#### *Claims 10-13, 21, 40-45, and 51-60*

Claims 10-13, 21, 40-45, and 51-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,117,279 to Smolanoff et al. ("Smolanoff") in view of U.S.

1 The Examiner has made multiple characterizations of the claims, the cited art, and the application of legal principles to those characterizations. Applicants shall not be deemed to agree with or to acquiesce in the Examiner's statements by not specifically addressing these characterizations in this response.

Patent No. 6,306,265 to Fu et al. ("Fu"). Claims 21, 43, and 51 are independent claims. Applicants herein traverse these rejections.

1. Neither Smolanoff nor Fu teach applying pulsed DC power to the target so that the target voltage oscillates between positive and negative voltages.

Claims 21 and 51 each recite "applying pulsed DC power to the target such that a target voltage oscillates between positive and negative voltages . . ." Claim 43 recites "applying pulsed DC power to a target such that a target voltage oscillates between positive and negative voltages . . . ." Therefore, each of the independent claims requires applying pulsed DC power to the target such that the target voltage oscillates between positive and negative voltages. Neither Smolanoff nor Fu teach this limitation. In fact, both Smolanoff and Fu teach away from this feature in that both teach that the target voltage must be at a negative potential so that the target functions as a cathode.

The Examiner states that "Smolanoff et al. discloses . . . wherein a plasma is created by application of the pulsed DC power to the target (Col. 6, lines 8-13) such that the target voltage opscillates [sic] between positive and negative voltages . . ." (Office Action, page 2). However, Smolanoff teaches away from the target voltage going positive. In fact, the Examiner's cited reference states exactly the opposite of the Examiner's assertion. that Smolanoff teaches that the target voltage oscillates between positive and negative voltages Smolanoff states that "[t]his main plasma in the region 23 becomes a source of positive ions of gas that are accelerated toward, and collide against, **the negatively charged surface of the target 16**, thereby ejecting particles of coating material from the target 16." (Smolanoff, col. 6, lines 8-13).

Smolanoff teaches in its background section that "[t]he plasma is typically generated by maintaining the target, either constantly or intermittently, **at a negative potential** so that the target functions as a cathode to supply electrons that excite the gas in the chamber and form a

plamsa adjacent to the target surface." (Smolanoff, col. 1, lines 33-37) (emphasis added). Further, in operation "[t]he gas ions accelerate toward the target, **which is negatively biased**, to collide with the target surface and eject from the target surface atoms and atomic clusters or particles of target material, as well as secondary electrons, which play a role in sustaining the plasma." (Smolanoff, col. 1, lines 41-46) (emphasis added).

Further, in describing Smolanoff's apparatus, as shown in Figure 1, Smolanoff teaches that "[t]he magnet structure 20 preferably includes magnets that produce a closed magnetic tunnel over the surface of the target 16 that traps electrons given off into the chamber 12 by the cathode assembly 17 **when the cathode assembly 17 is electrically energized to a negative potential as is familiar to one skilled in the art.**" (Smolanoff, col. 5, lines 39-44) (emphasis added).

In particular, Smolanoff teaches that the target is always negative:

> Power from the steady or pulsed DC power supply 21 and/or RF generator 24 **produces a negative potential on the target 16**. The negative potential accelerates ions towards the surface of the target which, upon impact, cause electrons to be emitted from the surface of the target 16. These electrons become trapped over the surface of the target 16 by the magnetic field generated by the magnet pack 20, until, eventually, the electrons strike and thereby ionize atoms of process gas in close proximity to the surface of the target 16, forming a main plasma in a region 23 of the volume 11 adjacent to the surface of the target 16. This main plasma in the region 23 becomes a source of positive ions of gas that are accelerated toward, and collide against, **the negatively charged surface of the target 16**, thereby ejecting particles of coating material from the target 16.

(Smolanoff, col. 6, line 66, through col. 6, line 12) (emphasis added).

Therefore, repeatedly Smolanoff teaches that the target must be negative in order to create the plasma. Smolanoff never teaches that the target is at a positive voltage, which according to the teachings of Smolanoff would not work because the positive ions of the plasma

would not then be attracted to the target. Smolanoff therefore teaches away from applying a positive voltage to the target. At a minimum, the Examiner can not maintain that Smolanoff teaches "applying pulsed DC power to the target such that a target voltage oscillates between positive and negative voltages" as is recited in claims 21 and 51 or "applying a pulsed DC power to a target such that a target voltage oscillates between positive and negative voltages" as is recited in claim 43.

Further Fu also teaches away from the target having a positive voltage. As taught in Fu, in describing a conventional PVD reactor, "[a] selectable DC power supply 22 **negatively biases the target 14 to about -600 VDC** with respect to the shield 20." (Fu, col. 1, lines 31-33) (emphasis added). Further, as was similarly taught in Smolanoff, "[w]hen the argon is admitted into the chamber, the DC voltage between the target 14 and the shield 20 ignites the argon into a plasma, and the **positively charged argon ions are attracted to the negatively charged target 14**." (Fu, col. 1, lines 51-54) (emphasis added). Therefore, Fu, like Smolanoff, teaches that the target must be negative and therefore teaches away from a positive target voltage. At a minimum, the Examiner can not maintain that Fu teaches "applying pulsed DC power to the target such that a target voltage oscillates between positive and negative voltages" as is recited in claims 21 and 51 or "applying a pulsed DC power to a target such that a target voltage oscillates between positive and negative voltages" as is recited in claim 43.

In responding to the remarks of Applicant's Amendment filed on February 6, 2007, the Examiner remarks that

> Applicant argues that Smolanoff et al. do not disclose a target voltage that oscillates between positive and negative voltages. However, Smolanoff is using and [sic] RF bias power, which will make the voltage to oscillate between positive and negative voltages, it doesn't matter if they are using just the negative voltage it will oscillate.

(Office Action, page 7). First, applying an RF bias to the substrate has negligible if any effect on the target voltage in a PVD deposition apparatus. Further, as seen in the discussion above, even if an RF voltage is applied to the target, the target achieves and maintains a negative voltage and never goes positive, as is well know in the art. Further, as is discussed in both Fu and Smolanoff, applying an RF bias to the substrate causes the substrate to become negative so as to attract the positive ions in the plasma. (*See* Smolanoff, col. 6, lines 51-63, "Such attraction of the positive ions of sputtered material toward the substrate 15 can be achieved, for example, **by applying a negative bias to the substrate 15 through the operation of the bias power supply 27**. Such bias attracts the positive sputtered ions . . . . For silicon semiconductor wafers, **this bias power supply 27 is preferably an RF generator** that operates in the range of from about 0.05 to 80 MHz." (emphasis added); Fu, col. 2, lines 36-45, "[t]he **pedestal 18** of FIG. 1, even if it is left electrically floating, **develops a DC self-bias**, which attracts ionized sputtered particles from the plasma across the plasma sheath adjacent to the pedestal 18 and deep into the hole 40 in the dielectral layer 42. **The effect can be accentuated with additional DC or RF biasing** of the pedestal electrode 18 to additionally accelerate the [positively] ionized particles extracted across the plasma sheath towards the wafer 16, thereby controlling the directionality of sputter deposition." (emphasis added)).

Therefore, neither Smolanoff nor Fu teach "applying pulsed DC power to the target such that a target voltage oscillates between positive and negative voltages" as is recited in claims 21 and 51 or "applying a pulsed DC power to a target such that a target voltage oscillates between positive and negative voltages" as is recited in claim 43. In fact, both Smolanoff and Fu teach away from a positive voltage on the target.

2. Neither Smolanoff nor Fu teach "band rejection filtering the pulsed DC power"

The Examiner identifies filter 22 shown in Figure 1 of Smolanoff as teaching the band rejection filter recited in independent claims 21, 43, and 51. Further, the Examiner comments that "using an specific type of filter is a matter of design choice depending on the quality of product needed, and it is obvious that the filter is going to work at certain frequencies." (Office Action, page 2) The Examiner further comments that "the limitation 'the filter is a band rejection filter at a frequency of the bias power' is a structural limitation in a method claim, so no matter what filter is used, as long as the same result is achieved, as explained above." (Office Action, page 2).

Claims 21, 43, and 51 have been amended such that the filtering is now a method step. Claims 21 and 43 now recite "band rejection filtering the DC power at a frequency of the bias power before applying the DC power to the target." Claim 51 now recites "narrow band rejection filtering the pulsed DC power at a frequency of the bias power before applying pulsed DC power to the target." Therefore, this limitation is now a method limitation and not a structural limitation.

Further, Smolanoff only refers to filter 22 once, and then only to identify it as "an RF filter 22." (Smolanoff, col. 5, line 58). Smolanoff does not teach that filter 22 performs the step "band rejection filtering the DC power at a frequency of the bias power" or "narrow band rejection filtering the pulsed DC power at a frequency of the bias power" as is recited in independent claims 21, 43, and 51.

Additionally, in order for the pulsed DC power applied to the target to be useful, the pulsed DC power must include substantially all of its Fourier constituents, and therefore only a band rejection filter that filters out a specific narrow band of filters can be utilized. Further, in

order that the pulsed DC power be protected from the RF bias power supply, the band rejection filter must be set to filter out the frequency of the RF bias power supply. A low pass filter, which is commonly utilized in systems such as Smolanoff, would destroy all of the low frequency components of the pulses. With a band rejection filter, all of the pulsed DC power except that within the rejected band passes to the target. Therefore, far from not mattering which filter is used, as the Examiner opines, it is extremely important that the filter be a band rejection filter that filters out the frequency of the RF bias power, as is recited in claims 21, 43, and 51. For at least this reason, claims 21, 43, and 51 are allowable over the combination of Smolanoff and Fu.

3. Neither Smolanoff nor Fu teach deposition of an oxide film

Each of claims 21, 43, and 51 recite deposition of an "oxide film." Both Smolanoff and Fu are directed towards deposition of metallic films. Smolanoff teaches away from deposition of insulating materials, as deposition of insulating materials would cause Smolanoff's reactor to become non-functional for its intended purpose.

As stated in Smolanoff, "[t]hose positive ions of sputtered material that are positively charged are capable of being electrically accelerated toward the substrate, for example, by application of a negative bias to the substrate." (Smolanoff, col. 2, lines 3-6). Smolanoff also explains this feature at col. 6, lines 51-63. Similarly, Fu teaches this same operable process in col. 2, lines 37-48. As Fu states, the substrate bias "attracts ionized sputter particles from the plasma." As is well known to those skilled in the art, when oxygen is introduced to the plasma, which is necessary to forming an oxide film, the oxygen reacts with the positive ions to form neutral particles of oxide, which are not attracted to the substrate by the RF bias on the substrate.

Both Smolanoff and Fu teach processes for ionized metal deposition or ionized metal plating (*see* Fu, col. 2, lines 47-48) and do not teach formation of oxide films on the substrate. Therefore, claims 21, 43, and 51 are allowable over the combination of Smolanoff and Fu for at least this reason.

4. Conclusion

For at least the reasons stated above, claims 21, 43, and 51 are allowable over the combination of Smolanoff and Fu. Claims 10-13 and 40-42 depend from claim 21 and are allowable over the combination of Smolanoff and Fu for at least the same reasons as is claim 21. Claims 44-45 depend from claim 43 and are allowable over the combination of Smolanoff and Fu for at least the same reasons as is claim 43. Claims 52-60 depend from claim 51 and are allowable for at least the same reasons as is claim 51.

***Claims 2-4, 6, and 22-24***

Claims 2-4, 6, and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smolanoff in view of Fu, as applied to claims 8, 10-13, and 21. As discussed above, claim 21 is allowable over the combination of Smolanoff and Fu. Claims 2-4, 6, and 22-24 depend from claim 21 and are allowable over the combination of Smolanoff and Fu for at least the same reasons as is claim 21.

***Claims 7 and 9***

Claims 7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smolanoff and Fu, as applied to claims 8, 10-13, and 21, and in view of U.S. Patent Publication No.

2003/0077914 to Le et al. ("Le"). Claim 21 is allowable over the combination of Smolanoff and Fu.

Le teaches deposition of oxides using pulsed DC processes without substrate bias. Le does not teach at least "band rejection filtering the DC power at a frequency of the bias power" or "narrow band rejection filtering the pulsed DC power at a frequency of the bias power" as is recited in independent claims 21, 43, and 51. Additionally, Le does not teach the combination of pulsed DC power and a RF bias to the substrate.

Further, one skilled in the art would not find a reason to combine Le with Smolanoff or Fu. Le is directed to deposition of oxide materials. Both Smolanoff and Fu are directed to deposition of ionized metal ions. One skilled in the art would realize that the introduction of oxygen, a reactive gas, to the processes disclosed in Smolanoff and Fu would render those processes non-functional for their intended purpose.

Therefore, claims 7 and 9 are allowable over the combination of Smolanoff, Fu, and Le.

## Conclusion

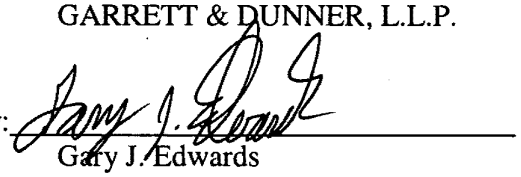
This Amendment is being filed with a Request for Continued Examination. In view of the foregoing remarks, Applicant submits that this claimed invention, as amended, is neither anticipated nor rendered obvious in view of the prior art references cited against this application. Applicant therefore requests the entry of this Amendment, the Examiner's reconsideration and reexamination of the application, and the timely allowance of the pending claims.

Please grant any extensions of time required to enter this response and charge any additional required fees to Deposit Account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: October 2, 2007

By: 
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EM 100825487 US**

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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

Sheet 1 of 1

| Complete if Known | |
|---|---|
| *Application Number* | 10/101,863 |
| *Filing Date* | March 16, 2002 |
| *First Named Inventor* | ZHANG, Hongmei |
| *Art Unit* | 2823 |
| *Examiner Name* | ESTRADA, Michelle |
| *Attorney Docket Number* | 10655.0016-00 |

## FOREIGN PATENT DOCUMENTS

| Examiner Initials* | Cite No.[1] | Foreign Patent Document<br>Country Code[1] Number[2] Kind Code[3] *(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 | Translation[4] |
|---|---|---|---|---|---|---|
| | | WO 2007/027535 A2 | 03-08-2007 | Symmorphix, Inc. | | |

## NON PATENT LITERATURE DOCUMENTS

| Examiner Initials* | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| | | Office Action dated September 22, 2006, from Korean Patent Office in Application No. 10-2005-7016055 (Attorney Docket No. 9140.0030-00202). | Yes |
| | | Office Action mailed May 21, 2007, in U.S. Application No. 10/291,179 (Attorney Docket No. 9140.0001-00). | |
| | | Final Office Action mailed April 13, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Amendment filed August 9, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Final Office Action mailed September 5, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Final Office Action mailed September 7, 2007, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Notice of Non-Compliant Amendment mailed April 12, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Response to Notice of Non-Compliant Amendment filed April 23, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Final Office Action mailed July 24, 2007 in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Response to Office Action filed July 9, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| | | Corrected Notice of Allowance mailed June 7, 2007, in U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| | | Supplemental Notice of Allowance mailed July 5, 2007, in U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| | | Second Supplemental Preliminary Amendment filed May 31, 2007, in U.S. Application No. 11/297,057 (Attorney Docket No. 9140.0042-00). | |
| | | PCT International Preliminary Report on Patentability mailed June 21, 2007, in PCT Application No. PCT/US2005/044781 (Attorney Docket No. 9140.0042-304). | |

| Examiner Signature | | Date Considered | |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO.**
**EM 100825487 US**

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 March 2007 (08.03.2007)

PCT

(10) International Publication Number
WO 2007/027535 A2

(51) International Patent Classification:
*H01G 4/06* (2006.01)

(21) International Application Number:
PCT/US2006/033315

(22) International Filing Date: 24 August 2006 (24.08.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/218,652 2 September 2005 (02.09.2005) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**
— *without international search report and to be republished upon receipt of that report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

WO 2007/027535 A2

(54) Title: DEPOSITION OF PEROVSKITE AND OTHER COMPOUND CERAMIC FILMS FOR DIELECTRIC APPLICATIONS


(57) Abstract: In accordance with the present invention, deposition of perovskite material, for example barium strontium titanite (BST) film, by a pulsed-dc physical vapor deposition process or by an RF sputtering process is presented. Such a deposition can provide a high deposition rate deposition of a layer of perovskite. Some embodiments of the deposition address the need for high rate deposition of perovskite films, which can be utilized as a dielectric layer in capacitors, other energy storing devices and micro-electronic applications. Embodiments of the process according to the present invention can eliminate the high temperature (>700 °C) anneal step that is conventionally needed to crystallize the BST layer.

# Deposition of Perovskite and Other Compound Ceramic Films for Dielectric Applications

## FIELD OF THE INVENTION

[001] The present invention is related to production and application of dielectric thin-films and, in particular, the deposition of perovskites such as Barium Strontium Titanate (BST) films and other ceramic oxides for dielectric applications.

## DISCUSSION OF RELATED ART

[002] Perovskite films, for example Barium Strontium Titanate (BST) films, are one of the attractive materials to use in capacitors for high density device applications because of its relatively high dielectric constant, low leakage current density, high dielectric breakdown strength, and ferroelectric perovskite phase that does not exhibit fatigue. However, electric properties of the perovskite films are greatly dependent on the deposition process, the substrate, the post-processing, and the related film structure. For all of the potential, thin film perovskites have rarely been utilized in manufacture primarily because of difficulties in controlling physical and chemical properties of the crystalline and amorphous phases of perovskite thin-film materials and their interactions with metallic and conductive electrodes.

[003] Solid-state thin-film devices are typically formed by stacking thin films of metal and dielectric on a substrate. The thin films typically include two metallic electrodes with a dielectric layer in between. The thin films can be deposited utilizing a number of deposition processes, including sputtering, electroplating, chemical vapor deposition, sol gel, or oxidation. Substrates suitable for these applications have conventionally been high temperature materials capable of withstanding at least one high temperature anneal process to at least 650-750 °C so as to crystallize the perovskite dielectric film in order to increase its

dielectric constant. Such a substrate can be any suitable material with appropriate structural and material properties, for example a semiconductor wafer, refractory metallic sheet (e.g., titanium, zirconium, or stainless steel), ceramic such as alumina, or other material capable of withstanding subsequent high temperature processing.

[004] However, conventional materials and production processes can limit the types of materials that can be used in device manufacture. Typically, the dielectric material is deposited in amorphous form and then the material is heated in an anneal process to form the crystalline material. Conventional formation of perovskite layers, for example, require an anneal at or above 650°C to transform the deposited amorphous film to a crystalline form. Such a high temperature anneal, however, severely limits the materials that can be utilized as the substrate, and often requires the use of expensive noble metals such as platinum to protect the substrate from reaction with the electrode material. Such high heat-treat temperatures are incompatible with standard semiconductor or MEM device processing, and limit the choice of substrate materials on which the layers can be formed, increasing the cost, and decreasing the yield of such devices formed with the layers.

[005] Therefore, there is a need for a low temperature process for depositing crystalline material, for example perovskite material and other ceramic oxides, onto a substrate.

## SUMMARY

[006] In accordance with the present invention, deposition of layers in a pulsed-DC physical vapor deposition process from a conductive ceramic target is presented. In some embodiments, the deposition can provide a low-temperature, high deposition-rate deposition of a dense amorphous layer of BST from a conductive BST target, which can be annealed at much lower temperature to yield crystalline BST. Some embodiments of the deposition address the need for low temperature, high rate deposition of perovskite films, for example

BST films, which can be utilized as the dielectric layer in high specific capacitance devices as, for example, de-coupling capacitors, energy storage devices, voltage tunable capacitors, or other micro-electronic devices.

[007] A method of depositing a perovskite or ceramic oxide layer according to some embodiments of the present invention includes placing a substrate in a reactor; flowing a gaseous mixture, for example argon and oxygen, through the reactor; and applying pulsed-DC power to a target formed of conductive perovskite or ceramic oxide material, such as BST, positioned opposite the substrate.

[008] In some embodiments the perovskite layer can be formed utilizing radio frequency (RF) sputtering. The perovskite is deposited by RF sputtering of a wide area target in the presence of a sputtering gas under a condition of uniform target erosion. The substrate is positioned opposite a planar target formed of perovskite, for example BST, the area of the target being larger than the area of the substrate. A central area of the target of the same size as the substrate and overlying the substrate is exposed to a uniform plasma condition, which provides a condition of uniform target erosion. A uniform plasma condition can be created without magnetic enhancement, termed diode sputtering, or by providing a time-averaged uniform magnetic field by scanning a magnet across the target in a plane parallel to the plane of the target.

[009] A film produced utilizing a pulsed dc, bias PVD process with a conductive ceramic target can be deposited at much higher rates than an insulating ceramic process, which requires an RF sputtering process. Further, deposition occurs with much less oxygen present in the gas flow to provide a fully oxidized film as opposed to a metallic target. The resulting film is much higher density than the low rate films. The films can be stoichiometric, uniform, highly dense, with low sintering temperatures and resulting high dielectric properties.

[010] In some embodiments, the substrate is preheated. The substrate can be heated to a temperature of about 400°C or below during deposition for low temperature perovskite deposition, or to higher temperatures for perovskite deposition on substrates capable of withstanding such temperature regime. Substrates suitable for low temperature perovskite deposition include glass, plastic, metal foil, stainless steel, and copper. A perovskite layer of thickness up to several microns thick can be deposited, although layers of any thickness can be formed.

[011] In some embodiments the perovskite layer formed on the substrate is later annealed. The anneal temperature can be as low as 400°C for low temperature anneal, and higher for perovskite deposition on substrates capable of withstanding such higher temperature regime. In some embodiments the perovskite target can be doped with transition metal dopants, for example manganese, transition elements, lanthanides (including the rare earth ions) and/or amphoteric elements.

[012] In some embodiments, a stacked capacitor structure can be formed. The stacked capacitor structure includes one or more capacitor stacks deposited on a thin substrate, wherein each capacitor stack includes: a bottom electrode layer, a perovskite, for example BST, dielectric layer deposited over the bottom electrode layer; and a top electrode layer deposited over the dielectric layer. A top conducting layer can be deposited over the capacitor stacks.

[013] In some embodiments, a capacitor structure can be formed in a cluster tool. An exemplary method of producing a capacitor in a cluster tool includes loading a substrate into the cluster tool; depositing an electrode layer over the substrate in a first chamber of the cluster tool; depositing a perovskite dielectric layer over the electrode layer in a second chamber of the cluster tool; depositing a second electrode layer over the dielectric layer in a

third chamber. In some embodiments the first and the second electrode layers can be deposited in the same chamber.

[014] A fixture for holding a thin substrate can include a top portion; and a bottom portion, wherein the thin substrate is held when the top portion is attached to the bottom portion.

[015] In some embodiments, the ceramic layer can be deposited on a substrate coated with iridium or other refractory conductive material to provide a low temperature anneal processed capacitive structure.

[016] These and other embodiments of the invention are further discussed below with reference to the following figures. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed. Further, specific explanations or theories regarding the deposition or performance of materials according to the present invention are presented for explanation only and are not to be considered limiting with respect to the scope of the present disclosure or the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

[017] Figures 1A and 1B illustrate a pulsed-DC biased reactive deposition apparatus that can be utilized in the methods of depositing according to the present invention.

[018] Figure 1C illustrates an RF sputtering deposition apparatus.

[019] Figure 2 shows an example of a target that can be utilized in the reactor illustrated in Figures 1A, 1B, and 1C.

[020] Figures 3A and 3B illustrate a thin-film capacitor design according to some embodiments of the present invention.

[021] Figures 4A, 4B, 4C, and 4D illustrate a thin substrate mount and mask arrangement that can be utilized in the deposition of dielectric perovskite layers, for example BST films, deposited according to some embodiments of the present invention.

[022] Figure 5 illustrates a cluster tool that can be utilized to form batteries with dielectric perovskite layers deposited according to some embodiments of the present invention.

[023] Figure 6 illustrates an example of stacked capacitor structure with dielectric perovskite layers deposited according to some embodiments of the present invention.

[024] In the figures, elements having the same designation have the same or similar functions.

## DETAILED DESCRIPTION

[025] In accordance with embodiments of the present invention, dielectric perovskite films or other ceramic oxide films are deposited on a substrate by a pulsed-DC physical vapor deposition (PVD) process utilizing a conductive ceramic target. In some embodiments, the film can be deposited by RF sputtering.

[026] In some embodiments, a dielectric perovskite layer, for example BST material, is deposited directly on the substrate with only low temperature anneal, eliminating the need of a subsequent high temperature anneal to crystallize the film. Removing the high temperature anneal allows for formation of capacitor structures on light-weight, low temperature, and low cost substrates such as copper foil and plastic sheet, reducing both the weight and the cost of capacitors while maintaining the high dielectric constant of the perovskite, for example BST, high-density dielectric film.

[027] Deposition of materials by pulsed-DC, RF biased reactive ion deposition is described in U.S. Patent Application Serial No. 10/101,863, entitled "Biased Pulse DC Reactive Sputtering of Oxide Films," to Hongmei Zhang, et al., filed on March 16, 2002.

Preparation of targets is described in U.S. Patent Application Serial No. 10/101,341, entitled "Rare-Earth Pre-Alloyed PVD Targets for Dielectric Planar Applications," to Vassiliki Milonopoulou, et al., filed on March 16, 2002. U.S. Patent Application Serial No. 10/101,863 and U.S. Patent Application Serial No. 10/101,341 are each assigned to the same assignee as is the present disclosure and each is incorporated herein in their entirety. Deposition of oxide materials by RF sputtering has also been described in U.S. Patent No. 6,506,289, which is also herein incorporated by reference in its entirety. Transparent oxide films can be deposited utilizing processes similar to those specifically described in U.S. Patent No. 6,506,289 and U.S. Application Serial No. 10/101,863.

[028] Figure 1A shows a schematic of a reactor apparatus 10 for sputtering material from a target 12 according to the present invention. In some embodiments, apparatus 10 may, for example, be adapted from an AKT-1600 PVD (400 X 500 mm substrate size) system from Applied Komatsu or an AKT-4300 (600 X 720 mm substrate size) system from Applied Komatsu, Santa Clara, CA. The AKT-1600 reactor, for example, has three deposition chambers connected by a vacuum transport chamber. These AKT reactors can be modified such that pulsed DC power is supplied to the target and RF power is supplied to the substrate during deposition of a material film.

[029] Apparatus 10 includes target 12, which is electrically coupled through a filter 15 to a pulsed DC power supply 14. In some embodiments, target 12 is a wide area sputter source target, which provides material to be deposited on a substrate 16. Substrate 16 is positioned parallel to and opposite target 12. Target 12 functions as a cathode when power is applied to it from the pulsed DC power supply 14 and is equivalently termed a cathode. Application of power to target 12 creates a plasma 53. Substrate 16 is capacitively coupled to an electrode 17 through an insulator 54. Electrode 17 can be coupled to an RF power supply 18. A magnet 20 is scanned across the top of target 12.

[030] For pulsed reactive DC magnetron sputtering, as performed by apparatus 10, the polarity of the power supplied to target 12 by power supply 14 oscillates between negative and positive potentials. During the positive period, the insulating layer on the surface of target 12 is discharged. To obtain arc free deposition, the pulsing frequency exceeds a critical frequency that can depend on target material, cathode current and reverse time. High quality films can be made using reactive pulse DC magnetron sputtering as shown in apparatus 10.

[031] Pulsed DC power supply 14 can be any pulsed DC power supply, for example an AE Pinnacle plus 10K by Advanced Energy, Inc. With this DC power supply, up to 10 kW of pulsed DC power can be supplied at a frequency of between 0 and 350 kHz. The reverse voltage can be 10% of the negative target voltage. Utilization of other power supplies can lead to different power characteristics, frequency characteristics and reverse voltage percentages. The reverse time on this embodiment of power supply 14 can be adjusted between 0 and 5 μs.

[032] Filter 15 prevents the RF bias power from power supply 18 from coupling into pulsed DC power supply 14. In some embodiments, power supply 18 can be a 2 MHz RF power supply, for example a Nova-25 power supply made by ENI, Colorado Springs, Co.

[033] In some embodiments, filter 15 can be a 2 MHz sinusoidal band rejection filter. In some embodiments, the band width of the filter can be approximately 100 kHz. Filter 15, therefore, prevents the 2 MHz power from the bias to substrate 16 from damaging power supply 14 while allowing the full bandwidth of the pulsed DC power supply to pass filter 15.

[034] Pulsed DC deposited films are not fully dense and may have columnar structures. Columnar structures can be detrimental to thin film applications such as barrier films and dielectric films, where high density is important, due to the boundaries between the

columns. The columns act to lower the dielectric strength of the material, but may provide diffusion paths for transport or diffusion of electrical current, ionic current, gas, or other chemical agents such as water.

[035] In the AKT-1600 based system, for example, target 12 can have an active size of about 675.70 X 582.48 by 4 mm in order to deposit films on substrate 16 that have dimension about 400 X 500 mm. The temperature of substrate 16 can be adjusted to between –50 °C and 500 °C. The distance between target 12 and substrate 16 can be between about 3 and about 9 cm. Process gas can be inserted into the chamber of apparatus 10 at a rate up to about 200 sccm while the pressure in the chamber of apparatus 10 can be held at between about .7 and 6 milliTorr. Magnet 20 provides a magnetic field of strength between about 400 and about 600 Gauss directed in the plane of target 12 and is moved across target 12 at a rate of less than about 20-30 sec/scan. In some embodiments utilizing the AKT 1600 reactor, magnet 20 can be a race-track shaped magnet with dimensions about 150 mm by 600 mm.

[036] In some embodiments of the present invention a perovskite layer is deposited by RF sputtering with a wide area target and a condition of uniform target erosion. An example apparatus 30 for RF sputtering is illustrated schematically in FIG. 1C. Apparatus 30 includes an RF power supply 60 coupled to wide area sputter source target 12 which provides material to be deposited on substrate 16. Substrate 16 is positioned parallel to and opposite target 12. Target 12 functions as a cathode when RF power is applied to it and is equivalently termed the cathode. In the present disclosure, target 12 can be formed from a perovskite material, for example BST, for deposition of dielectric perovskite film. Substrate 16 is a solid, smooth surface. Substrate 16 typically is supported on a holder or carrier sheet 17 that may be larger than substrate 16.

[037] In some embodiments, a feature of the RF sputtering method is that the area of wide area target 12 is greater than the area on the carrier sheet on which physically and

chemically uniform deposition is accomplished. Secondly, a central region on target 12, overlying the substrate 16, can be provided with a very uniform condition of sputter erosion of the target material. Uniform target erosion is a consequence of a uniform plasma condition. In the following discussion, all mention of uniform condition of target erosion is taken to be equivalent to uniform plasma condition. Uniform target erosion is evidenced by the persistence of film uniformity throughout an extended target life. A uniform deposited film is defined as a film having a nonuniformity in thickness, when measured at representative points on the entire surface of a substrate wafer, of less than about 5%. Thickness nonuniformity is defined, by convention, as the difference between the minimum and maximum thickness divided by twice the average thickness. If films deposited from a target from which more than about 20% of the weight of the target has been removed under constant process conditions continue to exhibit thickness uniformity, then the sputtering process is judged to be in a condition of uniform target erosion for all films deposited during the target life.

[038] Thus, a uniform plasma condition can be created in the region between the target and the substrate overlying the substrate. The region of uniform plasma condition is indicated in the exploded view of FIG. 1B. A plasma is created in the region denoted 51, which extends under the entire target 12. The central region of the target 52 experiences the condition of uniform sputter erosion. As discussed further below, a layer deposited on a substrate placed anywhere below central region 52 will have uniform film thickness.

[039] In addition, the region in which deposition provides uniform film thickness is larger than the area in which deposition provides a film with uniform physical or optical properties such as chemical composition or index of refraction. In the present invention the target can be planar or approximately planar for the formation of a film on a planar substrate which is to be coated with the material of the target. In practice, planarity of the target means

that all portions of the target surface in region 52 are within a few millimeters of an ideal planar surface, typically within 0.5 mm.

[040] Figure 2 illustrates an example of target 12. A film deposited on a substrate positioned on carrier sheet 17 directly opposed to region 52 of target 12 has good thickness uniformity. Region 52 is the region shown in Figure 1B that is exposed to a uniform plasma condition. In some implementations, carrier 17 can be coextensive with region 52. Region 24 shown in Figure 2 indicates the area below which both physically and chemically uniform deposition can be achieved, for example where physical and chemical uniformity provide refractive index uniformity. Figure 2 indicates region 52 of target 12 that provides thickness uniformity, which is, in general, larger than region 24 of target 12 providing thickness and chemical uniformity to the deposited film. In optimized processes, however, regions 52 and 24 may be coextensive.

[041] In some embodiments, magnet 20 extends beyond area 52 in one direction, for example the Y direction in Figure 2, so that scanning is necessary in only one direction, for example the X direction, to provide a time averaged uniform magnetic field. As shown in Figures 1A and 1B, magnet 20 can be scanned over the entire extent of target 12, which is larger than region 52 of uniform sputter erosion. Magnet 20 is moved in a plane parallel to the plane of target 12.

[042] The combination of a uniform target 12 with a target area 52 larger than the area of substrate 16 can provide films of highly uniform thickness. Further, the material properties of the film deposited can be highly uniform. The conditions of sputtering at the target surface, such as the uniformity of erosion, the average temperature of the plasma at the target surface and the equilibration of the target surface with the gas phase ambient of the process are uniform over a region which is greater than or equal to the region to be coated with a uniform film thickness. In addition, the region of uniform film thickness is greater

than or equal to the region of the film which is to have highly uniform optical properties such as index of refraction, density, transmission, or absorption.

[043] In the present disclosure, target 12 can be formed from perovskite material, such as BST, for deposition of dielectric perovskite film. In some embodiments of the present invention the perovskite target is doped with transition metal dopants, for example Manganese, transition elements, lanthanides (including the rare earth ions) and/or amphotaric elements. In some embodiments of the present invention the percentage of the dopant in the perovskite target is from 0.1 to several percent.

[044] In some embodiments of the invention, material tiles are formed. These tiles can be mounted on a backing plate to form a target for apparatus 10. A wide area sputter cathode target can be formed from a close packed array of smaller tiles. Target 12, therefore, may include any number of tiles, for example between 2 and 20 individual tiles. Tiles can be finished to a size so as to provide a margin of non-contact, tile to tile, less than about 0.010" to about 0.020" or less than half a millimeter so as to eliminate plasma processes that may occur between adjacent ones of tiles 30. The distance between tiles of target 12 and the dark space anode or ground shield 19 in Figure 1B can be somewhat larger so as to provide non contact assembly or to provide for thermal expansion tolerance during process chamber conditioning or operation.

[045] As shown in Figure 1B, a uniform plasma condition can be created in the region between target 12 and substrate 16 in a region overlying substrate 16. A plasma 53 can be created in region 51, which extends under the entire target 12. A central region 52 of target 12 can experience a condition of uniform sputter erosion. As discussed further below, a layer deposited on a substrate placed anywhere below central region 52 can then be uniform in thickness and other properties (i.e., dielectric, optical index, or material concentrations). In addition, in region 52 the deposition provides uniformity of deposited film that can be larger

than the area in which the deposition provides a film with uniform physical or optical properties such as chemical composition or index of refraction. In some embodiments, target 12 is substantially planar in order to provide uniformity in the film deposited on substrate 16. In practice, planarity of target 12 can mean that all portions of the target surface in region 52 are within a few millimeters of a planar surface, and can be typically within 0.5 mm of a planar surface.

[046] Reactive gases that provide a constant supply of oxygen to keep the target surface oxidized can be provided to expand the process window. Some examples of the gases that can be utilized for controlling surface oxidation are $O_2$, water vapor, hydrogen, $N_2O$, fluorine, helium, and cesium. Additionally, a feedback control system can be incorporated to control the oxygen partial pressure in the reactive chamber. Therefore, a wide range of oxygen flow rates can be controlled to keep a steady oxygen partial pressure in the resulting plasma. Other types of control systems such as target voltage control and optical plasma emission control systems can also be utilized to control the surface oxidation of the target. In some embodiments, power to target 12 can be controlled in a feedback loop at supply 14. Further, oxygen partial pressure controller 20 can control either oxygen or argon partial pressures in plasma 53. In some embodiments of the present invention, oxygen flow or partial pressure can be utilized to maintain a constant voltage of discharge from target 12.

[047] Figures 3A and 3B show a capacitor structure with a dielectric perovskite layer deposited according to some embodiments of the present invention. As shown in Figure 3A, a dielectric perovskite layer 302 is deposited on a substrate 301. In some embodiments, the dielectric layer 302 can be patterned in various ways before deposition of a substrate 301. In some embodiments, a first electrode layer 303 can be deposited on the substrate and the dielectric layer 302 is deposited over the first electrode layer. The second electrode layer 304 is then deposited over the dielectric layer 302. In some embodiments of

the invention, the dielectric perovskite layer 302 is crystalline and has sufficiently high dielectric constant without the necessity of a high temperature anneal. Therefore, substrate 301 can be a silicon wafer, titanium metal, alumina, or other conventional high temperature substrate, but may also be a low temperature material such as plastic, glass, or other material that may be susceptible to damage from the high temperature anneal. This feature can have the great advantage of decreasing the expense and weight of capacitor structures formed by the present invention. The low temperature deposition of perovskite material allows for successive depositions of perovskite and electrode layers, one upon another. Such a process would have the advantage that successive layers of capacitor structure would be obtained in a stacked condition without the inclusion of a substrate layer. The stacked layered capacitor would provide higher capacitance and higher energy storage than single layer devices with a smaller surface area. Additionally, a capacitor with a lower inductance can be obtained.

[048] In accordance with the present invention, perovskite films can be deposited on substrate 302 with a pulsed-DC biased PVD system as was described above. In particular, an AKT 1600 PVD system can be modified to provide an RF bias and an Advanced Energy Pinnacle plus 10K pulsed DC power supply can be utilized to provide power to a target. The pulsing frequency of the power supply can vary from about 0 to about 350 KHz. The power output of the power supply is between 0 and about 10 kW.

[049] A target of Barium Strontium Titanate with resistivity in the range of less than about megaohms can be utilized with high rate pulsed-dc sputtering. As discussed above, the target can be mounted on a monolithic backing plate as described in U.S. Provisional Application **{Attorney Docket No. 09140.6013}**, filed on August 26, 2005, which is also herein incorporated by reference in its entirety.

[050] In general, target 12 can be a dielectric material having a resistivity of less than about a megaohm, and therefore can be described as a conducting ceramic target. Target

12, which is formed of a dielectric perovskite material that may not be inherently conducting, is made conducting by formulation so as to contain an excess of metallic composition or by addition of a dopant that provides sufficient conductivity. Examples of suitable dopants include boron, antimony, arsenic, phosphorous, or other dopants. In the example of a BST target, the sintering process can be conducted in the presence of a reducing ambient to achieve a sufficiently conductive target material. Utilization of a conducting ceramic target material can be sputtered at high rates utilizing reactive pulsed-DC techniques so as to form dense stoichiometric dielectric films.

[051] Gas flows containing Oxygen and Argon can be utilized. In some embodiments, the Oxygen to Argon ratio ranges from 0 to about 50% with a total gas flow of between about 60 to about 80 sccm. The pulsing frequency ranges from about 200 kHz to about 350 kHz during deposition. RF bias can also be applied to the substrate. In many trials, the deposition rates varied from about 2 Angstrom/(kW sec) to about 1 Angstrom/(kW sec) depending on the $O_2$/Ar ratio as well as substrate bias.

[052] Figure 3A illustrates a layer of perovskite material 302 deposited on a thin substrate 301 according to some embodiments of the present invention. Substrate 301 can be formed of a thin metallic sheet (e.g., copper, titanium, stainless steel, or other suitable thin metallic sheet), can be formed of a high temperature plastic material, or may be formed of a ceramic, glass, or polymer material.

[053] Depositing materials on a thin substrate involves holding and positioning the substrate during deposition. Figures 4A, 4B, 4C, and 4D illustrate a reusable fixture 400 for holding a thin film substrate. As shown in Figure 4A, reusable fixture 400 includes a top portion 401 and a bottom portion 402 that are fastened together to secure the substrate. Thin substrate 301 is positioned between top portion 401 and bottom portion 402. As shown in Figure 7B, top portion 701 and bottom portion 702 are such that substrate 301 is brought into

a planar condition and subsequently clamped as top portion 401 is closed into bottom portion 402. Substrate 301 can be easily held by fixture 400 so that substrate 301 can be handled and positioned. In some embodiments, the corners of substrate 301, areas 403, are removed so that substrate 301 is more easily stretched by avoiding "wrap-around" corner clamping effects when top portion 401 is closed into bottom portion 402.

[054] As shown in Figure 4C, a mask 412 can be attached to fixture 400. In some embodiments, fixture 400 includes guides in order to align fixture 400 with respect to mask 412. In some embodiments, mask 412 may be attached to fixture 400 and travel with fixture 400. Mask 412 can be positioned at any desired height above substrate 301 in fixture 400. Therefore, mask 412 can function as either a contact or proximity mask. In some embodiments, mask 412 is formed of another thin substrate mounted in a fixture similar to fixture 400.

[055] As shown in Figure 4C and 4D, fixture 400 and mask 412 can be positioned relative to mount 410. Mount 410, for example, can be a susceptor, mount, or an electrostatic chuck of a processing chamber such as that shown in Figures 1A and 1B. Fixture 400 and mask 412 can have features that allow for ready alignment with respect to each other and with respect to mount 410. In some embodiments, mask 412 is resident in the processing chamber and aligned with fixture 400 during positioning of fixture 400 on mount 410, as shown in Figure 4D.

[056] Utilizing fixture 400 as shown in Figures 4A, 4B, 4C, and 4D allows processing of a thin film substrate in a processing chamber. In some embodiments, thin film substrates can be about 1 μm or more. Further, thin film substrate 301, once mounted within fixture 400, can be handled and moved from process chamber to process chamber. Therefore, a multiprocessor chamber system can be utilized to form stacks of layers,

including one or more layers of perovskite film deposited according to embodiments of the present invention.

[057] Figure 5 illustrates a cluster tool 500 for processing thin film substrates. Cluster tool 500 can, for example, include load lock 502 and load lock 503, through which mounted thin film substrate 301 is loaded and a resultant device is removed from cluster tool 500. Chambers 504, 505, 506, 507, and 508 are processing chambers for depositions of materials, heat treatments, etching, or other processes. One or more of chambers 504, 505, 506, 507, and 508 can be a pulsed-DC or RF PVD chamber such as discussed above with respect to Figures 1A, 1B, and 1C and within which a dielectric perovskite film may be deposited according to embodiments of the present invention.

[058] Processing chambers 504, 505, 506, 507, and 508 as well as load locks 502 and 503 are coupled by transfer chamber 501. Transfer chamber 501 includes substrate transfer robotics to shuttle individual wafers between processing chambers 504, 505, 506, 507, and 508 and load locks 502 and 503.

[059] In production of a thin-film capacitor, substrates are loaded into load lock 503. An electrode layer can be deposited in chamber 504, followed by a perovskite deposition performed in chamber 505. The substrate can then be removed through load lock 503 for an in-air heat treatment external to cluster tool 500. The treated wafer can then be reloaded into cluster tool 500 through load lock 502. The wafer can then again be removed from cluster tool 500 for deposition of a second electrode layer, or sometimes chamber 506 can be adapted to deposition of the second electrode layer. The process can be repeated to form a capacitor stack. The finished capacitor structure is then off-loaded from cluster tool 500 in load lock 502. Wafers are shuttled from chamber to chamber by robotics in transfer chamber 501.

[060] A capacitor structure produced according to the present invention could utilize thin film substrates loaded in a fixture such as fixture 400. Fixture 400 is then loaded into

load lock 503. Chamber 504 may still include deposition of the electrode layer. Chamber 505 then includes deposition of a perovskite layer according to embodiments of the present invention. A second electrode layer can then be deposited in chamber 506. In this process, only low temperature anneal is utilized to increase crystallinity and the dielectric constant of the perovskite layer.

[061] Another advantage of a thin film capacitor process is the ability to stack capacitor structures. In other words, substrates loaded into cluster tool 500 may traverse process chambers 504, 505, 506, 507, and 508 multiple times in order to produce multiply stacked capacitor structures. Figures 6A and 6B illustrate such structures.

[062] Figure 6A illustrates a parallel coupled stacking. As shown in Figure 6A, a substrate 301, which for example can be a high temperature plastic substrate, such as polyimide, is loaded into load lock 503. Electrode layer 303, for example, can be deposited in chamber 504. A dielectric perovskite layer 302 is then deposited on electrode layer 303. Perovskite layer 302 can be about 0.1 to 1 μm and can be deposited in chamber 505 according to embodiments of the present invention. The wafer can then be moved to chamber 506 where the next electrode layer 304 of thickness of about 0.1 μm or more is deposited. A second capacitor stack can then be deposited over the first capacitor stack formed by first electrode layer 303, perovskite layer 302, and second electrode layer 304. This capacitor stack includes second perovskite layer 305 and third electrode layer 306. In some embodiments, further stacks can be formed. In some embodiments, metal layers 303, 304, and 306 differ in the mask utilized in deposition so that tabs are formed for electrical coupling of layers.

[063] As discussed above, any number of individual capacitor stacks can be formed such that parallel capacitor formations are formed. Such a parallel arrangement of capacitor

stacking structure can be formed of alternating layers of electrode and perovskite dielectric layers and can have any number of dielectric layers.

[064] To form the structures shown in Figure 6, substrates are rotated again through the chambers of cluster tool 500 in order to deposit the multiple sets of capacitors. In general, a stack of any number of capacitors can be deposited in this fashion.

[065] Tables I and II illustrate some examples depositions of perovskite material, for example BST, according to the present invention. In these examples, the BST film is deposited using an AKT-1600 PVD (400 X 500 mm substrate size) system from Applied Komatsu. The power supply is an ENI 13.56 MHz RF power supply with a ENI matchbox. The target material is BST with resistivity in the range of kΩs or less. The target material can, for example, be sintered. Silicon wafers are used for initial experiments. 0.1-1 microns of BST films are deposited on Si wafers with various bottom electrode materials such as: n++ Si, Ir, Pt, $IrO_2$ and also $Ti_4O_7$, $Ti_3O_5$, Nb, Os. The Oxygen to Argon ratio ranges from 0 to 50%. Process pressure ranges from 3-10 mT. RF bias is applied to substrates for some of the examples. The dielectric constant of as deposited film range from 13 to 123 and increases after post-deposition anneal to more than 1000.

[066] One skilled in the art will recognize variations and modifications of the examples specifically discussed in this disclosure. These variations and modifications are intended to be within the scope and spirit of this disclosure. As such, the scope is limited only by the following claims.

TABLE 1

| Example # | Film Thickness (nm) | Target Power (W)r | Bias Power (W) | $Ar/O_2$ Ratio | Vbd | Ebd | C (PF) | Dielectric Constant |
|---|---|---|---|---|---|---|---|---|
| BST 2 | 3679 | 1500 | 100 | 50/50 | 157 | 4.267464 | 167 | 13.35 |
| BST 3 | 3736 | 1500 | 100 | 50/50 | 150 | 4.014989 | 168 | 13.64 |
| BST3-N++ 550c | 3736 | 1500 | 100 | | 40 | 1.070664 | 1670 | 135.57 |
| BST-Pt-1 | 2282 | 1500 | 100 | 50/25 | 47 | 2.059597 | 299.5 | 14.85 |
| BST Pt-1 550C | 2282 | 1500 | 100 | | 16 | 0.701139 | 5722 | 283.74 |
| BST-n++-4 | 2282 | 1500 | 100 | 50/25 | 120 | 5.258545 | 274 | 13.59 |
| BST-n++550c | 2282 | 1500 | 100 | | 30 | 1.314636 | 1970 | 97.69 |
| BST-IrO2-1 | 2310 | 1500 | 100 | 50/25 | 100 | 4.329004 | 296.2 | 14.87 |
| BST-IrO2-1 750C | 2310 | | | 50/25 | 2.4 | 0.103896 | 17700 | 888.46 |
| BST-Pt-2 | 2310 | 1500 | 100 | 50/25 | 100 | 4.329004 | 319 | 16.01 |
| BST-Pt-2 650C | 2310 | | | | 9.4 | 0.406926 | 9750 | 489.41 |
| BST-Pt-3 | 2199 | 1500 | 100 | 75/25 | 7 | 0.318327 | 2580 | 123.28 |
| BST-Pt-3 550 | 2199 | 1500 | 100 | 75/25 | 11.2 | 0.509322 | 10740 | 513.20 |
| BST IrO2-2 | 2199 | 1500 | 100 | 75/25 | 16.7 | 0.759436 | 378 | 18.06 |
| BST IrO2-2 550 | 2199 | 1500 | 100 | 75/25 | 1.4 | 0.063665 | 10400 | 496.95 |
| BST IrO2-2 650 | 2199 | 1500 | 100 | 75/25 | 6.9 | 0.313779 | 11000 | 525.62 |
| BST IrO2-2 750 | 2199 | | | 75/25 | 1.4 | 0.063665 | 21950 | 1048.85 |
| BST Pt 1 step | 2918 | 2000 | 0 | 50/50 | | | 1239 | 78.56 |
| BST Ir 1 step | 2918 | 2000 | 0 | 50/50 | | | 1180 | 74.82 |
| BST IrO2 1 step | 2918 | 2000 | 0 | 50/50 | | | 567 | 35.95 |
| BST Pt 2 steps | 1689 | 2000 | 0 | 100/0-50/50 | | | 1220 | 44.78 |
| BST Ir 2 steps | 1689 | 2000 | 0 | 100/0-50/50 | | | 1230 | 45.14 |
| BST IrO2 2 steps | 1689 | 2000 | 0 | 100/0-50/50 | | | 684 | 25.10 |

**Table II**

| Sample# | thickness | target power | bias power | Ar/O2 | dep time (sec) | Vbd | Ebd | C(PF) | Dielectric Constant, k | Vbd (V) | | C(PF) | Dielectric Constant, k (after 500C° anneal) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALDOEN++-1 | 840.4 | | | | | 70 | 8.329367 | 380 | 6.939418 | | | | |
| | 840.4 | | | | | | | 377 | 6.884633 | | | | |
| ALDOEN++-2 | 5767.2 | | | | | | | 60.5 | 7.581825 | | | | |
| | | | | | | | | 1200 | 0 | | | | |
| experiment 109 | 1000 | | | | | | | 1200 | 26.07562 | | | | |
| | 840 | | | | | 75 | 8.928571 | 405 | 7.392438 | | | | |
| ebonex,BST (A) | 1140 | 900 | 100 | | 3600 | | 0 | | 0 | | | | |
| Ir Coated #2 | 2220 | 900 | 0 | 50/50 | 5400 | | 0 | 508 | 24.50587 | | | 16800 | 810.4302 |
| | | | | | | | | | | | | 5000 | |
| | 2220 | | | | | | | | | | | 21530 | 1038.605 |
| IrO2 Coated #2 | 2220 | 900 | 0 | 50/50 | 5400 | | 0 | 365 | 17.60756 | 9 | 0.405 | 22000 | 1061.278 |
| | 2220 | | | | | | 0 | | | | | 20000 | 964.7979 |
| | | | | | | | | | | | | 19000 | |
| | | | | | | | | | | | | 9000 | |
| N++(1) | 2220 | 900 | 0 | | 5400 | 12 | 0.540541 | 290 | 13.98957 | 12 | | 2512 | 121.1786 |
| N++(2) | 840 | 900 | 100 | 50/50 | 5400 | 10 | 1.190476 | 982 | 17.92438 | 10 | | 2675 | 48.8266 |
| N++(3) | can't meas | 900 | 200 | | 5400 | | | 377 | | | | | |
| N++(4) | 1490 | 900 | 100 | 50/25 | 5400 | | 0 | 242 | 7.835289 | | | 537 | 17.38657 |
| Ti4O7 (A) | 910 | 900 | | 50/50 | | | 0 | 3030 | 59.91525 | | | 450 | 8.898305 |
| | 910 | | | | | | | 2962 | 58.57062 | | | | |
| | 910 | | | | | | | 2860 | 56.55367 | | | | |
| Ti4O7 (B) | 1490 | | | 50/25 | | | 0 | 1988 | 64.36593 | | | 314 | 10.16645 |
| | 1490 | | | | | | | 2048 | 66.30856 | | | | |
| Ir # 3 | 650 | 900 | 1000 sec no bias/ 4400sec bias 80W | 50/50 | 5400 | | | very leaky | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ir #4 | 870 | 900 | 500 sec no bias/ 4900 sec 50w bias | 50/50 | 5400 | | | very leaky | | | | | |
| Ir #5 | 2000 | 900 | 1500sec no bias/5700 sec 50W bias | 50/50 | 7200 | | | very leaky | | | | | |
| IrO2 (Tsub=450c) | 2000 | 900 | no bias | 50/50 | 5400 | 10 | 0.5 | 1390 | 60.40852 | 10 | | 5972 | 259.5393 |
| | 2000 | | | | | | | | | | | 6021 | 261.6688 |
| n++ (6)(Tsub=450c) | 934 | 900 | 75 w bias | 50/50 | 7200 | 12 | 1.284797 | 870 | 17.65711 | 12 | | 2857 | 57.98431 |
| n++ (7) (room) | 2541 | 900 | no bias | 50/50 | 5400 | | | 219 | | 13 | 0.512 | 2210 | 122.0254 |
| n++(8) (room) | 2504 | 900 | 75 w bias | 50/50 | 7200 | | | 224 | 12.18809 | 22 | 0.879 | 2218 | 120.6839 |
| n++ (9) (room) | 10000 | | 75 w bias | 50/50 | 28800 | | | 58 | 12.60322 | 55 | 0.55 | 954.7 | 207.4533 |
| n++ (10) (room) | 5000 | | 75w bias | 50/50 | 14400 | | | | | | | | |

WHAT IS CLAIMED IS:

1. A method of depositing a perovskite layer on a substrate, comprising:

placing the substrate into a reactor;

flowing a gaseous mixture through the reactor; and

providing power to a target formed of a perovskite material positioned opposite the substrate.

2. The method of claim 1, wherein providing power to the conducting target includes applying pulsed-DC power to the conducting target.

3. The method of claim 2 further including filtering the pulsed-DC power to protect a pulsed DC power supply from a bias power while allowing passage of the pulsed DC power through the filter.

4. The method of claim 2, further including supplying an RF bias power to the substrate.

5. The method of claim 1, wherein providing power to the conducting target includes applying RF power to the conducting target.

6. The method of claim 1, wherein a perovskite layer is formed on the substrate.

7. The method of claim 6, wherein the perovskite layer is a barium strontium titanite (BST) layer.

8. The method of claim 6, wherein the formed perovskite layer is more than about 0.1 micron thick.

9. The method of claim 6 wherein the formed perovskite layer is less than about 1 micron thick.

10. The method of claim 6, further comprising annealing the perovskite layer formed on the substrate.

11. The method of claim 10 wherein annealing the perovskite layer includes heating the perovskite layer to an anneal temperature of between about 500°C and about 800°C.

12. The method of claim 1, further comprising preheating the substrate before applying power to the conducting target.

13. The method of claim 12, wherein preheating the substrate including heating the substrate to a temperature of about 400 °C for low temperature perovskite deposition.

14. The method of claim 1, wherein the substrate is a low temperature substrate.

15. The method of claim 14, wherein the low temperature substrate is one of a set of substrates including glass, plastic, metal foil, copper, and stainless steel.

16. The method of claim 1 wherein the conducting target is doped with a transition metal dopant, transition element, lanthanide, and/or amphotaric elements.

17. The method of claim 16 wherein the target is doped with Manganese.

18. The method of claim 17 wherein a level of Manganese in the target is at least 0.1%.

19. The method of claim 1, wherein the perovskite target is a conductive target.

20. A capacitor structure, comprising:

a first conducting electrode layer;

a dielectric perovskite layer deposited over the first conducting electrode layer; and

a second conducting electrode layer deposited over the dielectric perovskite layer.

21. The capacitor of claim 20, wherein the first conducting layer is a copper sheet.

22. A stacked capacitor structure, comprising:

one or more capacitor stacks deposited on a substrate, wherein each capacitor stack comprises:

a bottom electrode layer,

a dielectric perovskite layer deposited over the electrode layer, and

a top electrode layer deposited over the one or more capacitor stacks.

23. The stacked capacitor structure of claim 22, wherein the capacitor stacks form a parallel stacked capacitor structure.

24. The stacked capacitor structure of claim 22, wherein the capacitor stacks form a series stacked capacitor structure.

25. A method of producing a capacitor, comprising:

loading a substrate into a cluster tool;

depositing a dielectric perovskite layer over a substrate in a chamber of the cluster tool.

26. The method of claim 25, wherein depositing the dielectric perovskite layer includes depositing perovskite film with a pulsed-DC PVD process.

27. The method of claim 25, wherein depositing the dielectric perovskite layer includes depositing perovskite film with an RF sputtering PVD process.

28. The method of claim 25, wherein depositing the dielectric perovskite layer includes depositing the perovskite material through a mask.

29. The method of claim 25, further including

depositing a bottom electrode layer on the substrate wherein the dielectric perovskite layer is deposited over the bottom electrode layer.

31. The method of claim 25, further including depositing a top electrode layer over the dielectric perovskite layer.

32. A fixture for holding a thin substrate, comprising:

a top portion; and

a bottom portion, wherein

the thin substrate is held when the top portion is attached to the bottom portion.

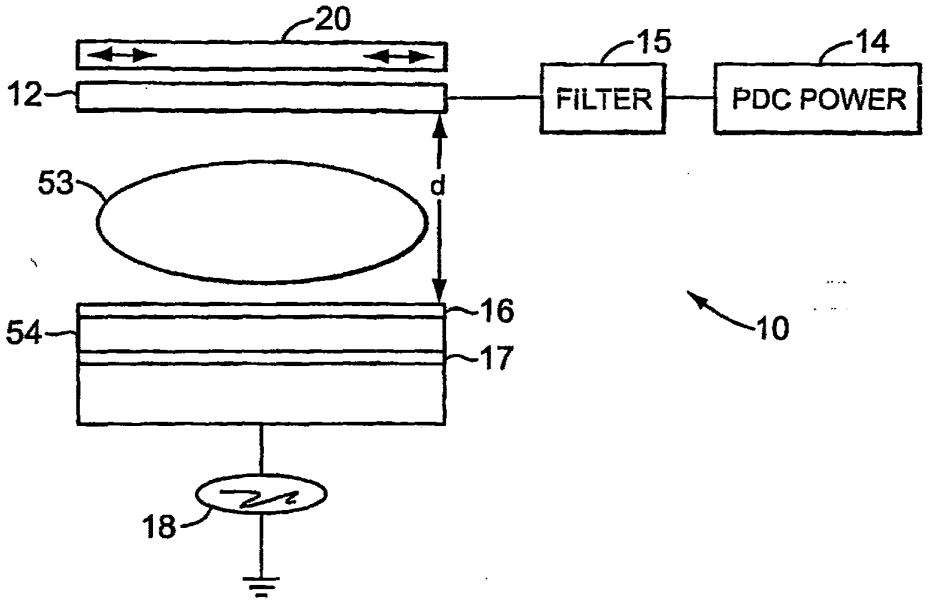
20
15
14
12
FILTER
PDC POWER
53
d
16
54
17
10
18

FIG. 1A

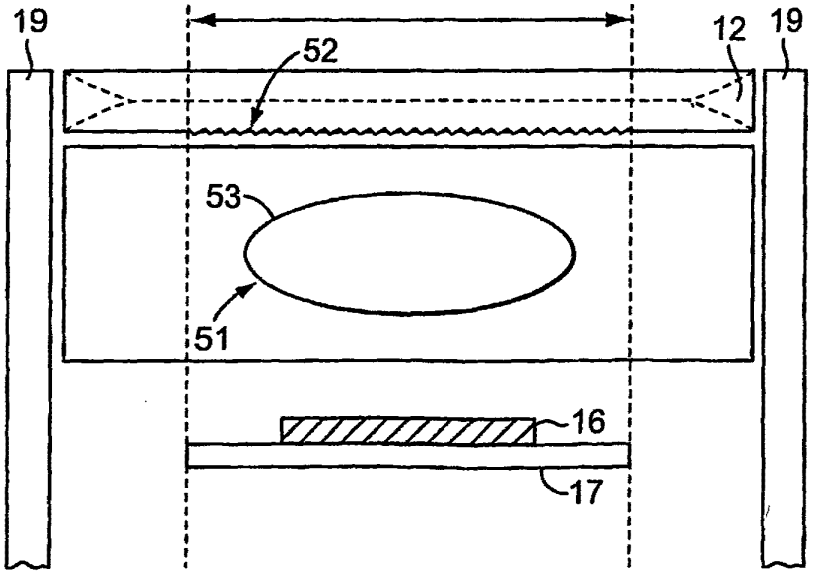
19
52
12
19
53
51
16
17

FIG. 1B

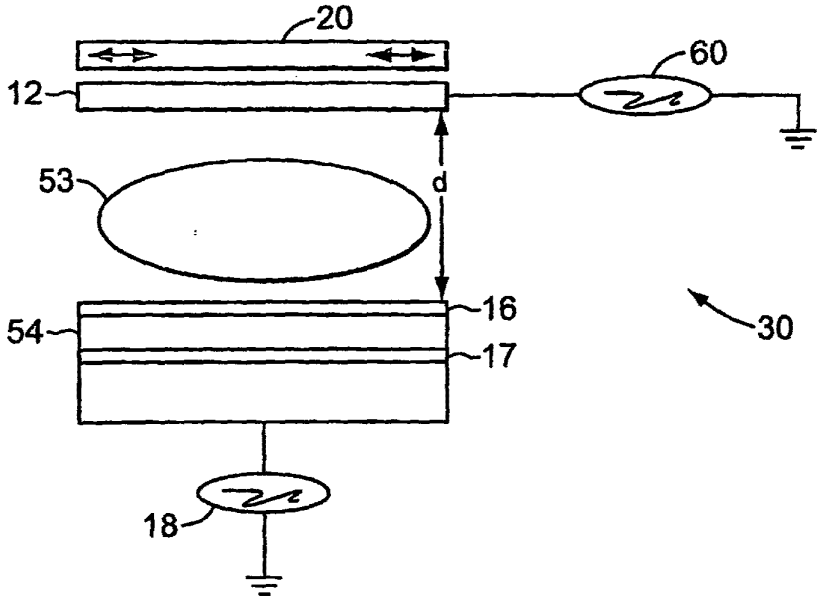


FIG. 1C

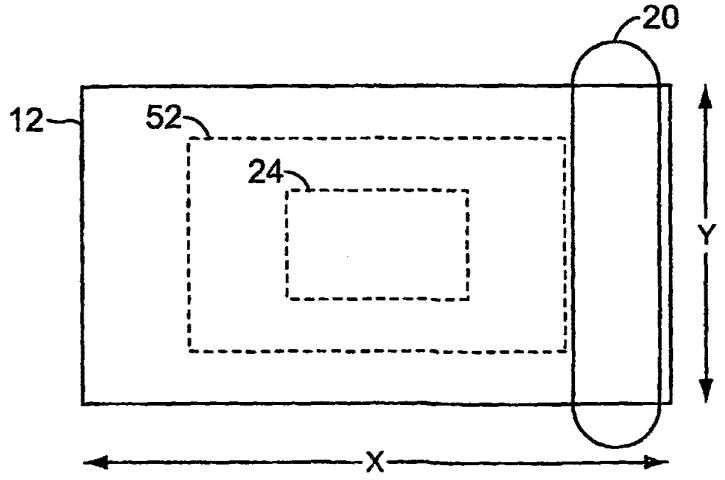


FIG. 2

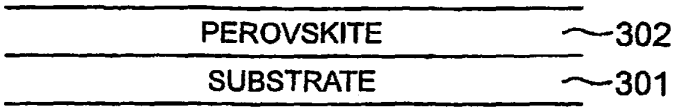


FIG. 3A

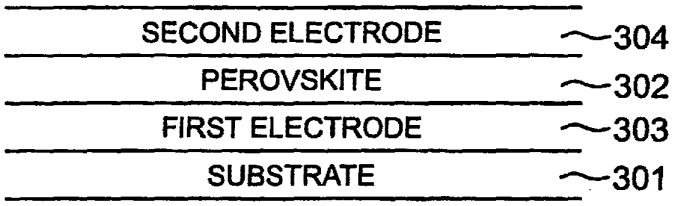


FIG. 3B

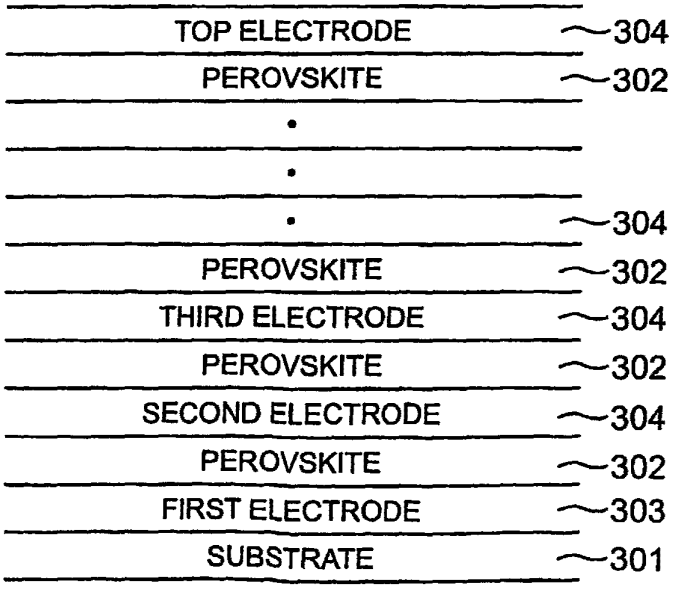


FIG. 6

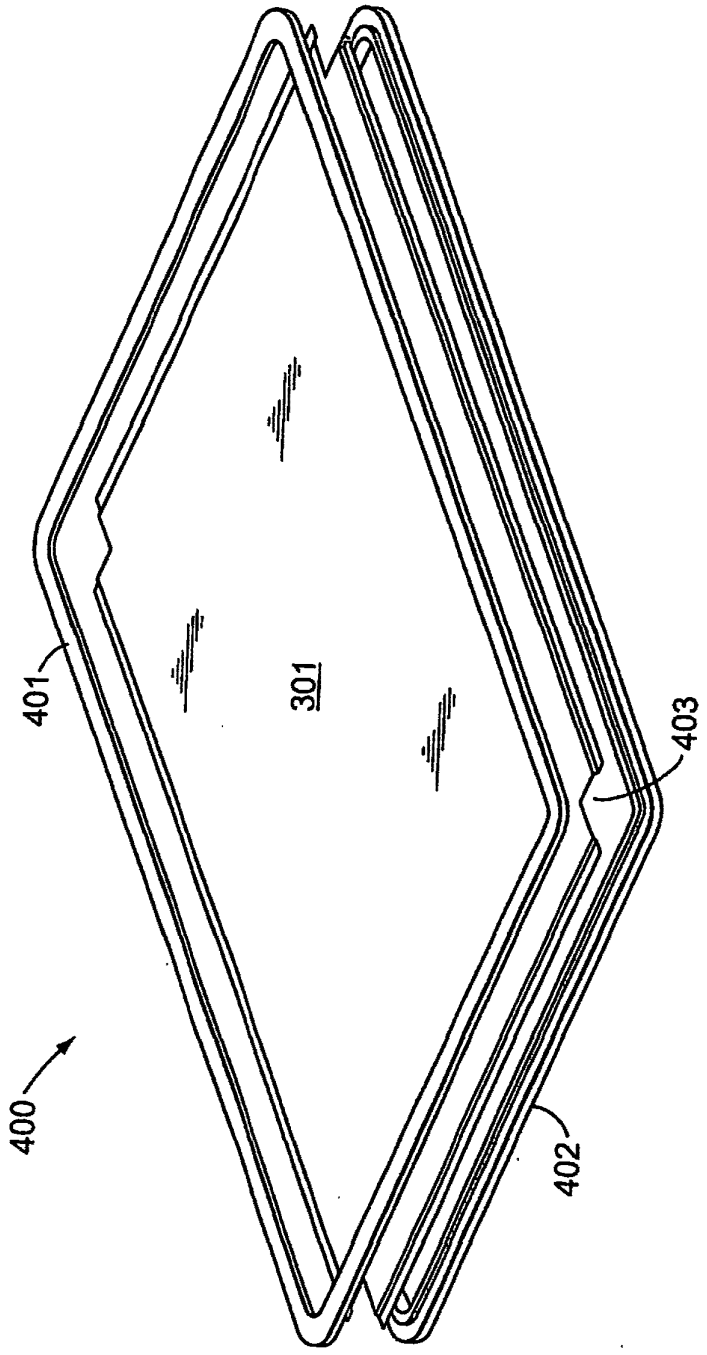


FIG. 4A

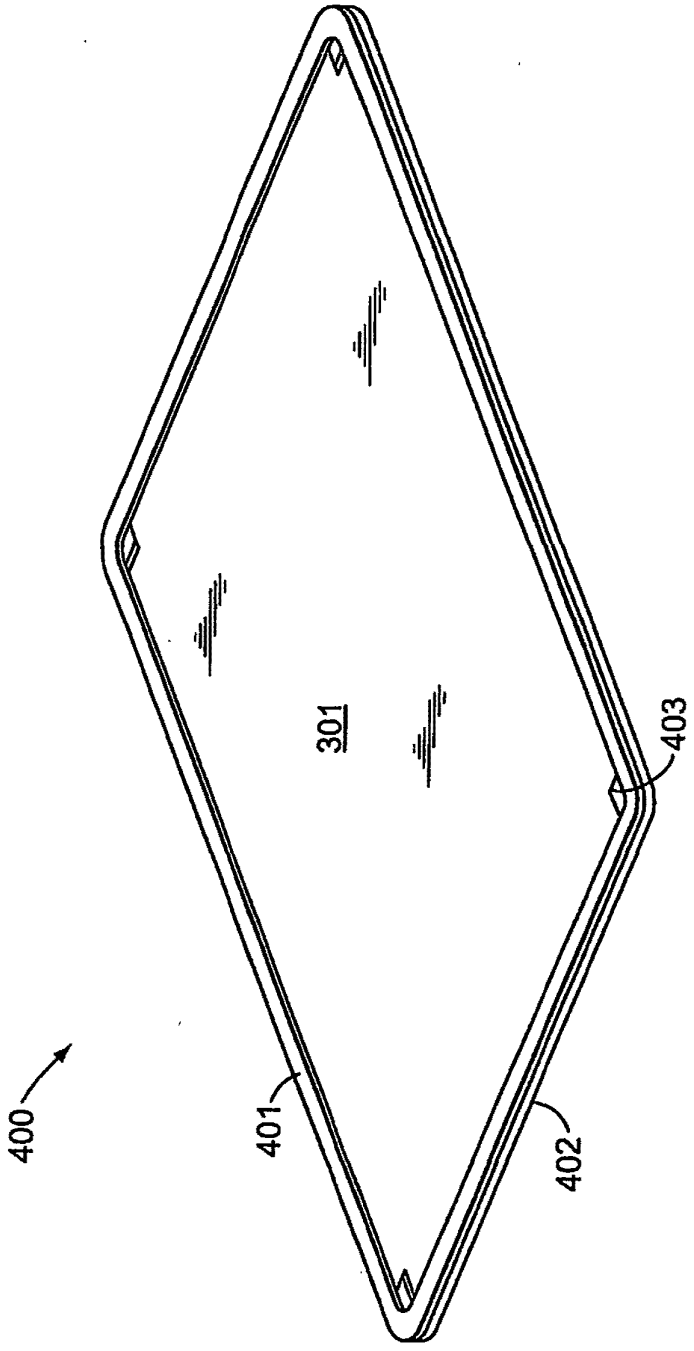


FIG. 4B

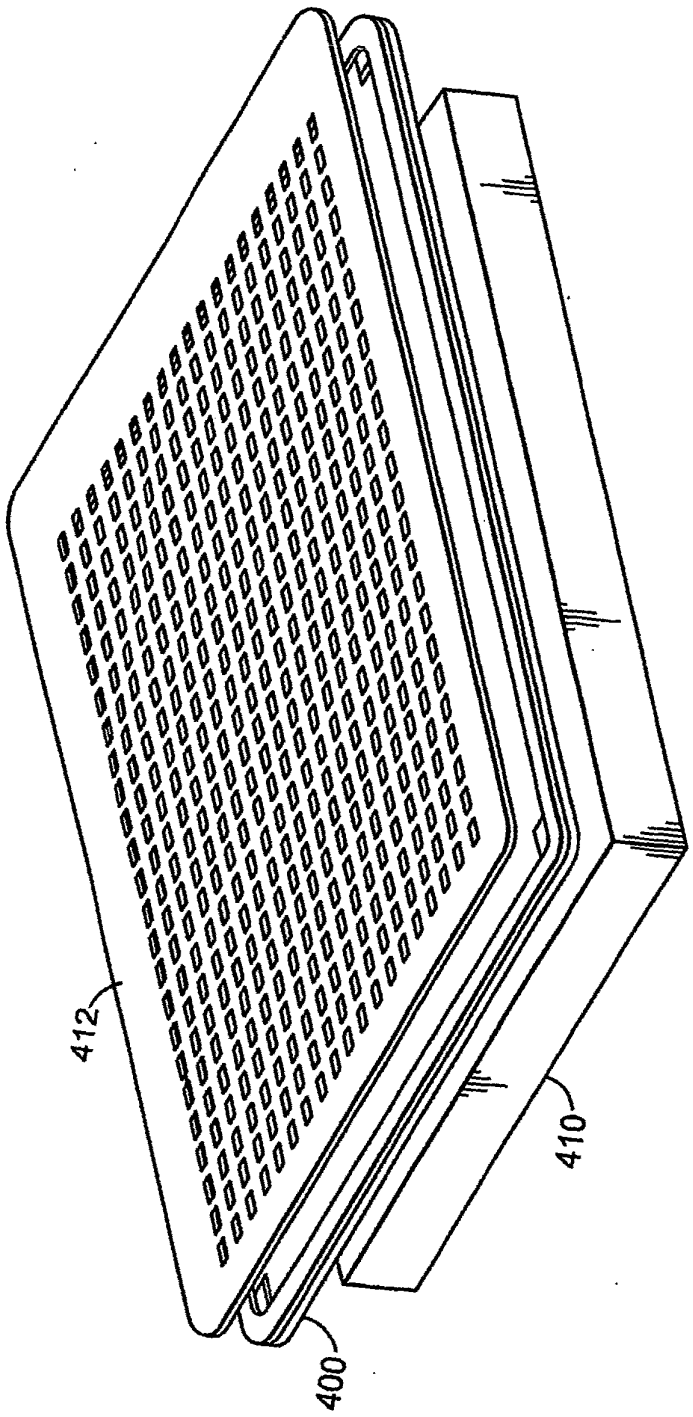


FIG. 4C

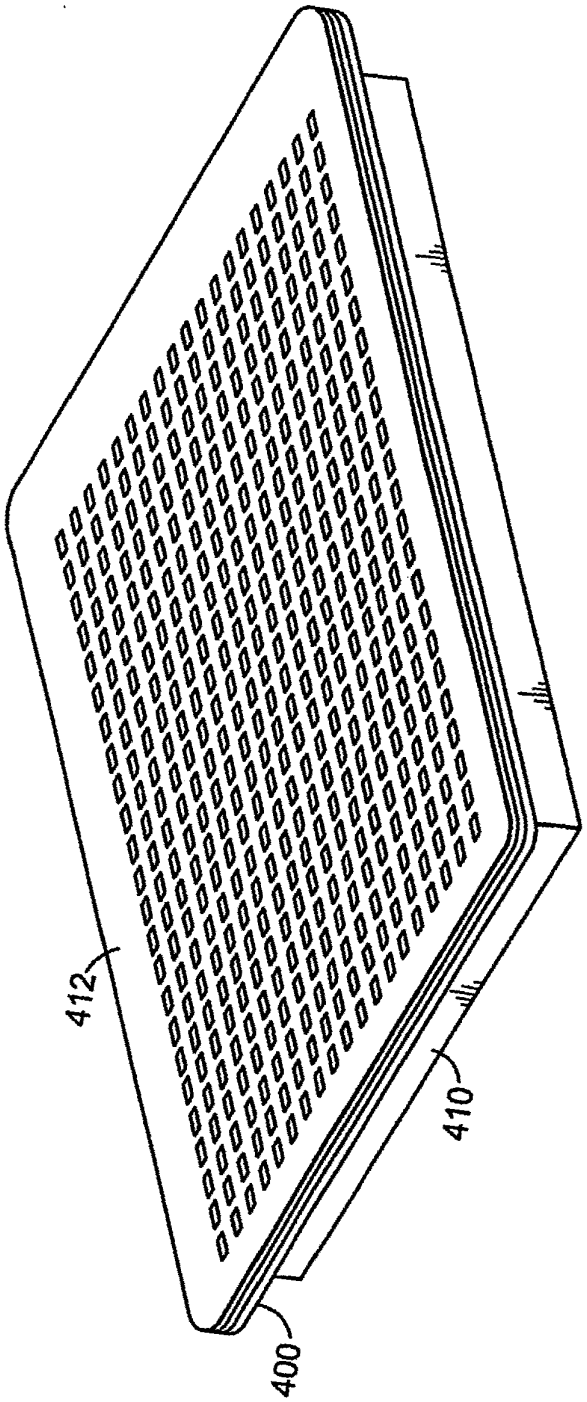


FIG. 4D

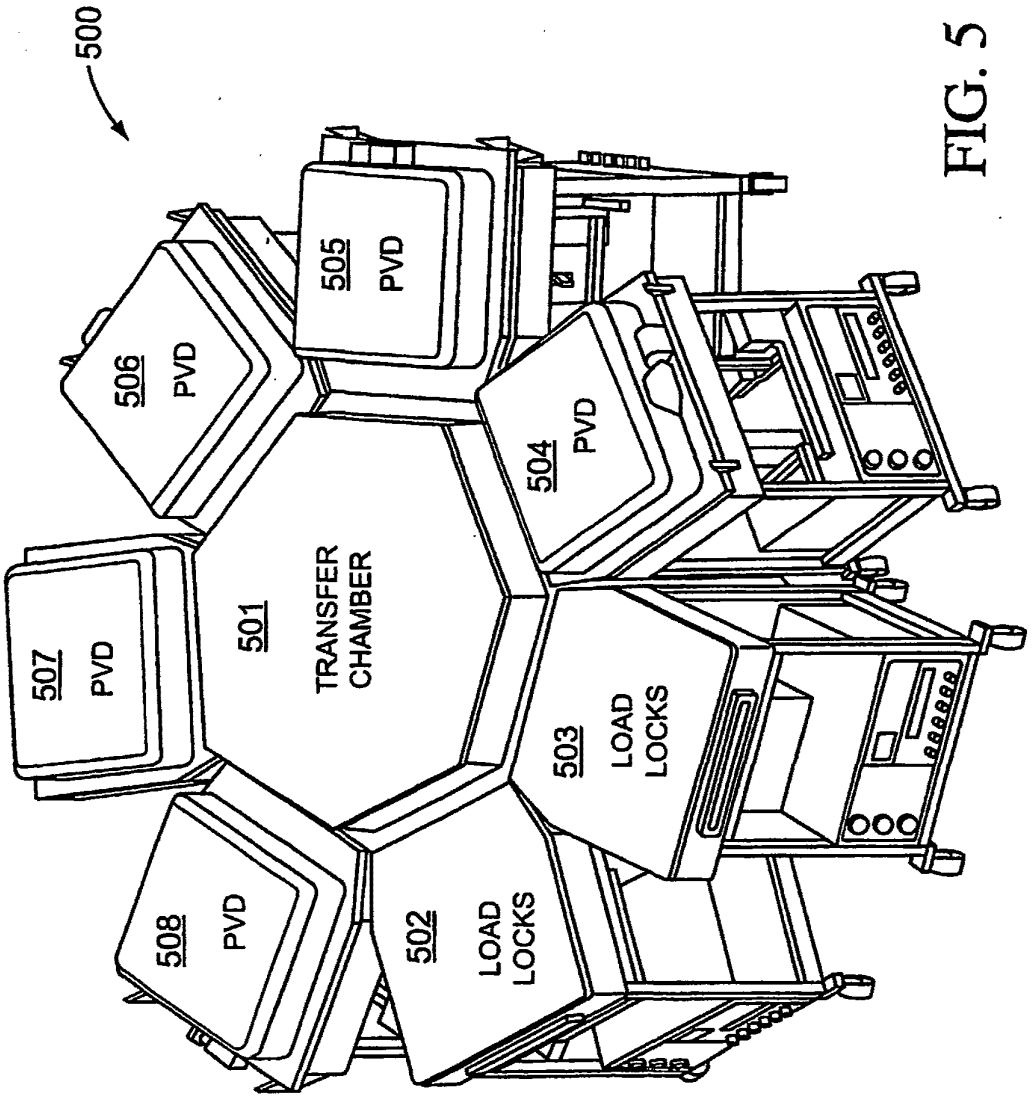
500
501 TRANSFER CHAMBER
502 LOAD LOCKS
503 LOAD LOCKS
504 PVD
505 PVD
506 PVD
507 PVD
508 PVD

FIG. 5

PTO/SB/06 (10-07)
Approved for use through 06/30/2010. OMB 0651-0032
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.

# PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number 10/101 863

10/2/07 APPLICATION 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), (b), or (c)) | N/A | N/A | N/A | | | N/A | |
| SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | | | N/A | |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | | | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X = | | OR | X = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X = | | | X = | |
| APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $260 ($130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | | | |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | N/A | | | N/A | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | | | TOTAL | 810. paid |

RCE

APPLICATION AS AMENDED – PART II

10/2/07

| AMENDMENT A | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | SMALL ENTITY RATE ($) | SMALL ENTITY ADDITIONAL FEE ($) | OR | OTHER THAN SMALL ENTITY RATE ($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * 36 | Minus | ** 39 | = — | X = | | OR | X = | |
| Independent (37 CFR 1.16(h)) | * 3 | Minus | *** 5 | = — | X = | | OR | X = | |
| Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | N/A | | OR | N/A | |
| | | | | | TOTAL ADD'L FEE | | OR | TOTAL ADD'L FEE | |

| AMENDMENT B | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) | OR | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X = | | OR | X = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X = | | OR | X = | |
| Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | N/A | | OR | N/A | |
| | | | | | 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.

This collection of information is required by 37 CFR 1.16. 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 12 minutes 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.**

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

# EAST Search History

| Ref # | Hits | Search Query | DBs | Default Operator | Plurals | Time Stamp |
|---|---|---|---|---|---|---|
| L1 | 4 | (pulsed with DC) with target with voltage with positive with negative | US-PGPUB; USPAT | OR | OFF | 2007/11/07 11:48 |
| L2 | 1848876 | @ad>"20020316" or @rlad>"20020316" | US-PGPUB; USPAT | OR | OFF | 2007/11/07 11:48 |
| L3 | 3 | 1 not 2 | US-PGPUB; USPAT | OR | OFF | 2007/11/07 11:48 |

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 10655.0016-00 | 6938 |

22852 7590 11/15/2007
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

| EXAMINER | |
|---|---|
| ESTRADA, MICHELLE | |
| ART UNIT | PAPER NUMBER |
| 2823 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 11/15/2007 | 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.

TH

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/101,863 | ZHANG ET AL. | |
| | Examiner | Art Unit | |
| | Michelle Estrada | 2823 | |

-- 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 *02 October 2007*.

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) *2-13,21-24 and 40-60* 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) *2-13,21-24 and 40-60* 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/SB/08) Paper No(s)/Mail Date *10/2/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *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 10/2/07 has been entered.

### *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 10-13, 21, 40-45 and 51-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smolanoff et al. (6,117,279) in view of Fu et al. (6,306,265), and further in view of Liu et al. (6,086,730) .

With respect to claims 21, 40, 43 and 51, Smolanoff et al. disclose providing pulsed DC power (21) through a filter (22) to a target (16) (Col. 5, lines 50-55); providing RF bias power to a substrate (15) positioned opposite the target (Col. 5, lines 60-65); providing process gas between the target and the substrate (Col. 7, lines 25-28); wherein the filter protects a pulsed DC power supply (21) from the bias power, and

wherein a plasma is created by application of the pulsed DC power to the target (Col. 6, lines 8-13); and wherein the film is deposited by exposure of the substrate to the plasma (Col. 6, lines 30-33); using an specific type of filter is a matter of design choice depending on the quality of product needed, and it is obvious that the filter is going to work at certain frequencies. Furthermore, if it is a band rejection, band pass, low-pass, high-pass, or stop band filter, this is a matter of design choice depending on what it is intended or needed for the desired final product or device. It is obvious that the filter is going to work at certain frequencies.

Smolanoff et al. do not clearly disclose wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and sputtering with the target in a poisonous mode to prepare the surface.

Fu et al. disclose wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and sputtering with the target in a poisonous mode to prepare the surface (Col. 19, lines 35-40).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Smolanoff et al. and Fu et al. to enable the conditioning step of Smolanoff et al. to be performed according to the teachings of Fu et al. because one of ordinary skill in the art would have been motivated to look to alternative suitable methods of performing the disclosed conditioning step of Smolanoff et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. See MPEP 2144.07.

The combination of Smolanoff et al. and Fu et al. does not clearly disclose applying pulsed DC power to the target such that a target voltage oscillates between positive and negative voltages.

Liu et al. disclose applying pulsed DC power to the target such that a target voltage oscillates between positive and negative voltages (Col. 8, lines 1-5 and Figs. 4B-4C).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Smolanoff et al., Fu et al. and Liu et al. to enable the pulsed DC power application step of the combination to be performed according to the teachings of Liu et al. because one of ordinary skill in the art would have been motivated to look to alternative suitable methods of performing the disclosed pulsed DC power application step of the combination and art recognized suitability for an intended purpose has been recognized to be motivation to combine. See MPEP 2144.07.

With respect to claims 8 and 52, Smolanoff et al. disclose wherein the process gas includes a mixture of oxygen and argon (Col. 7, lines 21-27).

With respect to claim 10, Smolanoff et al. disclose wherein the process gas further includes nitrogen (Col. 7, lines 25-26).

With respect to claim 11, Smolanoff et al. disclose wherein providing pulsed DC power to a target includes providing pulsed DC power to a target which has an area larger than that of the substrate (See fig. 1).

With respect to claims 12, 49 and 55, Smolanoff et al. disclose further including uniformly sweeping the target with a magnetic field (Col. 6, lines 1-7).

With respect to claims 13 and 50, Smolanoff et al. disclose wherein uniformly sweeping the target with a magnetic field includes sweeping a magnet in one direction across the target where the magnet extends beyond the target in the opposite direction (Col. 6, lines 1-6).

With respect to claims 56-60, One of ordinary skill in the art would have been led to the recited time pulse, bias power and frequency to routine experimentation to achieve a desire layer thickness, device dimension, device associated characteristics and device density on the finished wafer in view of the range of values disclosed.

In addition, the selection of time pulse, bias power and frequency, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and In re Aller, 105 USPQ 233

(CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Note that the specification contains no disclosure of either the critical nature of the claimed time pulse, bias power and frequency or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen time pulse, bias power and frequency or upon another variable recited in a claim, the Applicant must show that the chosen time pulse, bias power and frequency are critical. *In re Woodruf*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Claims 2-4, 6 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smolanoff et al. in view of Fu et al. and Liu et al. as applied to claims 10-13, 21, 40-45 and 51-60 above, and further in view of the following comments.

With respect to claims 2-4, 6 and 22-24, 41, 42, 44-48, One of ordinary skill in the art would have been led to the recited temperature, DC power, gas flow, time pulse and bias power to routine experimentation to achieve a desire layer thickness, device dimension, device associated characteristics and device density on the finished wafer in view of the range of values disclosed.

In addition, the selection of temperature, DC power, gas flow, time pulse and bias power, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935,

1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and In re Aller, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Note that the specification contains no disclosure of either the critical nature of the claimed temperature, DC power, gas flow, time pulse and bias power or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen temperature, DC power, gas flow, time pulse and bias power or upon another variable recited in a claim, the Applicant must show that the chosen temperature, DC power, gas flow, time pulse and bias power are critical. *In re Woodruf*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Claims 7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smolanoff et al. in view of Fu et al. and Liu et al. as applied to claims 10-13, 21, 40-45 and 51-60 above, and further in view of Le et al. (2003/0077914).

The combination of Smolanoff et al. and Fu et al. does not disclose wherein the film is an upper cladding layer of a waveguide structure and the bias power is optimized to provide planarization.

With respect to claim 7, Le et al. disclose wherein the film is an upper cladding layer of a waveguide structure and the bias power is optimized to provide planarization Page 5, Paragraph [0075].

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Smolanoff et al., Fu et al., Liu et al. and Le et al. to enable the film material of Smolanoff et al. to be the same according to the teachings of Le et al. because one of ordinary skill in the art would have been motivated to look to alternative suitable film materials for the disclosed film formation step of Smolanoff et al. and art recognized suitability for an intended purpose has been recognized to be motivation to combine. See MPEP 2144.07.

With respect to claim 9, Le et al. disclose wherein the oxygen flow is adjusted to adjust the index of refraction of the film (Page 5, Paragraph [0076]).

***Response to Arguments***

Applicant's arguments, filed 10/2/07, with respect to the rejection(s) of claim(s) 21, 43 and 51 under 35 USC 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Liu et al.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michelle Estrada whose telephone number is 571-272-1858. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2800.

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).

Michelle Estrada
Primary Examiner
Art Unit 2823

ME
November 13, 2007

IDS Form PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

| Complete if Known | |
|---|---|
| Application Number | 10/101,863 |
| Filing Date | March 16, 2002 |
| First Named Inventor | ZHANG, Hongmei |
| Art Unit | 2823 |
| Examiner Name | ESTRADA, Michelle |
| Attorney Docket Number | 10655.0016-00 |

## FOREIGN PATENT DOCUMENTS

| Examiner Initials | Cite No.[1] | Foreign Patent Document — Country Code[1] Number[2] Kind Code[3] (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 | Translation[4] |
|---|---|---|---|---|---|---|
| | | WO 2007/027535 A2 | 03-08-2007 | Symmorphix, Inc. | | |

## NON PATENT LITERATURE DOCUMENTS

| Examiner Initials | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| | | Office Action dated September 22, 2006, from Korean Patent Office in Application No. 10-2005-7016055 (Attorney Docket No. 9140.0030-00202). | Yes |
| | | Office Action mailed May 21, 2007, in U.S. Application No. 10/291,179 (Attorney Docket No. 9140.0001-00). | |
| | | Final Office Action mailed April 13, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Amendment filed August 9, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Final Office Action mailed September 5, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Final Office Action mailed September 7, 2007, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Notice of Non-Compliant Amendment mailed April 12, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Response to Notice of Non-Compliant Amendment filed April 23, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Final Office Action mailed July 24, 2007 in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Response to Office Action filed July 9, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| | | Corrected Notice of Allowance mailed June 7, 2007, in U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| | | Supplemental Notice of Allowance mailed July 5, 2007, in U.S. Application No. 11/228,805 (Attorney Docket No. 9140.0030-01). | |
| | | Second Supplemental Preliminary Amendment filed May 31, 2007, in U.S. Application No. 11/297,057 (Attorney Docket No. 9140.0042-00). | |
| | | PCT International Preliminary Report on Patentability mailed June 21, 2007, in PCT Application No. PCT/US2005/044781 (Attorney Docket No. 9140.0042-304). | |

| Examiner Signature | Michelle Estrada | Date Considered | 11/7/07 |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO. EM 100825487 US**

| Notice of References Cited | Application/Control No. 10/101,863 | Applicant(s)/Patent Under Reexamination ZHANG ET AL. | |
|---|---|---|---|
| | Examiner Michelle Estrada | Art Unit 2823 | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * | | Document Number Country Code-Number-Kind Code | Date MM-YYYY | Name | Classification |
|---|---|---|---|---|---|
| * | A | US-6,086,730 | 07-2000 | Liu et al. | 204/192.16 |
| * | B | US-5,584,974 | 12-1996 | Sellers, Jeff C. | 204/192.13 |
| | 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 | | | | | |
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**NON-PATENT DOCUMENTS**

| * | | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|---|
| | U | |
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| | 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.

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 10101863 | ZHANG ET AL. |
| | Examiner | Art Unit |
| | Estrada, Michelle | 2823 |

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| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

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

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 04/30/2007 | 11/11/2007 | | | | | | | |
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| | 36 | - | - | | | | | | | |

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 10101863 | ZHANG ET AL. |
| | Examiner | Art Unit |
| | Estrada, Michelle | 2823 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

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

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 04/30/2007 | 11/11/2007 | | | | | | | |
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| | 47 | ✓ | ✓ | | | | | | | |
| | 48 | ✓ | ✓ | | | | | | | |
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| | 57 | ✓ | ✓ | | | | | | | |
| | 58 | ✓ | ✓ | | | | | | | |
| | 59 | ✓ | ✓ | | | | | | | |
| | 60 | ✓ | ✓ | | | | | | | |

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 10101863 | ZHANG ET AL. |
| | Examiner | Art Unit |
| | Estrada, Michelle | 2823 |

| SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| | | | |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| See East search attached | 10/2/07 | ME |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
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11-29-07 1pm 2823


PATENT
Customer No. 22,852
Attorney Docket No. 10655.0016-00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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|---|---|---|
| In re Application of: | ) | |
| | ) | |
| Hongmei ZHANG et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| | ) | |
| Filed: March 16, 2002 | ) | |
| | ) | Confirmation No.: 6938 |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | |

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

Sir:

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(c)**

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(c), Applicants bring to the attention of the Examiner the documents on the attached listing. This Supplemental Information Disclosure Statement is being filed after the events recited in Section 1.97(b) but, to the undersigned's knowledge, before the mailing date of either a Final action, Quayle action, or a Notice of Allowance. Under the provisions of 37 C.F.R. § 1.97(c), this Supplemental Information Disclosure Statement includes a certification as specified by Section 1.97(e).

Based on reasonable inquiry, no document listed in this Supplemental Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and no document listed in this Supplemental Information Disclosure Statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing date of this Supplemental Information Disclosure Statement.

Copies of the listed non-patent literature documents are attached. A copy of the U.S. patent is not enclosed.

Applicants respectfully request that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claims in the application and Applicants determine that the cited documents do not constitute "prior art" under United States law, Applicants reserve the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

Applicants further reserve the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to Deposit Account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: November 27, 2007

By: _____
Gary J. Edwards
Reg. No. 41,008
(650) 849-6622

**EXPRESS MAIL LABEL NO.**
**EM 074696455 US**

| PTO/SB/08: Substitute for form 1449A/PTO | | | | Complete if Known | |
|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | Application Number | 10/101,863 |
| | | | | Filing Date | March 16, 2002 |
| | | | | First Named Inventor | Hongmei ZHANG |
| | | | | Art Unit | 2823 |
| (Use as many sheets as necessary) | | | | Examiner Name | Michelle ESTRADA |
| Sheet | 1 | of | 1 | Attorney Docket Number | 10655.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials* | Cite No.[1] | Document Number<br>Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US-7,262,131 | 08-28-2007 | Narasimhan et al. | |
| | | US- | | | |
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| | | US- | | | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

## FOREIGN PATENT DOCUMENTS

| Examiner Initials* | Cite No.[1] | Foreign Patent Document<br>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 | Translation[6] |
|---|---|---|---|---|---|---|
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## NONPATENT LITERATURE DOCUMENTS

| Examiner Initials* | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| | | Amendment/RCE filed October 31, 2007, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Amendment/RCE filed October 24, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Office Action dated November 15, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Final Office Action dated October 10, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| | | Amendment/RCE filed October 31, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |

| Examiner Signature | | Date Considered | |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO.**
**EM 074696455 US**

Customer No. 55022
Attorney Docket No. 106-0016-00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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| In re Application of: | ) | |
| | ) | |
| Hongmei ZHANG et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| | ) | |
| Filed: March 16, 2002 | ) | |
| | ) | |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | Confirmation No.: 6938 |

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

Sir:

**AMENDMENT AND RESPONSE TO OFFICE ACTION**

In reply to the Office Action mailed November 15, 2007, please amend the above-identified application as follows:

**Amendments to the Claims** are reflected in the listing of claims in this paper beginning on page 2.

**Remarks/Arguments** follow the amendment sections of this paper beginning on page 8 -

**AMENDMENTS TO THE CLAIMS:**

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

1. (Canceled).

¯. (Pr¯ iously presented): The method of Claim 21, further including holding the temperature of the substrate substantially constant.

3. (Previously presented): The method of Claim 21, wherein applying pulsed DC power through the filter includes supplying up to about 10 kW of power at a frequency of between about 40 kHz and about 350 kHz and a reverse time pulse between about 1.3 and 5 μs.

4. (Previously presented): The method of Claim 21, wherein adjusting an RF bias power to the substrate includes supplying up to 1000 W of RF power to the substrate.

5. (Canceled).

6. (Previously presented): The method of claim 4, wherein the RF bias power is zero.

7. (Previously presented): The method of Claim 21, wherein the RF bias power is optimized to provide planarization.

8. (Previously presented): The method of Claim 21, wherein a process gas of the process gas flow includes a mixture of Oxygen and Argon.

9. (Previously presented): The method of Claim 8, wherein the mixture is adjusted to adjust the index of refraction of the film.

10. (Previously presented): The method of Claim 8, wherein the mixture further includes nitrogen.

11. (Previously presented): The method of Claim 21, wherein applying pulsed DC power to the target includes adjusting pulsed DC power to a target which has an area larger than that of the substrate.

12. (Previously presented): The method of Claim 21, further including uniformly sweeping the target with a magnetic field.

13. (Previously presented): The method of Claim 12, wherein uniformly sweeping the target with a magnetic field includes sweeping a magnet in one direction across the target where the magnet extends beyond the target in the opposite direction.

14-20. (Canceled).

21. (Currently amended): A method of depositing an insulating oxide film on a substrate, comprising:

conditioning a target;

preparing the substrate;

adjusting an RF bias power to the substrate;

setting a process gas flow; and

applying pulsed DC power to the target such that a ~~target~~ voltage on the target oscillates between positive and negative voltages to create a plasma and deposit the oxide film; and

narrow band rejection filtering the DC power at a frequency of the bias power before applying the DC power to the target,

wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and then sputtering with the target in poisonous mode to prepare the surface.

22. (Previously presented ): The method of Claim 21, wherein setting the process gas flow includes adjusting constituents in order to adjust the index of refraction of the film.

23. (Previously presented): The method of Claim 21, wherein applying pulsed DC power includes setting the frequency in order to adjust the index of refraction of the film.

24. (Previously presented): The method of Claim 21, further including adjusting a temperature of the substrate in order to adjust the index of refraction of the film.

25-40. (Canceled).

41. (Previously presented): The method of claim 21, wherein a bandwidth of the narrow band rejection filter is about 100 kHz.

42. (Previously presented): The method of claim 21, wherein the frequency of the RF bias is about 2 MHz.

43. (Currently amended): A method of depositing an insulating oxide film on a substrate, comprising:

preparing the substrate;

adjusting an RF bias power to the substrate;

setting a process gas flow;

applying pulsed DC power to a target such that a ~~target~~ voltage on the target oscillates

between positive and negative voltages and an oxide film is deposited on the substrate; and

narrow band rejection filtering the DC power at a frequency of the bias power before applying the DC power to the target.

44. (Previously presented): The method of claim 43, wherein band rejection filtering the DC power includes utilizing a band rejection filter with a bandwidth of less than about 100 kHz.

45. (Previously presented): The method of claim 43, wherein the frequency of the RF bias is about 2 MHz.

46. (Previously presented): The method of Claim 43, wherein applying pulsed D˜ po¨er includes supplying up to about 10 kW of power at a frequency of between about 40 kHz and about 350 kHz and a reverse time pulse between about 1.3 and 5 μs.

˙7. (P˜˜ iously presented): The method of Claim 43, further including holding the temperature of the substrate substantially constant.

48. (Previously presented): The method of Claim 43, wherein adjusting an RF bias power to the substrate includes supplying up to 1000 W of RF power to the substrate.

49. (Previously presented): The method of Claim 43, further including uniformly sweeping the target with a magnetic field.

50. (Previously presented): The method of Claim 49, wherein uniformly sweeping the target with a magnetic field includes sweeping a magnet in one direction across the target where the magnet extends beyond the target in the opposite direction.

51. (Currently amended): A method of depositing an insulating oxide film on a substrate, comprising:

providing a process gas between the substrate and a target;

applying an RF bias power to the substrate;

applying pulsed DC power to the target such that a ~~target~~ voltage on the target oscillates between positive and negative voltages; and

narrow band rejection filtering the pulsed DC power at a frequency of the bias power before applying pulsed DC power to the target,

wherein the oxide film is deposited on the substrate.

52. (Previously presented): The method of claim 51, wherein the process gas includes one or more gasses chosen from the group consisting of Ar, $N_2$, $O_2$, $C_2F_6$, $CO_2$, CO, $NH_3$, NO, and halide containing gasses.

53. (Previously presented): The method of claim 51, wherein the target is a metallic target.

54. (Previously presented): The method of claim 51, wherein the target is an intermetllic target.

55. (Previously presented). The method of claim 51, further including sweeping the target with a magnetic field.

56. (Previously presented): The method of claim 51, wherein the pulsed DC power is supplied with a reverse time pulse between about 1.3 and 5 μs.

57. (Previously presented): The method of Claim 51, wherein applying an RF bias power to the substrate includes supplying up to 1000 W of RF power to the substrate.

58. (Previously presented) The method of claims 21, wherein applying pulsed DC power includes supplying pulsed DC power at a pulse frequency of between about 40 kHz and about 350 kHz.

59. (Previously presented) The method of claim 43, wherein applying pulsed DC power includes supplying pulsed DC power at a pulse frequency of between about 40 kHz and about 350 kHz.

60. (Previously presented) The method of claim 51, wherein applying pulsed DC power includes supplying pulsed DC power at a pulse frequency of between about 40 kHz and about 350 kHz.

## REMARKS

Claims 2-13, 21-24, and 40-60 are pending in the above-identified application. The Examiner has rejected claims 2-13, 21-24, and 40-60. In this application, claims 21, 43, and 51 are amended as discussed during an interview with the Examiner on December 11, 2007. Claim 40 is canceled.

## Examiner's Interview

Applicant thanks the Examiner for meeting with us on December 11, 2007 (the "Interview"). In attendance at the Interview were Examiner Michelle Estrada, Inventor R. Ernest Demaray, and Applicant's representative Gary J. Edwards. During the interview, all of the claims were discussed as well as the art that has been cited against the claims. Agreement with respect to the claims was reached. In this Amendment, the claims have been amended as discussed during the interview. The Examiner indicated in the Interview Summary that the proposed language for the claims "would overcome the rejection on record."

The substance of the discussion with the Examiner with respect to the claims and the art is provided below.

## Claim Rejections Under 35 U.S.C. § 103(a)

Claims 10-13, 21, 40-45, and 51-60

Claims 10-13, 21, 40-45, and 51-60 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,117,279 to Smolanoff et al. ("Smolanoff") in view of U.S. Patent No. 6,306,265 to Fu et al. ("Fu"), and in further view of U.S. Patent No. 6,086,730 to Liu et al. ("Liu"). Claims 21, 43, and 51 are independent claims. As discussed during the Interview,

Smolanoff, Fu, and Liu, either separately or in combination, do not teach or suggest "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages to create a plasma and deposit the oxide film" as is recited in claim 21; "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to a target such that a voltage on the target oscillates between positive and negative voltages and an oxide film is deposited on the substrate," as is recited in claim 43; or "applying an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages," as is recited in claim 51.

Further, both Smolanoff and Liu teach away from aspects of the claimed invention. As a result, there is no reason to combine Smolanoff or Liu with any other art in order to find claims 21, 43, or 51 obvious under 35 U.S.C. § 103 (a).

*I. Smolanoff does not teach, and in fact teaches away from, "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages."*

As discussed during the Interview, Smolanoff teaches away from a system where the target voltage becomes positive, as is recited in each of claims 21, 43, and 51. Smolanoff teaches a directed ion metal vapor source for deposition of conductive films. Although Smolanoff states that the DC source can be a pulsed DC source, Smolanoff also states that "[p]ower from the steady or **pulsed DC power supply 21** and/or RF generator 24 **produces a negative potential on the target 16.**" (Smolanoff, col. 5, line 66, -col. 6, line 1) (emphasis added). In every disclosure of target voltage, Smolanoff teaches that the target voltage must be negative. (*See, e.g.* col. 5, lines 39-44 ("[t]he magnet structure 20 preferably includes magnets that produce a closed magnetic tunnel over the surface of the target 16 that traps electrons given

off into the chamber 12 by the cathode assembly 17 when the cathode assembly 17 is **electrically energized to a negative potential** as is familiar to one skilled in the art"); col. 6, lines 9-12 ("[t]his main plasma in the region 23 becomes a source of positive ions of gas that are accelerated toward, and collide against, **the negatively charged surface of the target 16**, thereby ejecting particles of coating material from the target 16") (emphasis added)).

Smolanoff never teaches that the target can be positive and, in accordance with the teachings of Smolanoff, the target voltage must always be negative. Therefore, Smolanoff teaches away from "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages," as is recited in each of claims 21, 43, and 51. Smolanoff, then, also teaches away from "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages to create a plasma and deposit the oxide film" as is recited in claim 21; "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to a target such that a voltage on the target oscillates between positive and negative voltages and an oxide film is deposited on the substrate," as is recited in claim 43; or "applying an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages," as is recited in claim 51.

In addition, the Examiner indicated, with regard to the filter, that "if it is a band rejection, band pass, low-pass, high-pass, or stop band filter, this is a matter of design choice depending on what it is intended or needed for the desired final product or device." and then opined that "[i]t is obvious that the filter is going to work at certain frequencies." However, as explained during the Interview, that is not the case. The filter allows the combination of pulsed-DC power to the

target (where the target voltage is oscillated between positive and negative voltages) and an RF bias on the substrate. A filter that blocks too many of the constituent frequencies of the pulsed DC waveform results in the target voltage not attaining a positive voltage. A filter that does not block the RF bias voltage can result in failure of the DC power supply. Smolanoff does not teach the "narrow band rejection filtering" recited in each of claims 21, 43, and 51.

*II. Liu does not teach, and in fact teaches away from, the combination of pulsed DC voltage (where a voltage on the target oscillates between positive and negative voltages) and applying RF bias to the substrate.*

The Examiner stated that "[t]he combination of Smolanoff et al. and Fu et al. does not clearly disclose applying pulsed DC power to the target such that a target voltage oscillates between positive and negative voltages." (Office Action, page 4). The Examiner then relies on Liu to teach this aspect of claims 21, 43, and 51. As discussed above, Smolanoff teaches away from applying voltage to the target that causes the target voltage to become positive. Therefore, there is no reason to combine Smolanoff with Liu as suggested. Further, as discussed below, Liu also teaches away from combining a pulsed DC voltage to the target where the target voltage becomes positive and any bias voltage applied to the substrate except for a DC voltage applied to a conducting substrate.

Liu teaches deposition of conductive, diamond-like carbon thin films by sputtering with a pulsed-DC process. (*See, e.g.,* Liu, Abstract). Liu teaches that the carbon film is deposited by "a special type of pulsed DC power supply," (Liu, col. 6, lines 21-26), where the pulse characteristics provide "a positive potential to the target, by as much as, e.g. 300 volts positive," (Liu, col. 6, lines 44-45), and then "a negative potential to the target," (Liu, col. 6, line 50).

However, Liu teaches away from applying any bias to the substrate that is not a DC bias, and then only if the substrate is a conducting substrate. As taught in Liu,

> In addition to the pulsed DC sputtering with above mentioned characteristics, the substrate can also be biased in order to enhance the ta-C:H characteristics of the carbon film. **Although this can only be done with conductive substrates**, the effect is pronounced and useful. Nominally, the substrate is biased negative to the ground . . . .

(Liu, col. 6, line 66, to col. 7, line 3). Liu further teaches only DC bias voltages. (*See*, Liu, col. 7, lines 2-11).

Therefore, Liu does not teach the combination of pulsed DC where a voltage on the target oscillates between positive and negative voltages and applying an RF bias to the substrate, and in fact teaches away from such a combination especially as it applies to insulating films. As a result, Liu can not teach "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages to create a plasma and deposit the oxide film" as is recited in claim 21; "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to a target such that a voltage on the target oscillates between positive and negative voltages and an oxide film is deposited on the substrate," as is recited in claim 43; or "applying an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages," as is recited in claim 51.

There would be no reason to combine Smolanoff and Liu as suggested by the Examiner because each of these references teaches away from "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages to create a plasma and deposit the

oxide film" as is recited in claim 21; "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to a target such that a voltage on the target oscillates between positive and negative voltages and an oxide film is deposited on the substrate," as is recited in claim 43; or "applying an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages," as is recited in claim 51.

*III. Fu does not teach or suggest the claimed invention, and further Fu does not teach the elements for which it is being cited.*

The Examiner stated that "Smolanoff et al. do not clearly disclose wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and sputtering with the target in a poisonous mode to prepare the surface." (Office Action' page 3). Fu is relied upon to disclose "wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and sputtering with the target in a poisonous mode to prepare the surface (Col. 19, lines 35-40)." (Office Action, page 3).

As discussed above, there is no reason to combine either of Smolanoff and Liu with Fu because both Smolanoff and Liu teach away from the combination of pulsed-DC voltage to the target where the voltage on the target oscillates between positive and negative voltages and an RF bias applied to the substrate, as is recited in claims 21, 43, and 51. Additionally, Fu does not teach the elements for which it is relied or itself teach the combination of pulsed-DC power and RF bias recited in the claims.

Fu teaches high density, magnetic field enhanced ionized metal vapor deposition of conducting films. (*See* Fu, abstract). Fu, however, teaches utilization of a DC power supply (Fu, col. 1, lines 30-32) in combination with an RF bias applied to the substrate (Fu, col. 2, lines 36-

41). Therefore, Fu fails to teach "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages to create a plasma and deposit the oxide film" as is recited in claim 21; "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to a target such that a voltage on the target oscillates between positive and negative voltages and an oxide film is deposited on the substrate," as is recited in claim 43; or "applying an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages," as is recited in claim 51.

Fu does teach operation in the poison mode and operation in the metallic mode as applied to TiN deposition, but does not teach "wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and then sputtering with the target in poison mode to prepare the surface," as is recited in claim 21. As stated by Fu,

> Reactive sputtering to produce TiN is known to operate in two modes, metallic mode and poison mode. Metallic mode produces a high-density, gold-colored film on the wafer. Poison mode, which is often associated with a high nitrogen flow, produces a purple/brown film which advantageously has low stress. However, the poison-mode film has many grain boundaries, and film defects severely reduce chip yield. Furthermore, the deposition rate in poison mode is typically only one-quarter of the rate in metallic mode. It is generally believed that in poison mode the nitrogen reacts with the target to form a TiN surface on the Ti target while in metallic mode the target surface remains clean and TiN forms only the wafer.

(Fu, col. 19, lines 28-30). Fu teaches operation in either metallic mode or poison mode, and does not teach "wherein conditioning the target includes sputtering with the target in a metallic mode to remove the surface of the target and then sputtering with the target in poisonous mode to

prepare the surface," as is recited in claim 21. Independent claims 43 and 51 do not include this limitation.

*IV. Summary*

As discussed above, claims 21, 43, and 51 are allowable over the combination of Smolanoff, Fu, and Liu. Claims 10-13, 41-42, and 58 depend from claim 21 and are therefore allowable over the combination of Smolanoff, Fu, and Liu for at least the same reasons as is claim 21. Claim 40 has been canceled. Claims 44-45 and 59 depend from claim 43 and are allowable over the combination of Smolanoff, Fu, and Liu for at least the same reasons as is claim 43. Claims 52-57 and 60 depend from claim 51 and are allowable over the combination of Smolanoff, Fu, and Liu for at least the same reasons as is claim 51.

Claims 2-4, 6, and 22-24

Claims 2-4, 6, and 22-24 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Smolanoff in view of Fu and Liu, as applied to claims 10-13, 21, 40-45, and 51-60.

Claims 2-4, 6, and 22-24 depend from claim 21. As discussed above, claim 21 is allowable over the combination of Smolanoff, Fu, and Liu. Therefore, claims 2-4, 6, and 22-24 are allowable over the combination of Smolanoff, Fu, and Liu for at least the same reasons as is claim 21.

Claims 7-9

Claims 7 and 9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Smolanoff in view of Fu and Liu, as applied to claims 10-13, 21, 40-45, and 51-60, and in further view of U.S. Patent Publication No. 2003/0077914 to Le et al. ("Le").

Claims 7 and 9 depend from claim 21. As discussed above, claim 21 is allowable over the combination of Smolanoff, Fu, and Liu. Le does not cure the defects in the teachings of Smolanoff, Fu, and Liu. Further, there is no reason to combine Smolanoff and Liu with any other art in order to find claim 21 obvious because both Smolanoff and Liu teach away from "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages to create a plasma and deposit the oxide film" as is recited in claim 21.

Le teaches deposition of an anti-reflective coating by pulsing a DC source with no bias applied to the substrate. As taught in Le,

> The pulsed DC power source 22 applies a pulsed DC (direct current) voltage to the target 14. The pulsed DC voltage may be oscillated between negative and positive states. In one version, the pulsed DC voltage is pulsed between "on" and "off" states . . . .

(Le, par. 0071). As further stated, "[t]he pulsed DC voltage alleviates this problem by maintaining "on" and "off" states during each pulse cycle." (Le, par. 0072). Therefore, Le does not teach that the target voltage goes positive, and only teaches that the DC voltage is pulsed. Further, there is no teaching of a bias applied to the substrate. Therefore, Le does not teach "adjusting an RF bias power to the substrate" in combination with "applying pulsed DC power to the target such that a voltage on the target oscillates between positive and negative voltages to create a plasma and deposit the oxide film" as is recited in claim 21.

Further, Le was apparently presented to teach "wherein the RF bias power is optimized to provide planarization," as is recited in claim 7. However, Le does not teach RF bias or planarization of a cladding layer.

Therefore, claims 7 and 9 are allowable over the cited art for at least the same reasons as is claim 21.

## Conclusion

In view of the foregoing amendments, which are discussed during the Interview, and the remarks, which provides the substance of the discussion during the Interview, Applicant respectfully requests the timely allowance of the pending claims, which the Examiner indicated would be allowable after the amendments provided herein. If the Examiner has any questions or concerns regarding this Amendment or these Remarks, the Examiner is invited to call Applicant's representative.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: December 18, 2007

By: 

Gary J. Edwards
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# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 2610189 |
| **Application Number:** | 10101863 |
| **International Application Number:** | |
| **Confirmation Number:** | 6938 |
| **Title of Invention:** | Biased pulse DC reactive sputtering of oxide films |
| **First Named Inventor/Applicant Name:** | Hongmei Zhang |
| **Customer Number:** | 22852 |
| **Filer:** | Gary James Edwards/Annie Wong |
| **Filer Authorized By:** | Gary James Edwards |
| **Attorney Docket Number:** | 10655.0016-00 |
| **Receipt Date:** | 18-DEC-2007 |
| **Filing Date:** | 16-MAR-2002 |
| **Time Stamp:** | 19:10:11 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

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## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes) /Message Digest | Multi Part /.zip | Pages (if appl.) |
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| 1 | Amendment - After Non-Final Rejection | Amendment_Response_to_OA_10655-0016-00.pdf | 237230<br>5b7b12a167c6082e1fe7acb03285f0060eea8dbe | no | 17 |

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# PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

| Application or Docket Number | Filing Date | ☐ To be Mailed |
|---|---|---|
| 10/101,863 | 03/16/2002 | |

## APPLICATION 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), (b), or (c)) | N/A | N/A | N/A | | | N/A | |
| ☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m)) | N/A | N/A | N/A | | | N/A | |
| ☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | | | N/A | |
| TOTAL CLAIMS (37 CFR 1.16(i)) | minus 20 = | * | X $ = | | OR | X $ = | |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | minus 3 = | * | X $ = | | | X $ = | |
| ☐ APPLICATION SIZE FEE (37 CFR 1.16(s)) | If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). | | | | | | |
| ☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) | | | | | | | |
| * If the difference in column 1 is less than zero, enter "0" in column 2. | | | TOTAL | | | TOTAL | |

## APPLICATION AS AMENDED – PART II

| AMENDMENT 12/18/2007 | (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(i)) | * 35 | Minus | ** 39 | = 0 | X $25 = | 0 | OR | X $ = | |
| Independent (37 CFR 1.16(h)) | * 3 | Minus | ***5 | = 0 | X $105 = | 0 | OR | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | OR | | |
| | | | | | TOTAL ADD'L FEE | 0 | OR | TOTAL ADD'L FEE | |

| AMENDMENT | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE ($) | ADDITIONAL FEE ($) | | RATE ($) | ADDITIONAL FEE ($) |
|---|---|---|---|---|---|---|---|---|---|
| Total (37 CFR 1.16(i)) | * | Minus | ** | = | X $ = | | OR | X $ = | |
| Independent (37 CFR 1.16(h)) | * | Minus | *** | = | X $ = | | OR | X $ = | |
| ☐ Application Size Fee (37 CFR 1.16(s)) | | | | | | | | | |
| ☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) | | | | | | | 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.

Legal Instrument Examiner:
eugenia v. hardy

This collection of information is required by 37 CFR 1.16. 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 12 minutes 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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# EAST Search History

| | | | | | | |
|---|---|---|---|---|---|---|
| S66 | 105 | (n-well and p-well) and ((STI or isolation) and (epitaxial$3 with trench)) | US-PGPUB; USPAT | OR | OFF | 2004/02/17 14:39 |
| S67 | 100 | ((n-well and p-well) and ((STI or isolation) and (epitaxial$3 with trench))) not (@ad>"20020511" or @rlad>"20020511") | US-PGPUB; USPAT | OR | OFF | 2004/02/17 14:39 |
| S68 | 97 | (((n-well and p-well) and ((STI or isolation) and (epitaxial$3 with trench))) not (@ad>"20020511" or @rlad>"20020511")) not (438/429.ccls. not (@ad>"20020511" or @rlad>"20020511")) | US-PGPUB; USPAT | OR | OFF | 2004/02/17 14:39 |
| S69 | 1236723 | @ad>"20020511" or @rlad>"20020511" | US-PGPUB; USPAT | OR | OFF | 2006/09/05 09:32 |
| S70 | 121 | band with (rejection or stop or low or narrow) with filter with frequency with bias | US-PGPUB; USPAT | OR | OFF | 2006/09/05 09:33 |
| S71 | 93 | S70 not S69 | US-PGPUB; USPAT | OR | OFF | 2006/09/05 09:33 |
| S72 | 1 | ("7262131").PN. | US-PGPUB; USPAT | OR | OFF | 2008/01/17 12:13 |
| S73 | 2456 | (438/769,770,771,787,788).CCLS. | US-PGPUB; USPAT | OR | OFF | 2008/01/17 12:17 |
| S74 | 1939945 | @ad>"20020316" or @rlad>"20020316" | US-PGPUB; USPAT | OR | OFF | 2008/01/17 12:17 |
| S75 | 1498 | S73 not S74 | US-PGPUB; USPAT | OR | OFF | 2008/01/17 12:18 |
| S78 | 3342 | (204/192.12,192.15).CCLS. | US-PGPUB; USPAT | OR | OFF | 2008/01/17 12:18 |
| S79 | 316 | (427/533).CCLS. | US-PGPUB; USPAT | OR | OFF | 2008/01/17 12:19 |
| S80 | 1190 | (257/E21.273,E21.278,E21.462).CCLS. | US-PGPUB; USPAT | OR | OFF | 2008/01/17 12:26 |
| S81 | 550 | S80 not S74 | US-PGPUB; USPAT | OR | OFF | 2008/01/17 12:26 |

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22852 7590 01/25/2008

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WASHINGTON, DC 20001-4413

| EXAMINER | |
|---|---|
| ESTRADA, MICHELLE | |
| ART UNIT | PAPER NUMBER |
| 2823 | |

DATE MAILED: 01/25/2008

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 10655.0016-00 | 6938 |

TITLE OF INVENTION: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | YES | $720 | $300 | $0 | $1020 | 04/25/2008 |

**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.**



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)

22852 7590 01/25/2008

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

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. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 10655.0016-00 | 6938 |

TITLE OF INVENTION: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | YES | $720 | $300 | $0 | $1020 | 04/25/2008 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| ESTRADA, MICHELLE | 2823 | 438-788000 |

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. _____

This collection of information is required by 37 CFR 1.311. 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 12 minutes 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: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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.

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. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 10655.0016-00 | 6938 |

22852 7590 01/25/2008

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

| EXAMINER | |
|---|---|
| ESTRADA, MICHELLE | |
| ART UNIT | PAPER NUMBER |
| 2823 | |

DATE MAILED: 01/25/2008

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

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.

| Notice of Allowability | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/101,863 | ZHANG ET AL. | |
| | Examiner | Art Unit | |
| | Michelle Estrada | 2823 | |

*-- 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 *12/18/07*.

2. ☒ The allowed claim(s) is/are *2-4,6-13,21-24 and 41-60*.

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 11/27/07
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 _____ .
7. ☐ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

MICHELLE ESTRADA
PRIMARY EXAMINER

PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

| Complete if Known | |
|---|---|
| Application Number | 10/101,863 |
| Filing Date | March 16, 2002 |
| First Named Inventor | Hongmei ZHANG |
| Art Unit | 2823 |
| Examiner Name | Michelle ESTRADA |
| Attorney Docket Number | 10655.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials* | Cite No.[1] | Document Number Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| MR | | US-7,262,131 | 08-28-2007 | Narasimhan et al. | |
| | | US- | | | |
| | | US- | | | |
| | | US- | | | |
| | | US- | | | |
| | | US- | | | |
| | | US- | | | |
| | | US- | | | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

## 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 | Translation[6] |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

## NONPATENT LITERATURE DOCUMENTS

| Examiner Initials* | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| ME | | Amendment/RCE filed October 31, 2007, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Amendment/RCE filed October 24, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Office Action dated November 15, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Final Office Action dated October 10, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |
| ME | | Amendment/RCE filed October 31, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 9140.0025-00). | |

| Examiner Signature | Michelle Estrada | Date Considered | 1/17/08 |
|---|---|---|---|

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.

**EXPRESS MAIL LABEL NO. EM 074696455 US**

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

Bib Data Sheet

CONFIRMATION NO. 6938

| SERIAL NUMBER | FILING DATE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002<br>RULE | 438 | 2823 | M-12245 US |

APPLICANTS

Hongmei Zhang, San Jose, CA;

Mukundan Narasimhan, San Jose, CA;
Ravi B. Mullapudi, San Jose, CA;Richard E. Demaray, Portola Valley, CA;

** CONTINUING DATA **********

None

** FOREIGN APPLICATIONS **********

None

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY **
** 05/17/2002

| Foreign Priority claimed | STATE OR | SHEETS | TOTAL | INDEPENDENT |
|---|---|---|---|---|
| ☐ yes ☑ no<br>35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after allowance<br>Verified and Acknowledged Examiner's Signature Initials | COUNTRY<br>CA | DRAWING<br>27 | CLAIMS<br>~~39~~ 19 | CLAIMS<br>~~5~~ 2 |

ADDRESS
22852
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER
LLP
901 NEW YORK AVENUE, NW
WASHINGTON , DC
20001-4413

TITLE
Biased pulse DC reactive sputtering of oxide films

| | | |
|---|---|---|
| FILING FEE<br>RECEIVED | FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following: | ☐ All Fees<br>☐ 1.16 Fees ( Filing )<br>☐ 1.17 Fees ( Processing Ext. of time ) |

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 10101863 | ZHANG ET AL. |
| | Examiner | Art Unit |
| | Estrada, Michelle | 2823 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

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

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 04/30/2007 | 11/11/2007 | 01/17/2008 | | | | | | |
| | 1 | - | - | | | | | | | |
| 2 | 2 | ✓ | ✓ | = | | | | | | |
| 3 | 3 | ✓ | ✓ | = | | | | | | |
| 4 | 4 | ✓ | ✓ | = | | | | | | |
| | 5 | ✓ | ✓ | - | | | | | | |
| 5 | 6 | ✓ | ✓ | = | | | | | | |
| 6 | 7 | ✓ | ✓ | = | | | | | | |
| 7 | 8 | ✓ | ✓ | = | | | | | | |
| 8 | 9 | ✓ | ✓ | = | | | | | | |
| 9 | 10 | ✓ | ✓ | = | | | | | | |
| 10 | 11 | ✓ | ✓ | = | | | | | | |
| 11 | 12 | ✓ | ✓ | = | | | | | | |
| 12 | 13 | ✓ | ✓ | = | | | | | | |
| | 14 | - | - | - | | | | | | |
| | 15 | - | - | - | | | | | | |
| | 16 | - | - | - | | | | | | |
| | 17 | - | - | - | | | | | | |
| | 18 | - | - | - | | | | | | |
| | 19 | - | - | - | | | | | | |
| | 20 | - | - | - | | | | | | |
| 1 | 21 | ✓ | ✓ | = | | | | | | |
| 13 | 22 | ✓ | ✓ | = | | | | | | |
| 14 | 23 | ✓ | ✓ | = | | | | | | |
| 15 | 24 | ✓ | ✓ | = | | | | | | |
| | 25 | - | - | - | | | | | | |
| | 26 | - | - | - | | | | | | |
| | 27 | - | - | - | | | | | | |
| | 28 | - | - | - | | | | | | |
| | 29 | - | - | - | | | | | | |
| | 30 | - | - | - | | | | | | |
| | 31 | - | - | - | | | | | | |
| | 32 | - | - | - | | | | | | |
| | 33 | - | - | - | | | | | | |
| | 34 | - | - | - | | | | | | |
| | 35 | - | - | - | | | | | | |
| | 36 | - | - | - | | | | | | |

| Index of Claims | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 10101863 | ZHANG ET AL. |
| | Examiner | Art Unit |
| | Estrada, Michelle | 2823 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ✓ | Rejected | - | Cancelled | N | Non-Elected | A | Appeal |
| = | Allowed | ÷ | Restricted | I | Interference | O | Objected |

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

| CLAIM | | DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Final | Original | 04/30/2007 | 11/11/2007 | 01/17/2008 | | | | | | |
| | 37 | - | - | - | | | | | | |
| | 38 | - | - | - | | | | | | |
| | 39 | - | - | - | | | | | | |
| | 40 | ✓ | ✓ | - | | | | | | |
| 16 | 41 | ✓ | ✓ | = | | | | | | |
| 17 | 42 | ✓ | ✓ | = | | | | | | |
| 18 | 43 | ✓ | ✓ | = | | | | | | |
| 19 | 44 | ✓ | ✓ | = | | | | | | |
| 20 | 45 | ✓ | ✓ | = | | | | | | |
| 21 | 46 | ✓ | ✓ | = | | | | | | |
| 22 | 47 | ✓ | ✓ | = | | | | | | |
| 23 | 48 | ✓ | ✓ | = | | | | | | |
| 24 | 49 | ✓ | ✓ | = | | | | | | |
| 25 | 50 | ✓ | ✓ | = | | | | | | |
| 26 | 51 | ✓ | ✓ | = | | | | | | |
| 27 | 52 | ✓ | ✓ | = | | | | | | |
| 28 | 53 | ✓ | ✓ | = | | | | | | |
| 29 | 54 | ✓ | ✓ | = | | | | | | |
| 30 | 55 | ✓ | ✓ | = | | | | | | |
| 31 | 56 | ✓ | ✓ | = | | | | | | |
| 32 | 57 | ✓ | ✓ | = | | | | | | |
| 33 | 58 | ✓ | ✓ | = | | | | | | |
| 34 | 59 | ✓ | ✓ | = | | | | | | |
| 35 | 60 | ✓ | ✓ | = | | | | | | |

| Issue Classification | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 10101863 | ZHANG ET AL. |
| | Examiner | Art Unit |
| | Estrada, Michelle | 2823 |

| ORIGINAL | | INTERNATIONAL CLASSIFICATION | |
|---|---|---|---|
| CLASS | SUBCLASS | CLAIMED | NON-CLAIMED |
| 438 | 778 | H 0 1 L 21 / 31 (2006.01.01) | |
| CROSS REFERENCE(S) | | H 0 1 L 21 / 469 (2006.01.01) | |

| CLASS | SUBCLASS (ONE SUBCLASS PER BLOCK) | | | | |
|---|---|---|---|---|---|
| 438 | 787 | 788 | | | |
| 427 | 533 | | | | |
| 204 | 192.12 | 192.15 | | | |

| | | | |
|---|---|---|---|
| NONE (Assistant Examiner) (Date) | Michelle Estrada MICHELLE ESTRADA PRIMARY EXAMINER | Total Claims Allowed: 35 | |
| J. Stephens 1-24-08 (Legal Instruments Examiner) (Date) | Estrada, Michelle 1/17/08 (Primary Examiner) (Date) | O.G. Print Claim(s) 1 | O.G. Print Figure 1A |

U.S. Patent and Trademark Office

Part of Paper No. 20080117

| Search Notes | Application/Control No. | Applicant(s)/Patent Under Reexamination |
|---|---|---|
| | 10101863 | ZHANG ET AL. |
| | Examiner | Art Unit |
| | Estrada, Michelle | 2823 |

| SEARCHED | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| Updated as before | | 1/17/08 | ME |
| 257 | E21.273,E21.278,E21.462 | 1/17/08 | Me |

| SEARCH NOTES | | |
|---|---|---|
| Search Notes | Date | Examiner |
| See East search attached | 10/2/07 | ME |
| Inspected parent for pertinent prior art | 1/17/08 | ME |

| INTERFERENCE SEARCH | | | |
|---|---|---|---|
| Class | Subclass | Date | Examiner |
| PG Pub text search | | 1/17/08 | ME |

IDS Form PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

Sheet 1 of 1

| Complete if Known | |
|---|---|
| *Application Number* | 10/101,863 |
| *Filing Date* | March 16, 2002 |
| *First Named Inventor* | Hongmei ZHANG |
| *Art Unit* | 2823 |
| *Examiner Name* | Michelle ESTRADA |
| *Attorney Docket Number* | 10655.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials* | Cite No.[1] | Document Number<br>Number-Kind Code[2] *(if known)* | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US- | | | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

## FOREIGN PATENT DOCUMENTS

| Examiner Initials* | Cite No.[1] | Foreign Patent Document<br>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 | Translation[6] |
|---|---|---|---|---|---|---|
| | | | | | | |

## NONPATENT LITERATURE DOCUMENTS

| Examiner Initials* | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| | | Response to Office Action dated November 21, 2007, in U.S. Appl. No. 10/291,179 (Attorney Docket No. 9140.0001-00). | |
| | | Response to Office Action dated December 5, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Final Office Action dated January 29, 2008, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Office Action dated January 25, 2008, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Response to Office Action dated December 18, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Notice of Allowance dated February 1, 2008, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Office Action dated November 16, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 10655.0025-00). | |
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| Examiner Signature | | Date Considered | |
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**EXPRESS MAIL LABEL NO.**
**EM 074697411 US**

| IDS Form PTO/SB/08: Substitute for form 1449A/PTO | Complete if Known | |
|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | Application Number | 10/650,461 |
| | Filing Date | August 27, 2003 |
| | First Named Inventor | DAWES, David |
| (Use as many sheets as necessary) | Art Unit | 2883 |
| | Examiner Name | DUPUIS, Derek L. |
| Sheet 1 of 1 | Attorney Docket Number | 10655.0025-00 |

**U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS**

| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
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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 | Translation[6] |
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**NON PATENT LITERATURE DOCUMENTS**

| Examiner Initials | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| /DLD/ | | Amendment/RCE filed August 9, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| /DLD/ | | Office Action dated September 5, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| /DLD/ | | Final Office Action dated September 7, 2007, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| /DLD/ | | Response to Final Office Action filed October 2, 2007, in U.S. Application No. 10/101,863 (Attorney Docket No. 9140.0016-00). | |
| /DLD/ | | Final Office Action dated July 24, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
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| Examiner Signature | /Derek Dupuis/ | Date Considered | 11/12/2007 |
|---|---|---|---|

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**EXPRESS MAIL LABEL NO. EM 100825650 US**

03-15-08

1fw 2823

PATENT
Customer No. 22,852
Attorney Docket No. 10655.0016-00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| In re Application of: | ) | |
| | ) | |
| ZHANG, Hongmei et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| | ) | |
| Filed: March 16, 2002 | ) | |
| | ) | Confirmation No.: 6938 |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | |

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

Sir:

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(d)**

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(d), Applicants brings to the attention of the Examiner the documents on the attached listing. This Supplemental Information Disclosure Statement is being filed after a Notice of Allowance but before payment of the issue fee and the Commissioner is authorized to charge the fee of $180.00 to Deposit Account No. 06-0916, as specified under § 1.17(p) and a statement as specified under § 1.97(e).

Based on reasonable inquiry, no document listed in this Supplemental Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and no document listed in this Supplemental Information Disclosure Statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing date of this Supplemental Information Disclosure Statement.

Copies of the listed non-patent literature documents are attached. Applicants respectfully request that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claims in the application and Applicants determine that the cited documents do not constitute "prior art" under United States law, Applicants reserve the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

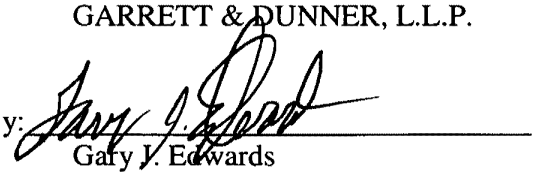
Applicants further reserve the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any additional fee due in connection with the filing of this Statement, please charge the fee to Deposit Account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: February 13, 2008

By: 
Gary J. Edwards
Reg. No. 41,008
(650) 849-6622

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 10655.0016-00 | 6938 |

22852 7590 03/03/2008

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

| EXAMINER | |
|---|---|
| ESTRADA, MICHELLE | |
| ART UNIT | PAPER NUMBER |
| 2823 | |

| MAIL DATE | DELIVERY MODE |
|---|---|
| 03/03/2008 | 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.

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

| APPLICATION NO./ CONTROL NO. | FILING DATE | FIRST NAMED INVENTOR / PATENT IN REEXAMINATION | ATTORNEY DOCKET NO. |
|---|---|---|---|
| 10101863 | 3/16/02 | ZHANG ET AL. | 10655.0016-00 |

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

| EXAMINER | |
|---|---|
| Michelle Estrada | |
| **ART UNIT** | **PAPER** |
| 2823 | 20080221 |

**DATE MAILED:**

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

**Commissioner for Patents**

Attached are the IDS filed 7/28/05 and 7/13/06 that have been considered.

/Michelle Estrada/
Primary Examiner, Art Unit 2823

PTO-90C (Rev.04-03)


PATENT
Customer No. 22,852
Attorney Docket No. 9140.0016-00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| In re Application of: | ) | |
| | ) | |
| ZHANG, Hongmei et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| | ) | |
| Filed: March 16, 2002 | ) | |
| | ) | |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | Confirmation No.: 6938 |

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

Sir:

**SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(b)**

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(b), applicants bring to the attention of the Examiner the documents on the attached listing. This Information Disclosure Statement is being filed before the mailing date of a first Office Action after the filing of a Request for Continued Examination in the above-referenced application. Applicants respectfully request that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

Based on reasonable inquiry, no document listed in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and no document listed in this Information Disclosure Statement was known to any individual

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ME/

designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing date of this Information Disclosure Statement.

Copies of the listed foreign patents and non-patent literature documents are attached. Copies of the U.S. patents and patent publications are not enclosed.

Applicants respectfully request that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claims in the application and applicants determine that the cited documents do not constitute "prior art" under United States law, applicant reserves the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

Applicants further reserve the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: July 28, 2005

By: _____
Gary J. Edwards
Reg. No. 41,008

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**EV 727733065 US**



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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

| Sheet | 1 | of | 9 |
|---|---|---|---|

| Complete if Known | |
|---|---|
| *Application Number* | 10/101,863 |
| *Filing Date* | March 16, 2002 |
| *First Named Inventor* | ZHANG, Hongmei |
| *Art Unit* | 2823 |
| *Examiner Name* | ESTRADA, Michelle |
| *Attorney Docket Number* | 9140.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] *(if known)* | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US 2005/0006768 A1 | 01-13-2005 | Narasimhan et al. | |
| | | US 2005/0000794 A1 | 01-06-2005 | Demaray et al. | |
| | | US 2004/0259305 A1 | 12-23-2004 | Demaray et al. | |
| | | US 2004/0105644 A1 | 06-03-2004 | Dawes | |
| | | US 2003/0174391 A1 | 09-18-2003 | Pan et al. | |
| | | US 2003/0141186 A1 | 07-31-2003 | Wang et al. | |
| | | US 2003/0127319 A1 | 06-10-2003 | Demaray et al. | |
| | | US 2003/0097858 A1 | 05-29-2003 | Strohhofer et al. | |
| | | US 2002/0170821 A1 | 11-21-2002 | Sandlin et al. | |
| | | US 2001/041460 A1 | 11-15-2001 | Wiggins | |
| | | US 2001/0027159 A1 | 10-04-2001 | Kaneyoshi | |
| | | US 6,750,156 B2 | 06-15-2004 | Le et al. | |
| | | US 6,576,546 B2 | 06-10,-2003 | Gilbert et al. | |
| | | US 6,444,750 B1 | 09-03-2002 | Touhsaent | |
| | | US 6,433,380 B2 | 08-13-2002 | Shin | |
| | | US 6,423,776 B1 | 07-23-2002 | Akkapeddi et al. | |
| | | US 6,416,598 B1 | 07-09-2002 | Sircar | |
| | | US 6,413,645 B1 | 07-02-2002 | Graff et al. | |
| | | US 6,365,319 B1 | 04-02-2002 | Heath et al. | |
| | | US 6,302,939 B1 | 10-16-2001 | Rabin et al. | |
| | | US 6,300,215 B1 | 10-09-2001 | Shin | |
| | | US 6,261,917 B1 | 07-17-2001 | Quek et al. | |
| | | US 6,248,640 B1 | 06-19-2001 | Nam | |
| | | US 6,232,242 | 05-15-2001 | Hata et al. | |
| | | US 6,214,660 B1 | 04-10-2001 | Uemoto et al. | |
| | | US 6,210,544 B1 | 04-03-2001 | Sasaki | |
| | | US 6,204,111 B1 | 03-20-2001 | Uemoto et al. | |
| | | US 6,198,217 B1 | 03-06-2001 | Suzuki et al. | |
| | | US 6,197,167 B1 | 03-06-2001 | Tanaka | |
| | | US 6,165,566 | 12-26-2000 | Tropsha | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**

*(Use as many sheets as necessary)*

Sheet 2 of 9

| Complete if Known | |
|---|---|
| Application Number | 10/101,863 |
| Filing Date | March 16, 2002 |
| First Named Inventor | ZHANG, Hongmei |
| Art Unit | 2823 |
| Examiner Name | ESTRADA, Michelle |
| Attorney Docket Number | 9140.0016-00 |

| U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS | | | | | |
|---|---|---|---|---|---|
| | | US 6,157,765 | 12-05-2000 | Bruce et al. | |
| | | US 6,146,225 | 11-14-2000 | Sheats et al. | |
| | | US 6,106,933 | 08-22-2000 | Nagai et al. | |
| | | US 6,080,643 | 06-27-2000 | Noguchi et al. | |
| | | US 6,077,642 | 06-20-2000 | Ogata et al. | |
| | | US 6,071,323 | 06-06-2000 | Kawaguchi | |
| | | US 6,058,233 | 05-02-2000 | Dragone | |
| | | US 6,052,397 | 04-18-2000 | Jeon et al. | |
| | | US 6,051,296 | 04-18-2000 | McCaulley et al. | |
| | | US 6,046,081 | 04-04-2000 | Kuo | |
| | | US 6,004,660 | 12-21-1999 | Topolski et al. | |
| | | US 5,966,491 | 10-12-1999 | DiGiovanni | |
| | | US 5,952,778 | 09-14-1999 | Haskal et al. | |
| | | US 5,930,584 | 07-27-1999 | Sun et al. | |
| | | US 5,900,057 | 05-04-1999 | Buchal et al. | |
| | | US 5,882,946 | 03-16-1999 | Otani | |
| | | US 5,870,273 | 02-09-1999 | Sogabe et al. | |
| | | US 5,853,830 | 12-29-1998 | McCaulley et al. | |
| | | US 5,831,262 | 11-03-1998 | Greywall et al. | |
| | | US 5,811,177 | 09-22-1998 | Shi et al. | |
| | | US 5,771,562 | 06-30-1998 | Harvey, III et al. | |
| | | US 5,762,768 | 06-09-1998 | Goy et al. | |
| | | US 5,757,126 | 05-26-1998 | Harvey, III et al. | |
| | | US 5,738,731 | 04-14-1998 | Shindo et al. | |
| | | US 5,731,661 | 03-24-1998 | So et al. | |
| | | US 5,689,522 | 11-18-1997 | Beach | |
| | | US 5,686,360 | 11-11-1997 | Harvey, III et al. | |
| | | US 5,654,984 | 08-05-1997 | Hershbarger et al. | |
| | | US 5,607,789 | 03-04-1997 | Treger et al. | |
| | | US 5,591,520 | 01-07-1997 | Migliorini et al. | |
| | | US 5,563,979 | 10-08-1996 | Bruce et al. | |
| | | US 5,538,796 | 07-23-1996 | Schaffer et al. | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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| IDS Form PTO/SB/08: Substitute for form 1449A/PTO | | | | Complete if Known | |
|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | *Application Number* | 10/101,863 |
| | | | | *Filing Date* | March 16, 2002 |
| | | | | *First Named Inventor* | ZHANG, Hongmei |
| | | | | *Art Unit* | 2823 |
| *(Use as many sheets as necessary)* | | | | *Examiner Name* | ESTRADA, Michelle |
| Sheet | 3 | of | 9 | *Attorney Docket Number* | 9140.0016-00 |

| U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS | | | | | |
|---|---|---|---|---|---|
| | | US 5,499,207 | 03-12-1996 | Miki et al. | |
| | | US 5,457,569 | 10-10-1995 | Liou et al. | |
| | | US 5,355,089 | 10-11-1994 | Treger | |
| | | US 5,309,302 | 05-03-1994 | Vollmann | |
| | | US 5,306,569 | 04-26-1994 | Hiraki | |
| | | US 5,303,319 | 04-12-1994 | Ford et al. | |
| | | US 5,296,089 | 03-22-1994 | Chen et al. | |
| | | US 5,173,271 | 12-22-1992 | Chen et al. | |
| | | US 5,119,460 | 06-02-1992 | Bruce et al. | |
| | | US 5,107,538 | 04-21-1992 | Benton et al. | |
| | | US 5,085,904 | 02-04-1992 | Deak et al. | |
| | | US 4,587,225 | 05-06-1986 | Tsukuma et al. | |
| | | RE 32,449 | 06-30-1987 | Claussen | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

| FOREIGN PATENT DOCUMENTS | | | | | | |
|---|---|---|---|---|---|---|
| Examiner Initials | Cite No.[1] | Foreign Patent Document<br>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 | Translation[6] |
| | | EP 1 189 080 A2 | 03-20-2002 | Agere Systems Optoelectronics Guardian Corporation | | |
| | | EP 1 092 689 A1 | 04-18-2001 | BPS Alzenau GmbH | | |
| | | EP 1068899 A1 | 01-17-2001 | Nippon Sheet Glass Co., Ltd. | | |
| | | EP 0 639 655 A1 | 02-22-1995 | Asahi Glass Co, Ltd. | | |
| | | EP 0 652 308 A2 | 10-13-1994 | Mega Chips Corp. | | |
| | | EP 0 510 883 A2 | 10-28-1992 | AT&T | | |
| | | JP 7-233469 | 09-05-1995 | Asahi Glass Co, Ltd. | | |
| | | JP 2-054764 A2 | 02-23-1990 | Leybold AG | | |
| | | WO 00/21898 A1 | 04-20-2000 | Samsung Electronics Co. | | |
| | | | | | | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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.

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| IDS Form PTO/SB/08: Substitute for form 1449A/PTO | | | | Complete if Known | |
|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | *Application Number* | 10/101,863 |
| | | | | *Filing Date* | March 16, 2002 |
| | | | | *First Named Inventor* | ZHANG, Hongmei |
| | | | | *Art Unit* | 2823 |
| *(Use as many sheets as necessary)* | | | | *Examiner Name* | ESTRADA, Michelle |
| Sheet | 4 | of | 9 | *Attorney Docket Number* | 9140.0016-00 |

| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| Examiner Initials* | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
| | | AFFINITO et al., "PML/oxide/PML Barrier Layer Performance Differences Arising from Use of UV or Electron Beam Polymerization of the PML Layers," *Thin Solid Films* Vol. 308-309, pp. 19-25 (1997) | |
| | | AFFINITO et al., "Polymer-Oxide Transparent Barrier Layers," Society of Vacuum Coaters, 39th Ann. Technical Conference Proceedings, May 5-10, 1996, Philadelphia, PA, pp. 392-397 (1996). | |
| | | ALDER, T. et al., "High-Efficiency Fiber-to-Chip Coupling Using Low-Loss Tapered Single-Mode Fiber," IEEE Photonics Technology Letters, 12(8):1016-1018 (2000). | |
| | | ALMEIDA, Vilson R. et al., "Nanotaper for compact mode conversion," *Optics Letters*, 28(15):1302-1304 (2003). | |
| | | ASGHARI et al., "ASOC--A Manufacturing Integrated Optics Technology," Part of the SPIE Conference on Integrated Optics Devices III, vol. 3620, pp. 252-262 (Jan. 1999). | |
| | | BARBIER et al, "Amplifying Four-Wavelength Combiner, Based on Erbium/Etterbium-Doped Waveguide Amplifiers and Integrated Splitters", *IEEE PHOTONICS TECHNOLOGY LETTTERS*, Vol.9, pp 315-317, 1997, 4 pages | |
| | | BEACH R.J., "Theory and optimization of lens ducts," *Applied Optics,* 35:12:2005-15 (1996) | |
| | | BESTWICK, T., "ASOC silicon integrated optics technology," Part of the SPIE Conferences on Photonics Packaging and Integration, SPIE vol. 3631, pp. 182-190 (Jan. 1999). | |
| | | BORSELLA et al., "Structural incorporation of silver insoda-lime glass by the ion-exchange process: a photoluminescence spectroscopy study", *Applied Physics* A 71, pp. 125-132 (2000) | |
| | | CAMPBELL et al., "Titanium dioxide ($TiO_2$)-based gate insulators," *IBM J. Res. Develop.* 43(3), 383-391, (May 1999). | |
| | | CHANG, C.Y. (edited by), "ULSI Technology," The McGraw-Hill Companies, Inc., New York, 1996, Chapter 4, pp. 169-170, 226-231 (1996).. | |
| | | CHEN et al. "Development of Supported Bifunctional Electrocatalysts for Unitized Regenerative Fuel Cells," *Journal of the Electrochemical Society*, 149(8), A1092-99, (2002). | |
| | | CHOI et al., "Er-Al-codoped silicate planar light waveguide-type amplifier fabricated by radio-frequency sputtering," *Optics Letters*, vol. 25, No. 4, pp. 263-265 (Feb. 15, 2000). | |
| | | COOKSEY et al. "Predicting Permeability & Transmission Rate for Multilayer Materials," *Foodtechnology*, Vol. 53, No. 9, pp. 60-63 (September 1999). | |
| | | Crowder, et al., "Low-Temperature Single-Crystal Si TFT's Fabricated on Si Films Processed via Sequential Lateral Solidification," IEEE, vol. 19, no. 8 (August 1998), pages 306-308. | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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| | | | | First Named Inventor | ZHANG, Hongmei |
| | | | | Art Unit | 2823 |
| *(Use as many sheets as necessary)* | | | | Examiner Name | ESTRADA, Michelle |
| Sheet | 5 | of | 9 | Attorney Docket Number | 9140.0016-00 |

| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | DELAVAUX et al., "Integrated optics erbium ytterbium amplifier system in 10 Gb/s fiber transmission experiment", 22nd European Conference on Optical Communication - ECOC' 96, Oslo, 4 pages (1996). | |
| | | Distiributed Energy Resources: Fuel Cells, Projects, http://www.eere.energy.gov/der/fuel_cells/projects.html (2003). | |
| | | DuPont Teijin Films, Mylar 200 SBL 300, Product Information (2000). | |
| | | Electrometals Technologies Limited, Financial Report for the year 2002, Corporate Directory, Chairman's Review, Review of Operations (2002). | |
| | | E-Tek website: FAQ, Inside E-Tek, E-Tek News, Products; http://www.etek-inc.com/ (2003). | |
| | | FLYTZANIS et al, "nonlinear Optics in Composite Materials," E. Wolf, Progress in Optics XXIX (c) Elsevier Scince Publishers B.V., pp. 323-425 (1991). | |
| | | FRAZAO et al., "EDFA Gain Flattening Using Long-Period Fibre Gratings Based on the Electric Arc Technique," (date unknown). | |
| | | GARCIA, C. "Size Dependence of Lifetime and Absorption Cross Section of Si Nanocrystals Embedded in $SiO_2$," Appl. Phys. Lett., Vol. 82, No. 10, pp. 1595-7 (March 2003). | |
| | | GOOSSENS et al., "Sensitization of $TiO_2$ with p-type semiconductor polymers," Delft Interfaculty Research Center, Delft University of Technology Laboratory of Inorganic Chemistry, The Netherlands (1998). | |
| | | Greene et al., "Morphological and electrical properties of rf sputtered Y203-doped Zr02 thin films," J. Vac. Sci. Tecnol., vol. 13, no. 1 (Jan/Feb 1976), pages 72-75. | |
| | | HAN, Hak-Seung et al. "Optical Gain at 1.54 □m in Erbium-Doped Silicon Nanocluster Sensitized Waveguide," *Appl. Phys. Lett.*, Vol. 79, No. 27, pp. 4568-70 (December 2001). | |
| | | HAYAKAWA et al., "Enhanced fluorescence from $Eu^{3+}$ owing to surface plasma oscillation of silver particles in glass", *Journal of Non-Crystalline Solids*, Vol. 259, pp. 16-22 (1999). | |
| | | HAYAKAWA et al, "Field enhancement effect of small Ag particles on the fluorescence from $Eu^{3+}$-doped $SiO_2$ glass", *Appl. Phys. Lett.*, Vol. 74, No 11, pp. 1513-1515 (March 1999). | |
| | | HAYFIELD, P.C.S., "Development of a New Material-Monolithic Ti4O7 Ebonix Ceramic," Royal Society Chemistry," (2002). | |
| | | HEHLEN et al. "Spectroscopic Properties of $Er^{3+}$ - and $Yb^{3+}$-doped Soda-Lime Silicate and Aluminosilicate Glasses," *Physical Review B*, Vol. 56, No. 15, pp. 9302-9318 (October 1997). | |
| | | HEHLEN et al. "Uniform Upconversion in High-Concentration $Er^{3+}$-doped Soda Lime Silicate and Aluminosilicate Glasses," *Optics Letters*, Vol. 22, No. 11, pp. 772-774 (June 1997). | |
| | | HORST et al., "Compact, Tunable Optical Devices in Silicon-Oxynitride Wave Guide Technology," IBM Research Division, 3 pages (1999). | |

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| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | HUBNER, J. and Guldberg-Kjaer, S., "Planar Er-and Yb-Doped Amplifiers and Lasers," COM Technical University of Denmark, 10.sup.th European Conf. On Integrated Optics, Session WeB2, pp. 71-74 (2001). | |
| | | Hwang, Man-Soo et al., "The effect of pulsed magnetron sputtering on the properties of indium tin oxide thin films," Elsevier Science B.V., P. 29-33, (2003). | |
| | | Im, et al. "Controlled Super-lateral Growth of Si Films for Microstructural Manipulation and Optimization," Materials Science Program (1998), pages. 603-617. | |
| | | Im, et al., "Crystalline Si Films for Integrated Active-Matrix LiquidCrystal Displays," MrS Bulletin (March 1996), pages. 39-48. | |
| | | Im, et al., "Single-crystal Si films for thin-film transistor devices," American Institute of Physics (1997), pages. 3434-3436. | |
| | | ITOH, M. et al., "Large reduction of singlemode-fibre coupling loss in 1.5% delta planar lightwave circuits using spot-size converters," Electronics Letters, 38(2):72-74 (2002). | |
| | | JACKSON et al. "An Accurate Compact EDFA Model," Dept. of Electrical and Computer Engineering, University of BC (date unknown). | |
| | | JANSSEN et al. "Photoinduced electron transfer from conjugated polymers onto nanocrystalline $TiO_2$," Eindhoven University of Technology, The Netherlands (date unknown). | |
| | | JOHNSON, J.E. et al., "Monolithically Integrated Semiconductor Optical Amplifier and Electroabsorption Modulator with Dual-Waveguide Spot-Size Converter Input," IEEE Journal of Selected Topics in Quantum Electronics, 6(1):19-25, (2000). | |
| | | JONSSON L.B. et al. "Frequency response in pulsed DC reactive sputtering processes," *Thin Solid Films,* Vol. 365, pp. 43-48 (2000). | |
| | | KATO et al., "Recent progress on PLC hybrid integration," Part of the SPIE Conference on Optoelectric Integrated Circuits III, SPIE. vol. 3631, pp. 28-36 (Jan. 1999). | |
| | | KATO, Kuniharu et al., "PLC Hybrid Integration Technology and Its Application to Photonic Components," IEEE Journal of Selected Topics in Quantum Electronics, 6(1):4-13 (2000). | |
| | | KIK, P.G. et al. "Gain Limiting Processes in Er-doped Si Nanocrystal Waveguides in $SiO_2$," *J. Appl. Phys.*, Vol. 91, No. 1, pp. 534-536 (January 1, 2002). | |
| | | KIM et al. "Frequency-dependent pulsed direct current magnetron sputtering of titanium oxide films," *J. Vac. Sci. Technol.* A 19(2); 429-434 (March 2001). | |
| | | KIM et al. "Mixture Behaviour and Microwave Dielectric Properties in the Low-fired $TiO_2$-CuO System," *Jpn. J. Appl. Phys.*, 39, 2696-2700, (2000). | |
| | | LADOUCEUR, F. et al., " 8.8 Evaluation of Results", Silica-based Buried Channel Waveguides and Devices,, Chapman & Hall, London, pp. 98-99 (1996). | |
| | | LADOUCEUR, F. et al., "Effect of side wall roughness in buried channel waveguides," *IEEE Proc.*, vol. 141, pp. 242-248 (Aug. 1994). | |
| | | LAMB, William B., "Designing Nonfoil Containing Skins for VIP Applications," DuPont VIA Symposium Presenation, (1999). | |

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| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | LAMB, William et al. "Designing Non-Foil Containing Skins for Vacuum InsulationPanel (VIP) Applications," *Vuoto*, Vol. XXVIII, No. 1-2 - Gennaio-Giugno 1999, pp. 55-58 (1999). | |
| | | LANGE et al, "High Gain Ultra-Short Length Phosphate glass Erbium-Doped Fiber Amplifier Material", OSA Optical Fiber Communications (OFC), 3 pages (2002). | |
| | | LAPORTA et al, "Diode-pumped cw bulk Er: Yb: glass laser", 1952 Optics Letters/Vol. 16, No. 24/Dec. 15, 6 pages (1991). | |
| | | LAURENT-LUND, C. et al., "PECVD Grown Multiple Core Planar Waveguides with Extremely Low Interface Reflections and Losses," *IEEE Photonics Technology Letters*, Vol. 10, No. 10, pp. 1431-1433 (Oct. 1998). | |
| | | LEE et al., "Effect of size and roughness on light transmission in a S/SiO.sub.2 waveguide: Experiments and model," Department of Materials Science and Engineering, Massachusetts Institute of Technology, (Jul. 12, 2000). | |
| | | LEE et al. "Effects of interfacial layer growth on the electrical characteristics of thin titanium oxide films on silicon," *Applied Physics Letters*, 74(21), 3143-3145, (May 1999). | |
| | | LOVE, J.D. et al., "Quantifying Loss Minimisation in Single-Mode Fibre Tapers," Electronics Letters, 22(17):912-914, (1986). | |
| | | MARDARE et al. "On the structure of Titanium Oxide Thin Films," *Analele Stiintifice Ale Universitatii AL. I. Cuza IASI,* Vol. XLV-XLVI, 201-208 (1999). | |
| | | MARQUES, P.V.S. et al., "Planar Silica-on-Silicon Waveguide Lasers Based in Two Layer Core Devices," 10.sup.th European Conference on Integrated Optics, Session WeB2, pp. 79-82 (2001). | |
| | | MEIJERINK et al, LUMINESCENCE OF $AG^+$ IN CRYSTALLINE AND GLASSY $SrB_4O_7$, Journal of Physics and Chemistry of Solids, Vol. 54, No. 8, pp. 901-906, (1993). | |
| | | MESNAOUI et al, "Spectroscopic properties of $AG^+$ ions in phospage glasses of $NaPO_3$-$AgPO_3$ system", EUROPEAN JOURNAL OF SOLID STATE AND INORGANIC CHEMISTRY, Vol. 29, pages 1001-1013, 14 pages (1992). | |
| | | MITOMI, O. et al., "Design of a Single-Mode Tapered Waveguide for Low-Loss Chip-to-Fiber Coupling,: IEEE Journal of Quantum Electronics, 30(8):1787-1793, (1994). | |
| | | MIZUNO et al. "Temperature dependence of oxide decomposition on titanium surfaces in UHV," submitted to Journal of Vacuum Science and Technology, (October 28, 2001). | |
| | | OHKUBO et al., "Polarization-Insensitive Arrayed-Waveguide Grating Using Pure Si)2 Cladding," Fifth Optoelectronics and Communication Conference (OECC 2000) Technical Digest, 2 pages (Jul. 2000). | |
| | | OHMI et al., "Rare earth metal oxides for high-K gate insulator," Tokyo Institute of Technology,(date unknown). | |
| | | OHTSUKI et al., "Gain Characteristics of a high concentration $Er^{3+}$-doped phosphate glass waveguide", *J. Appl. Phys.* 78(6), pp. 3617-3621 (1995). | |
| | | ONO et al., "Design of a Low-loss Y-branch Optical Waveguide," Fifth Optoelectronic and Communications Conference (OECC 2000) Technical Digest, 2 pages (Jul. 2000). | |

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| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | PADMINI et al. "Realization of High Tunability Barium Strontium Titanate Thin Films by RF Magnetron Sputtering," College of Engineering, University of California, Santa Barbara. (date unknown). | |
| | | PETERS et al., "Formation mechanism of silver nanocrystals made by ion irradiation of $Na^+$--$Ag^+$ ion-exchanged sodalime silicate glass", Nuclear Instruments and Methods in Physics Research B 168, pp. 237-244 (2000). | |
| | | RAJARAJAN, M. et al., "Numerical Study of Spot-Zise Expanders for an Efficient OEIC to SMF Coupling," IEEE Photonics Technology Letters, 10(8):1082-1084, (1998). | |
| | | RAMASWAMY et al., "Ion-Exchanged Glass Waveguides: A Review", *Journal of Lightwave Technology*, Vol. 6, No. 6, pp. 984-1001 (1988) | |
| | | Sanyo Vacuum Industries Co., Ltd. Products Info, $TiO_2$, (2003). http://www.sanyovac.co.jp/Englishweb/products/ETiO2.htm | |
| | | SCHERMER, R. et al., "Investigation of Mesa Dielectric Waveguides,", Proceedings of the OSA Integrated Photonics Research Topical Meeting and Exhibit, Paper No. IWB3 (Jun 2001). | |
| | | Second International Symposium of Polymer Surface Modification: Relevance to Adhesion, Preliminary Program (1999). | |
| | | Seventh International Conference on $TiO_2$ Photocatalysis: Fundamentals & Applications, Toronto, Ontario, Canada, Final Program (November 17-21, 2002) | |
| | | SEWELL, P. et al., "Rib Waveguide Spot-Size Transformers: Modal Properties," Journal of Lightwave Technology, 17(5):848-856, (1999). | |
| | | SLOOFF et al, "Optical properties of Erbium-doped organic polydentate cage complexes", *J. Appl. Phys.* 83, pp. 497-503 (Jan. 1998). | |
| | | SMITH, R.E., "Reduced Coupling Loss Using a Tapered-Rib Adiabatic-Following Fiber Coupler," *IEEE Photonics Technology Letters,* 8(8):1052-1054 (1996). | |
| | | STROHHOFER, et al. "Energy transfer to $Er^{3+}$ in Ag ion-exchanged glass", FOM Institute for Atomic and Molecular Physics, 10 pages (date unknown). | |
| | | SUGIYAMA et al., "Gas Permeation Through the Pinholes of Plastic Film Laminated with Aluminium Foil," Vuoto, Vol. XXVIII, N. 1-2 - Gennaio-Guigno (1999). | |
| | | TERVONEN, A., "Challenges and opportunities for integrated optics in optical networks," Part of the SPIE Conference in Integrated Optics Devices III, SPIE vol. 3620, pp. 2-11 (Jan. 1999). | |
| | | TREICHEL et al., "The influence of pulsed magnetron sputtering on topography and crystallinity of TiO2 films on glass," *Space and Coatings Technology*, Vol. 123, pp. 268-272 (2000). | |
| | | Tukamoto, H. et al., "Electronic Conductivity of $LiCoO_s$ and Its Enhancement by Magnesium Doping," J. Electrochem. Soc., vol. 44, no. 9, pages 3164-3168 (September 1997). | |
| | | VILJANEN et al, "Planar Optical Coupling Elements for Multimode Fibers with Two-Step Ion Migration Process", Applied Physics, 24, No. 1, pp. 61-63 (January 1981). | |
| | | VILLEGAS et al, "Optical spectroscopy ofa soda lime glass exchanged with silver", Physics and Chemistry of Glasses 37(6), pp. 248-253 (1996). | |

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| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | VON ROTTKAY et al. "Influence of stoichiometry on electrochromic cerium-titanium oxide compounds," Lawrence Berkeley National Laboratory, UC Berkeley, CA, (date unknown). | |
| | | WILKES, Kenneth T. "Gas Permeation Through Vacuum Barrier Films and its Effect on VIP Thermal Performance," Vacuum Insulation Panel Symp., Baltimore, Maryland, (May 3, 1999). | |
| | | YANAGAWA, H. et al., "Index-and-Dimensional Taper and Its Application to Photonic Devices," Journal of Lightwave Technology, 10(5):587-591 (1992). | |
| | | Response to Office Action filed on March 14, 2005 in U.S. Serial No. 10/291,179 (Attorney Docket No. 09140-0001-00). | |
| | | Office Action issued on June 15, 2005 in U.S. Serial No. 10/291,179 (Attorney Docket No. 09140-0001-00). | |
| | | Response to Office Action filed on September 3, 2002 in U.S. Patent No. 6,533,907 (Attorney Docket No. 09140-0004-00). | |
| | | Response to Office Action filed on August 10, 2004 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on February 12, 2004 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Amendment/RCE filed on March 10, 2005 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on March 17, 2005 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Response to Office Action filed on June 17, 2005 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on July 8, 2005 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on May 14, 2003 in U.S. Serial No. 10/101,492 (Attorney Docket No. 09140-0015-00). | |
| | | Response to Office Action filed on August 14, 2003 in U.S. Serial No. 10/101,492 (Attorney Docket No. 09140-0015-00). | |
| | | Response to Office Action filed on March 3, 2004 in U.S. Serial No. 10/101,492 (Attorney Docket No. 09140-0015-00). | |
| | | Response to Office Action filed on February 23, 2004 in U.S. Serial No. 10/101,341 (Attorney Docket No. 09140-0017-00). | |
| | | Response to Office Action filed on December 08, 2004 in U.S. Serial No. 10/101,341 (Attorney Docket No. 09140-0017-00). | |
| | | Office Action issued on March 14, 2005 in U.S. Serial No. 10/789,953 (Attorney Docket No. 09140-0030-00). | |
| | | Office Action issued March 24, 2005 in U.S. Application No. 10/851,542 (Attorney Docket No. 09140.0033-00). | |

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IFW


PATENT
Customer No. 22,852
Attorney Docket No. 9140.0016-00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| In re Application of: | ) | |
| | ) | |
| ZHANG, Hongmei et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: ESTRADA, Michelle |
| | ) | |
| Filed: March 16, 2002 | ) | |
| | ) | |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | Confirmation No.: 6938 |

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

Sir:

**TENTH SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(c)**

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(c), Applicants bring to the attention of the Examiner the documents on the attached listing. This Tenth Supplemental Information Disclosure Statement is being filed after the events recited in Section 1.97(b) but, to the undersigned's knowledge, before the mailing date of either a Final action, Quayle action, or a Notice of Allowance. Under the provisions of 37 C.F.R. § 1.97(c), the Commissioner is hereby authorized to charge the fee of $180.00 to Deposit Account No. 06-0916 as specified by Section 1.17(p).

Copies of the listed foreign and non-patent literature documents are attached. Copies of the U.S. patents and patent publications are not enclosed.

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01 FC:1806 180.00 AR

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Applicants respectfully request that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claims in the application and Applicants determine that the cited documents do not constitute "prior art" under United States law, Applicants reserve the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

Applicants further reserve the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: July 13, 2006

By: _____
Gary J. Edwards
Reg. No. 41,008

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**U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS**

| Examiner Initials* | Cite No.[1] | Document Number Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US 4,710,940 | 12-01-1987 | Sipes, Jr. | |
| | | US 4,785,459 | 11-15-1988 | Baer | |
| | | US 5,435,826 | 07-25-1995 | Sakakibara et al. | |
| | | US 5,512,147 | 04-30-1996 | Bates et al. | |
| | | US 5,569,520 | 10-29-1996 | Bates | |
| | | US 5,597,660 | 01-28-1997 | Bates et al. | |
| | | US 5,612,152 | 03-18-1997 | Bates | |
| | | US 6,168,884 B1 | 01-02-2001 | Neudecker et al. | |
| | | US 6,236,793 B1 | 05-22-2001 | Lawrence et al. | |
| | | US 6,242,132 B1 | 06-05-2001 | Neudecker et al. | |
| | | US 6,365,300 B1 | 04-02-2002 | Ota et al. | |
| | | US 6,760,520 B1 | 07-06-2004 | Medin et al. | |
| | | US 6,818,356 B1 | 11-16-2004 | Bates | |
| | | US 2001/0031122 A1 | 10-18-2001 | Lackritz et al. | |
| | | US 2003/0185266 A1 | 10-02-2003 | Henrichs | |
| | | US 2006/0134522 A1 | 06-22-2006 | Zhang et al. | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

**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 | Translation[6] |
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| *(Use as many sheets as necessary)* | | | | *Examiner Name* | ESTRADA, Michelle |
| Sheet | 2 | of | 2 | *Attorney Docket Number* | 9140.0016-00 |



| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| Examiner Initials* | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
| | | COCORULLO, G. et al., "Amorphous silicon waveguides and light modulators for integrated photonics realized by low-temperature plasma-enhanced chemical-vapor deposition," *Optics Lett. 21*(24):2002-2004 (1996). | |
| | | Notice of Allowance mailed August 6, 2002, for US Patent No. 6,506,289 (Atty. Docket No. 09140.0002-01). | |
| | | Final Office Action mailed June 9, 2006 in U.S. Appl. No. 11/100,856 (Atty. Docket No. 09140.0015-01). | |
| | | Office Action issued on March 23, 2006, in U.S. Application No. 10/650,461 (Atty. Docket No. 09140-0025-00). | |
| | | Specification as filed September 2, 2005, for U.S. Appl. No. 11/218,652 (Atty. Docket No. 09140.0052-00000). | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
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Bib Data Sheet

**CONFIRMATION NO. 6938**

| SERIAL NUMBER | FILING OR 371(c) DATE / RULE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | 438 | 2823 | 10655.0016-00 |

**APPLICANTS**

Hongmei Zhang, San Jose, CA;
Mukundan Narasimhan, San Jose, CA;
Ravi B. Mullapudi, San Jose, CA;
Richard E. Demaray, Portola Valley, CA;

** CONTINUING DATA **********

** FOREIGN APPLICATIONS **********

**IF REQUIRED, FOREIGN FILING LICENSE GRANTED** ** SMALL ENTITY **
** 05/17/2002

| Foreign Priority claimed | STATE OR COUNTRY | SHEETS DRAWING | TOTAL CLAIMS | INDEPENDENT CLAIMS |
|---|---|---|---|---|
| ☐ yes ☐ no | CA | 27 | 39 | 5 |

35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance

Verified and Acknowledged _____ Examiner's Signature Initials

**ADDRESS**
22852

**TITLE**

BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS

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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 10655.0016-00 | 6938 |

22852 7590 03/13/2008

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WASHINGTON, DC 20001-4413

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|---|---|
| ESTRADA, MICHELLE | |
| ART UNIT | PAPER NUMBER |
| 2823 | |

| MAIL DATE | DELIVERY MODE |
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| 03/13/2008 | PAPER |

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| APPLICATION NO./ CONTROL NO. | FILING DATE | FIRST NAMED INVENTOR / PATENT IN REEXAMINATION | ATTORNEY DOCKET NO. |
|---|---|---|---|
| 10101863 | 3/16/02 | ZHANG ET AL. | 10655.0016-00 |

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| EXAMINER | |
|---|---|
| Michelle Estrada | |
| **ART UNIT** | **PAPER** |
| 2823 | 20080304 |

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**Commissioner for Patents**

Attached is the IDS filed 2/13/08 that have been considered.

/Michelle Estrada/
Primary Examiner, Art Unit 2823

PTO-90C (Rev.04-03)

IDS Form PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

Sheet 1 of 1

| Complete if Known | |
|---|---|
| *Application Number* | 10/101,863 |
| *Filing Date* | March 16, 2002 |
| *First Named Inventor* | Hongmei ZHANG |
| *Art Unit* | 2823 |
| *Examiner Name* | Michelle ESTRADA |
| *Attorney Docket Number* | 10655.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials* | Cite No.[1] | Document Number Number-Kind Code[2] *(if known)* | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
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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 | Translation[6] |
|---|---|---|---|---|---|---|
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## NONPATENT LITERATURE DOCUMENTS

| Examiner Initials* | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
|---|---|---|---|
| | | Response to Office Action dated November 21, 2007, in U.S. Appl. No. 10/291,179 (Attorney Docket No. 9140.0001-00). | |
| | | Response to Office Action dated December 5, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Final Office Action dated January 29, 2008, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| | | Office Action dated January 25, 2008, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| | | Response to Office Action dated December 18, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Notice of Allowance dated February 1, 2008, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
| | | Office Action dated November 16, 2007, in U.S. Application No. 10/650,461 (Attorney Docket No. 10655.0025-00). | |
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| Examiner Signature | /Michelle Estrada/ | Date Considered | 03/04/2008 |
|---|---|---|---|

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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

Sheet 1 of 1

| Complete if Known | |
|---|---|
| *Application Number* | 10/650,461 |
| *Filing Date* | August 27, 2003 |
| *First Named Inventor* | DAWES, David |
| *Art Unit* | 2883 |
| *Examiner Name* | DUPUIS, Derek L. |
| *Attorney Docket Number* | 10655.0025-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
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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 | Translation[6] |
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|---|---|---|---|
| /DLD/ | | Amendment/RCE filed August 9, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| /DLD/ | | Office Action dated September 5, 2007, in U.S. Application No. 09/903,081 (Attorney Docket No. 9140.0014-00). | |
| /DLD/ | | Final Office Action dated September 7, 2007, in U.S. Application No. 11/100,856 (Attorney Docket No. 9140.0015-01). | |
| /DLD/ | | Response to Final Office Action filed October 2, 2007, in U.S. Application No. 10/101,863 (Attorney Docket No. 9140.0016-00). | |
| /DLD/ | | Final Office Action dated July 24, 2007, in U.S. Application No. 10/954,182 (Attorney Docket No. 9140.0016-01). | |
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| Examiner Signature | /Derek Dupuis/ | Date Considered | 11/12/2007 |
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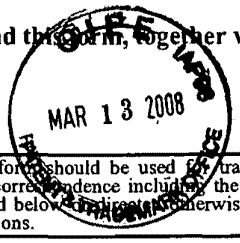


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Signed: Annie Wong

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 10655.0016-00 | 6938 |

TITLE OF INVENTION: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS

| APPLN. TYPE | SMALL ENTITY | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE |
|---|---|---|---|---|---|---|
| nonprovisional | YES | $720 | $300 | $0 | $1020 | 04/25/2008 |

| EXAMINER | ART UNIT | CLASS-SUBCLASS |
|---|---|---|
| ESTRADA, MICHELLE | 2823 | 438-788000 |

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1 Finnegan, Henderson,
2 Farabow, Garrett &
3 Dunner, L.L.P.

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(B) RESIDENCE: (CITY and STATE OR COUNTRY): Minnetonka, Minnesota

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☒ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

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Authorized Signature Gary J. Edwards Date March 12, 2008

Typed or printed name Gary J. Edwards Registration No. 41,008

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|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 10655.0016-00 | 6938 |

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| ART UNIT | PAPER NUMBER |
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|---|---|---|---|
| 10101863 | 3/16/02 | ZHANG ET AL. | 10655.0016-00 |

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| EXAMINER | |
|---|---|
| Michelle Estrada | |
| **ART UNIT** | **PAPER** |
| 2823 | 20080221 |

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/Michelle Estrada/
Primary Examiner, Art Unit 2823

PTO-90C (Rev.04-03)

| Complete if Known | |
|---|---|
| Application Number | 10/101,863 |
| Filing Date | March 16, 2002 |
| First Named Inventor | ZHANG et al. |
| Art Unit | 2823 |
| Examiner Name | Michelle ESTRADA |
| Attorney Docket Number | 09140-0016-00000 |

**U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS**

| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US 2002/0033330 A1 | Mar. 21, 2002 | Demaray et al. | |
| | | US 2002/0134671 A1 | Jul. 17, 2003 | Demaray et al. | |
| | | US 2003/0063883 A1 | Apr. 3, 2003 | Demaray et al. | |
| | | US 2003/0127319 A1 | Jul. 10, 2003 | Demaray et al. | |
| | | US 2003/0134054 A1 | Jul. 17, 2003 | Demaray et al. | |
| | | US 2003/0173207 A1 | Sep. 18, 2003 | Zhang et al. | |
| | | US 2003/0173208 A1 | Sep. 18, 2003 | Pan et al. | |
| | | US 2003/0174391 A1 | Sep. 18, 2003 | Pan et al. | |
| | | US 2003/0175142 A1 | Sep. 18, 2003 | Milonopoulou et al. | |
| | | US 2004/0105644 A1 | Jun. 3, 2004 | Dawes | |
| | | US 6,506,289 | Jan. 14, 2003 | Demaray et al. | |
| | | US 6,533,907 | Mar. 18, 2003 | Demaray et al. | |
| | | US 6,827,826 | Dec. 7, 2004 | Demaray et al. | |
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**Note: Copies of the U.S. Patent Documents are not Required in IDS filed after October 21, 2004**

**FOREIGN PATENT DOCUMENTS**

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|---|---|---|---|---|---|---|
| | | WO 2004/021532 A1 | Mar. 11, 2004 | Symmorphix, Inc. | | |
| | | WO 2004/077519 A2 | Sep. 10, 2004 | Narasimhan et al. | | |
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| Examiner Signature | /Michelle Estrada/ | Date Considered | 03/11/2008 |
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| IDS Form PTO/SB/08: Substitute for form 1449A/PTO | | | | Complete if Known | |
|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | Application Number | 10/101,863 |
| | | | | Filing Date | March 16, 2002 |
| | | | | First Named Inventor | ZHANG et al. |
| | | | | Art Unit | 2823 |
| (Use as many sheets as necessary) | | | | Examiner Name | Michelle ESTRADA |
| Sheet | 2 | of | 2 | Attorney Docket Number | 09140-0016-00000 |

| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| Examiner Initials | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
| | | Office Action issued on September 27, 2004 in U.S. Serial No. 10/291,179 ~ (Attorney Docket No. 09140-0001-00). | |
| | | Office Action issued on November 28, 2001 in U.S. Patent No. 6,506,289 (Attorney Docket No. 09140-0002-01). | |
| | | Office Action issued on April 17,2002 in U.S. Patent No. 6,506,289 (Attorney Docket No. 09140-0002-01). | |
| | | Quayle Action issued on November 10, 2003 in U.S. Patent No. 6,827,826 (Attorney Docket No. 09140-0002-02). | |
| | | Office Action issued on May 2, 2002 in U.S. Patent No. 6,533,907 (Attorney Docket No. 09140-0004-00). | |
| | | Office Action issued on February 12, 2004 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on September 10, 2004 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on September 3, 2003 in U.S. Serial No. 10/101,492 (Attorney Docket No. 09140-0015-00). | |
| | | Office Action issued on October 22, 2003 in U.S. Serial No. 10/101,341 (Attorney Docket No. 09140-0017-00). | |
| | | Office Action issued on June 10, 2004 in U.S. Serial No. 10/101,341 (Attorney Docket No. 09140-0017-00). | |
| | | Office Action issued on May 4, 2004 in U.S. Serial No. 10/101,493 (Attorney Docket No. 09140-0021-00). | |
| | | International Search Report issued on November 21, 2003 in PCT/US03/24809 (Attorney Docket No. 09140-0025-00). | |
| | | International Search Report issued on October 11, 2004 in PCT/US2004/005531 (Attorney Docket No. 09140-0030-00) | |
| | | Written Opinion issued on October 11, 2004 in PCT/US2004/005531 (Attorney Docket No. 09140-0030-00) | |
| | | Patent Application No. 10/851,542 for ENERGY CONVERSION AND STORAGE DEVICES BY PHYSICAL VAPOR DEPOSITION OF TITANIUM AND TITANIUM OXIDES AND SUB-OXIDES filed on May 20, 2004. (Attorney Docket No. 09140-0033-00) | |
| | | Patent Application No. 10/850,968 for TRANSPARENT CONDUCTIVE OXIDES FROM A METALLIC TARGET filed on May 20, 2004. (Attorney Docket No. 09140-0034-00) | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 03/11/2008 |
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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 1 of 9

| Complete if Known | |
|---|---|
| Application Number | 10/101,863 |
| Filing Date | March 16, 2002 |
| First Named Inventor | ZHANG, Hongmei |
| Art Unit | 2823 |
| Examiner Name | ESTRADA, Michelle |
| Attorney Docket Number | 9140.0016-00 |

## U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS

| Examiner Initials | Cite No.[1] | Document Number Number-Kind Code[2] (if known) | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US 2005/0006768 A1 | 01-13-2005 | Narasimhan et al. | |
| | | US 2005/0000794 A1 | 01-06-2005 | Demaray et al. | |
| | | US 2004/0259305 A1 | 12-23-2004 | Demaray et al. | |
| | | US 2004/0105644 A1 | 06-03-2004 | Dawes | |
| | | US 2003/0174391 A1 | 09-18-2003 | Pan et al. | |
| | | US 2003/0141186 A1 | 07-31-2003 | Wang et al. | |
| | | US 2003/0127319 A1 | 06-10-2003 | Demaray et al. | |
| | | US 2003/0097858 A1 | 05-29-2003 | Strohhofer et al. | |
| | | US 2002/0170821 A1 | 11-21-2002 | Sandlin et al. | |
| | | US 2001/041460 A1 | 11-15-2001 | Wiggins | |
| | | US 2001/0027159 A1 | 10-04-2001 | Kaneyoshi | |
| | | US 6,750,156 B2 | 06-15-2004 | Le et al. | |
| | | US 6,576,546 B2 | 06-10,-2003 | Gilbert et al. | |
| | | US 6,444,750 B1 | 09-03-2002 | Touhsaent | |
| | | US 6,433,380 B2 | 08-13-2002 | Shin | |
| | | US 6,423,776 B1 | 07-23-2002 | Akkapeddi et al. | |
| | | US 6,416,598 B1 | 07-09-2002 | Sircar | |
| | | US 6,413,645 B1 | 07-02-2002 | Graff et al. | |
| | | US 6,365,319 B1 | 04-02-2002 | Heath et al. | |
| | | US 6,302,939 B1 | 10-16-2001 | Rabin et al. | |
| | | US 6,300,215 B1 | 10-09-2001 | Shin | |
| | | US 6,261,917 B1 | 07-17-2001 | Quek et al. | |
| | | US 6,248,640 B1 | 06-19-2001 | Nam | |
| | | US 6,232,242 | 05-15-2001 | Hata et al. | |
| | | US 6,214,660 B1 | 04-10-2001 | Uemoto et al. | |
| | | US 6,210,544 B1 | 04-03-2001 | Sasaki | |
| | | US 6,204,111 B1 | 03-20-2001 | Uemoto et al. | |
| | | US 6,198,217 B1 | 03-06-2001 | Suzuki et al. | |
| | | US 6,197,167 B1 | 03-06-2001 | Tanaka | |
| | | US 6,165,566 | 12-26-2000 | Tropsha | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ME/

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**INFORMATION DISCLOSURE STATEMENT BY APPLICANT**

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Sheet 2 of 9

| Complete if Known | |
|---|---|
| Application Number | 10/101,863 |
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| Examiner Name | ESTRADA, Michelle |
| Attorney Docket Number | 9140.0016-00 |

| U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS | | | | | |
|---|---|---|---|---|---|
| | | US 6,157,765 | 12-05-2000 | Bruce et al. | |
| | | US 6,146,225 | 11-14-2000 | Sheats et al. | |
| | | US 6,106,933 | 08-22-2000 | Nagai et al. | |
| | | US 6,080,643 | 06-27-2000 | Noguchi et al. | |
| | | US 6,077,642 | 06-20-2000 | Ogata et al. | |
| | | US 6,071,323 | 06-06-2000 | Kawaguchi | |
| | | US 6,058,233 | 05-02-2000 | Dragone | |
| | | US 6,052,397 | 04-18-2000 | Jeon et al. | |
| | | US 6,051,296 | 04-18-2000 | McCaulley et al. | |
| | | US 6,046,081 | 04-04-2000 | Kuo | |
| | | US 6,004,660 | 12-21-1999 | Topolski et al. | |
| | | US 5,966,491 | 10-12-1999 | DiGiovanni | |
| | | US 5,952,778 | 09-14-1999 | Haskal et al. | |
| | | US 5,930,584 | 07-27-1999 | Sun et al. | |
| | | US 5,900,057 | 05-04-1999 | Buchal et al. | |
| | | US 5,882,946 | 03-16-1999 | Otani | |
| | | US 5,870,273 | 02-09-1999 | Sogabe et al. | |
| | | US 5,853,830 | 12-29-1998 | McCaulley et al. | |
| | | US 5,831,262 | 11-03-1998 | Greywall et al. | |
| | | US 5,811,177 | 09-22-1998 | Shi et al. | |
| | | US 5,771,562 | 06-30-1998 | Harvey, III et al. | |
| | | US 5,762,768 | 06-09-1998 | Goy et al. | |
| | | US 5,757,126 | 05-26-1998 | Harvey, III et al. | |
| | | US 5,738,731 | 04-14-1998 | Shindo et al. | |
| | | US 5,731,661 | 03-24-1998 | So et al. | |
| | | US 5,689,522 | 11-18-1997 | Beach | |
| | | US 5,686,360 | 11-11-1997 | Harvey, III et al. | |
| | | US 5,654,984 | 08-05-1997 | Hershbarger et al. | |
| | | US 5,607,789 | 03-04-1997 | Treger et al. | |
| | | US 5,591,520 | 01-07-1997 | Migliorini et al. | |
| | | US 5,563,979 | 10-08-1996 | Bruce et al. | |
| | | US 5,538,796 | 07-23-1996 | Schaffer et al. | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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| Sheet | 3 | of | 9 | Attorney Docket Number | 9140.0016-00 |

| U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS | | | | | |
|---|---|---|---|---|---|
| | | US 5,499,207 | 03-12-1996 | Miki et al. | |
| | | US 5,457,569 | 10-10-1995 | Liou et al. | |
| | | US 5,355,089 | 10-11-1994 | Treger | |
| | | US 5,309,302 | 05-03-1994 | Vollmann | |
| | | US 5,306,569 | 04-26-1994 | Hiraki | |
| | | US 5,303,319 | 04-12-1994 | Ford et al. | |
| | | US 5,296,089 | 03-22-1994 | Chen et al. | |
| | | US 5,173,271 | 12-22-1992 | Chen et al. | |
| | | US 5,119,460 | 06-02-1992 | Bruce et al. | |
| | | US 5,107,538 | 04-21-1992 | Benton et al. | |
| | | US 5,085,904 | 02-04-1992 | Deak et al. | |
| | | US 4,587,225 | 05-06-1986 | Tsukuma et al. | |
| | | RE 32,449 | 06-30-1987 | Claussen | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

| FOREIGN PATENT DOCUMENTS | | | | | | |
|---|---|---|---|---|---|---|
| Examiner Initials | Cite No.[1] | Foreign Patent Document<br>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 | Translation[6] |
| | | EP 1 189 080 A2 | 03-20-2002 | Agere Systems Optoelectronics Guardian Corporation | | |
| | | EP 1 092 689 A1 | 04-18-2001 | BPS Alzenau GmbH | | |
| | | EP 1068899 A1 | 01-17-2001 | Nippon Sheet Glass Co., Ltd. | | |
| | | EP 0 639 655 A1 | 02-22-1995 | Asahi Glass Co, Ltd. | | |
| | | EP 0 652 308 A2 | 10-13-1994 | Mega Chips Corp. | | |
| | | EP 0 510 883 A2 | 10-28-1992 | AT&T | | |
| | | JP 7-233469 | 09-05-1995 | Asahi Glass Co, Ltd. | | |
| | | JP 2-054764 A2 | 02-23-1990 | Leybold AG | | |
| | | WO 00/21898 A1 | 04-20-2000 | Samsung Electronics Co. | | |
| | | | | | | |

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|---|---|---|---|

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| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| Examiner Initials | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
| | | AFFINITO et al., "PML/oxide/PML Barrier Layer Performance Differences Arising from Use of UV or Electron Beam Polymerization of the PML Layers," *Thin Solid Films* Vol. 308-309, pp. 19-25 (1997) | |
| | | AFFINITO et al., "Polymer-Oxide Transparent Barrier Layers," Society of Vacuum Coaters, 39th Ann. Technical Conference Proceedings, May 5-10, 1996, Philadelphia, PA, pp. 392-397 (1996). | |
| | | ALDER, T. et al., "High-Efficiency Fiber-to-Chip Coupling Using Low-Loss Tapered Single-Mode Fiber," IEEE Photonics Technology Letters, 12(8):1016-1018 (2000). | |
| | | ALMEIDA, Vilson R. et al., "Nanotaper for compact mode conversion," *Optics Letters*, 28(15):1302-1304 (2003). | |
| | | ASGHARI et al., "ASOC--A Manufacturing Integrated Optics Technology," Part of the SPIE Conference on Integrated Optics Devices III, vol. 3620, pp. 252-262 (Jan. 1999). | |
| | | BARBIER et al, "Amplifying Four-Wavelength Combiner, Based on Erbium/Etterbium-Doped Waveguide Amplifiers and Integrated Splitters", *IEEE PHOTONICS TECHNOLOGY LETTTERS*, Vol.9, pp 315-317, 1997, 4 pages | |
| | | BEACH R.J., "Theory and optimization of lens ducts," *Applied Optics*, 35:12:2005-15 (1996) | |
| | | BESTWICK, T., "ASOC silicon integrated optics technology," Part of the SPIE Conferences on Photonics Packaging and Integration, SPIE vol. 3631, pp. 182-190 (Jan. 1999). | |
| | | BORSELLA et al., "Structural incorporation of silver insoda-lime glass by the ion-exchange process: a photoluminescence spectroscopy study", *Applied Physics* A 71, pp. 125-132 (2000) | |
| | | CAMPBELL et al., "Titanium dioxide ($TiO_2$)-based gate insulators," *IBM J. Res. Develop.* 43(3), 383-391, (May 1999). | |
| | | CHANG, C.Y: (edited by), "ULSI Technology," The McGraw-Hill Companies, Inc., New York, 1996, Chapter 4, pp. 169-170, 226-231 (1996).. | |
| | | CHEN et al. "Development of Supported Bifunctional Electrocatalysts for Unitized Regenerative Fuel Cells," *Journal of the Electrochemical Society*, 149(8), A1092-99, (2002). | |
| | | CHOI et al., "Er-Al-codoped silicate planar light waveguide-type amplifier fabricated by radio-frequency sputtering," *Optics Letters*, vol. 25, No. 4, pp. 263-265 (Feb. 15, 2000). | |
| | | COOKSEY et al. "Predicting Permeability & Transmission Rate for Multilayer Materials," *Foodtechnology*, Vol. 53, No. 9, pp. 60-63 (September 1999). | |
| | | Crowder, et al., "Low-Temperature Single-Crystal Si TFT's Fabricated on Si Films Processed via Sequential Lateral Solidification," IEEE, vol. 19, no. 8 (August 1998), pages 306-308. | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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.

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| Sheet | 5 | of | 9 | Attorney Docket Number | 9140.0016-00 |

| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | DELAVAUX et al., "Integrated optics erbium ytterbium amplifier system in 10 Gb/s fiber transmission experiment", 22nd European Conference on Optical Communication - ECOC' 96, Oslo, 4 pages (1996). | |
| | | Distiributed Energy Resources: Fuel Cells, Projects, http://www.eere.energy.gov/der/fuel_cells/projects.html (2003). | |
| | | DuPont Teijin Films, Mylar 200 SBL 300, Product Information (2000). | |
| | | Electrometals Technologies Limited, Financial Report for the year 2002, Corporate Directory, Chairman's Review, Review of Operations (2002). | |
| | | E-Tek website: FAQ, Inside E-Tek, E-Tek News, Products; http://www.etek-inc.com/ (2003). | |
| | | FLYTZANIS et al, "nonlinear Optics in Composite Materials," E. Wolf, Progress in Optics XXIX (c) Elsevier Scince Publishers B.V., pp. 323-425 (1991). | |
| | | FRAZAO et al., "EDFA Gain Flattening Using Long-Period Fibre Gratings Based on the Electric Arc Technique," (date unknown). | |
| | | GARCIA, C. "Size Dependence of Lifetime and Absorption Cross Section of Si Nanocrystals Embedded in $SiO_2$," Appl. Phys. Lett., Vol. 82, No. 10, pp. 1595-7 (March 2003). | |
| | | GOOSSENS et al., "Sensitization of $TiO_2$ with p-type semiconductor polymers," Delft Interfaculty Research Center, Delft University of Technology Laboratory of Inorganic Chemistry, The Netherlands (1998). | |
| | | Greene et al., "Morphological and electrical properties of rf sputtered Y203-doped Zr02 thin films," J. Vac. Sci. Tecnol., vol. 13, no. 1 (Jan/Feb 1976), pages 72-75. | |
| | | HAN, Hak-Seung et al. "Optical Gain at 1.54 □m in Erbium-Doped Silicon Nanocluster Sensitized Waveguide," *Appl. Phys. Lett.*, Vol. 79, No. 27, pp. 4568-70 (December 2001). | |
| | | HAYAKAWA et al., "Enhanced fluorescence from $Eu^{3+}$ owing to surface plasma oscillation of silver particles in glass", *Journal of Non-Crystalline Solids*, Vol. 259, pp. 16-22 (1999). | |
| | | HAYAKAWA et al, "Field enhancement effect of small Ag particles on the fluorescence from $Eu^{3+}$-doped $SiO_2$ glass", *Appl. Phys. Lett.*, Vol. 74, No 11, pp. 1513-1515 (March 1999). | |
| | | HAYFIELD, P.C.S., "Development of a New Material-Monolithic Ti4O7 Ebonix Ceramic," Royal Society Chemistry," (2002). | |
| | | HEHLEN et al. "Spectroscopic Properties of $Er^{3+}$ - and $Yb^{3+}$-doped Soda-Lime Silicate and Aluminosilicate Glasses," *Physical Review B*, Vol. 56, No. 15, pp. 9302-9318 (October 1997). | |
| | | HEHLEN et al. "Uniform Upconversion in High-Concentration $Er^{3+}$-doped Soda Lime Silicate and Aluminosilicate Glasses," *Optics Letters*, Vol. 22, No. 11, pp. 772-774 (June 1997). | |
| | | HORST et al., "Compact, Tunable Optical Devices in Silicon-Oxynitride Wave Guide Technology," IBM Research Division, 3 pages (1999). | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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| Sheet | 6 | of | 9 | Attorney Docket Number | 9140.0016-00 |

| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | HUBNER, J. and Guldberg-Kjaer, S., "Planar Er-and Yb-Doped Amplifiers and Lasers," COM Technical University of Denmark, 10.sup.th European Conf. On Integrated Optics, Session WeB2, pp. 71-74 (2001). | |
| | | Hwang, Man-Soo et al., "The effect of pulsed magnetron sputtering on the properties of indium tin oxide thin films," Elsevier Science B.V., P. 29-33, (2003). | |
| | | Im, et al. "Controlled Super-lateral Growth of Si Films for Microstructural Manipulation and Optimization," Materials Science Program (1998), pages. 603-617. | |
| | | Im, et al., "Crystalline Si Films for Integrated Active-Matrix LiquidCrystal Displays," MrS Bulletin (March 1996), pages. 39-48. | |
| | | Im, et al., "Single-crystal Si films for thin-film transistor devices," American Institute of Physics (1997), pages. 3434-3436. | |
| | | ITOH, M. et al., "Large reduction of singlemode-fibre coupling loss in 1.5% delta planar lightwave circuits using spot-size converters," Electronics Letters, 38(2):72-74 (2002). | |
| | | JACKSON et al. "An Accurate Compact EDFA Model," Dept. of Electrical and Computer Engineering, University of BC (date unknown). | |
| | | JANSSEN et al. "Photoinduced electron transfer from conjugated polymers onto nanocrystalline $TiO_2$," Eindhoven University of Technology, The Netherlands (date unknown). | |
| | | JOHNSON, J.E. et al., "Monolithically Integrated Semiconductor Optical Amplifier and Electroabsorption Modulator with Dual-Waveguide Spot-Size Converter Input," IEEE Journal of Selected Topics in Quantum Electronics, 6(1):19-25, (2000). | |
| | | JONSSON L.B. et al. "Frequency response in pulsed DC reactive sputtering processes," *Thin Solid Films,* Vol. 365, pp. 43-48 (2000). | |
| | | KATO et al., "Recent progress on PLC hybrid integration," Part of the SPIE Conference on Optoelectric Integrated Circuits III, SPIE. vol. 3631, pp. 28-36 (Jan. 1999). | |
| | | KATO, Kuniharu et al., "PLC Hybrid Integration Technology and Its Application to Photonic Components," IEEE Journal of Selected Topics in Quantum Electronics, 6(1):4-13 (2000). | |
| | | KIK, P.G. et al. "Gain Limiting Processes in Er-doped Si Nanocrystal Waveguides in $SiO_2$," *J. Appl. Phys.*, Vol. 91, No. 1, pp. 534-536 (January 1, 2002). | |
| | | KIM et al. "Frequency-dependent pulsed direct current magnetron sputtering of titanium oxide films," *J. Vac. Sci. Technol.* A 19(2); 429-434 (March 2001). | |
| | | KIM et al. "Mixture Behaviour and Microwave Dielectric Properties in the Low-fired $TiO_2$-CuO System," *Jpn. J. Appl. Phys.*, 39, 2696-2700, (2000). | |
| | | LADOUCEUR, F. et al., " 8.8 Evaluation of Results", Silica-based Buried Channel Waveguides and Devices,, Chapman & Hall, London, pp. 98-99 (1996). | |
| | | LADOUCEUR, F. et al., "Effect of side wall roughness in buried channel waveguides," *IEEE Proc.*, vol. 141, pp. 242-248 (Aug. 1994). | |
| | | LAMB, William B., "Designing Nonfoil Containing Skins for VIP Applications," DuPont VIA Symposium Presenation, (1999). | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | LAMB, William et al. "Designing Non-Foil Containing Skins for Vacuum InsulationPanel (VIP) Applications," *Vuoto*, Vol. XXVIII, No. 1-2 - Gennaio-Giugno 1999, pp. 55-58 (1999). | |
| | | LANGE et al, "High Gain Ultra-Short Length Phosphate glass Erbium-Doped Fiber Amplifier Material", OSA Optical Fiber Communications (OFC), 3 pages (2002). | |
| | | LAPORTA et al, "Diode-pumped cw bulk Er: Yb: glass laser", 1952 Optics Letters/Vol. 16, No. 24/Dec. 15, 6 pages (1991). | |
| | | LAURENT-LUND, C. et al., "PECVD Grown Multiple Core Planar Waveguides with Extremely Low Interface Reflections and Losses," *IEEE Photonics Technology Letters*, Vol. 10, No. 10, pp. 1431-1433 (Oct. 1998). | |
| | | LEE et al., "Effect of size and roughness on light transmission in a S/SiO.sub.2 waveguide: Experiments and model," Department of Materials Science and Engineering, Massachusetts Institute of Technology, (Jul. 12, 2000). | |
| | | LEE et al. "Effects of interfacial layer growth on the electrical characteristics of thin titanium oxide films on silicon," *Applied Physics Letters*, 74(21), 3143-3145, (May 1999). | |
| | | LOVE, J.D. et al., "Quantifying Loss Minimisation in Single-Mode Fibre Tapers," Electronics Letters, 22(17):912-914, (1986). | |
| | | MARDARE et al. "On the structure of Titanium Oxide Thin Films," *Analele Stiintifice Ale Universitatii AL. I. Cuza IASI*, Vol. XLV-XLVI, 201-208 (1999). | |
| | | MARQUES, P.V.S. et al., "Planar Silica-on-Silicon Waveguide Lasers Based in Two Layer Core Devices," 10.sup.th European Conference on Integrated Optics, Session WeB2, pp. 79-82 (2001). | |
| | | MEIJERINK et al, LUMINESCENCE OF $AG^+$ IN CRYSTALLINE AND GLASSY $SrB_4O_7$, Journal of Physics and Chemistry of Solids, Vol. 54, No. 8, pp. 901-906, (1993). | |
| | | MESNAOUI et al, "Spectroscopic properties of $AG^+$ ions in phospage glasses of $NaPO_3$-$AgPO_3$ system", EUROPEAN JOURNAL OF SOLID STATE AND INORGANIC CHEMISTRY, Vol. 29, pages 1001-1013, 14 pages (1992). | |
| | | MITOMI, O. et al., "Design of a Single-Mode Tapered Waveguide for Low-Loss Chip-to-Fiber Coupling,: IEEE Journal of Quantum Electronics, 30(8):1787-1793, (1994). | |
| | | MIZUNO et al. "Temperature dependence of oxide decomposition on titanium surfaces in UHV," submitted to Journal of Vacuum Science and Technology, (October 28, 2001). | |
| | | OHKUBO et al., "Polarization-Insensitive Arrayed-Waveguide Grating Using Pure Si)2 Cladding," Fifth Optoelectronics and Communication Conference (OECC 2000) Technical Digest, 2 pages (Jul. 2000). | |
| | | OHMI et al., "Rare earth metal oxides for high-K gate insulator," Tokyo Institute of Technology,(date unknown). | |
| | | OHTSUKI et al., "Gain Characteristics of a high concentration $Er^{3+}$-doped phosphate glass waveguide", *J. Appl. Phys.* 78(6), pp. 3617-3621 (1995). | |
| | | ONO et al., "Design of a Low-loss Y-branch Optical Waveguide," Fifth Optoelectronic and Communications Conference (OECC 2000) Technical Digest, 2 pages (Jul. 2000). | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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| | | | | Art Unit | 2823 |
| (Use as many sheets as necessary) | | | | Examiner Name | ESTRADA, Michelle |
| Sheet | 8 | of | 9 | Attorney Docket Number | 9140.0016-00 |

| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | PADMINI et al. "Realization of High Tunability Barium Strontium Titanate Thin Films by RF Magnetron Sputtering," College of Engineering, University of California, Santa Barbara. (date unknown). | |
| | | PETERS et al., "Formation mechanism of silver nanocrystals made by ion irradiation of $Na^+$--$Ag^+$ ion-exchanged sodalime silicate glass", Nuclear Instruments and Methods in Physics Research B 168, pp. 237-244 (2000). | |
| | | RAJARAJAN, M. et al., "Numerical Study of Spot-Zise Expanders for an Efficient OEIC to SMF Coupling," IEEE Photonics Technology Letters, 10(8):1082-1084, (1998). | |
| | | RAMASWAMY et al., "Ion-Exchanged Glass Waveguides: A Review", *Journal of Lightwave Technology*, Vol. 6, No. 6, pp. 984-1001 (1988) | |
| | | Sanyo Vacuum Industries Co., Ltd. Products Info, $TiO_2$, (2003). http://www.sanyovac.co.jp/Englishweb/products/ETiO2.htm | |
| | | SCHERMER, R. et al., "Investigation of Mesa Dielectric Waveguides,", Proceedings of the OSA Integrated Photonics Research Topical Meeting and Exhibit, Paper No. IWB3 (Jun 2001). | |
| | | Second International Symposium of Polymer Surface Modification: Relevance to Adhesion, Preliminary Program (1999). | |
| | | Seventh International Conference on $TiO_2$ Photocatalysis: Fundamentals & Applications, Toronto, Ontario, Canada, Final Program (November 17-21, 2002) | |
| | | SEWELL, P. et al., "Rib Waveguide Spot-Size Transformers: Modal Properties," Journal of Lightwave Technology, 17(5):848-856, (1999). | |
| | | SLOOFF et al, "Optical properties of Erbium-doped organic polydentate cage complexes", *J. Appl. Phys.* 83, pp. 497-503 (Jan. 1998). | |
| | | SMITH, R.E., "Reduced Coupling Loss Using a Tapered-Rib Adiabatic-Following Fiber Coupler," *IEEE Photonics Technology Letters*, 8(8):1052-1054 (1996). | |
| | | STROHHOFER, et al. "Energy transfer to $Er^{3+}$ in Ag ion-exchanged glass", FOM Institute for Atomic and Molecular Physics, 10 pages (date unknown). | |
| | | SUGIYAMA et al., "Gas Permeation Through the Pinholes of Plastic Film Laminated with Aluminium Foil," Vuoto, Vol. XXVIII, N. 1-2 - Gennaio-Guigno (1999). | |
| | | TERVONEN, A., "Challenges and opportunities for integrated optics in optical networks," Part of the SPIE Conference in Integrated Optics Devices III, SPIE vol. 3620, pp. 2-11 (Jan. 1999). | |
| | | TREICHEL et al., "The influence of pulsed magnetron sputtering on topography and crystallinity of TiO2 films on glass," *Space and Coatings Technology*, Vol. 123, pp. 268-272 (2000). | |
| | | Tukamoto, H. et al., "Electronic Conductivity of $LiCoO_8$ and Its Enhancement by Magnesium Doping," J. Electrochem. Soc., vol. 44, no. 9, pages 3164-3168 (September 1997). | |
| | | VILJANEN et al, "Planar Optical Coupling Elements for Multimode Fibers with Two-Step Ion Migration Process", Applied Physics, 24, No. 1, pp. 61-63 (January 1981). | |
| | | VILLEGAS et al, "Optical spectroscopy ofa soda lime glass exchanged with silver", Physics and Chemistry of Glasses 37(6), pp. 248-253 (1996). | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ME/

| IDS Form PTO/SB/08: Substitute for form 1449A/PTO | | | | Complete if Known | |
|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | Application Number | 10/101,863 |
| | | | | Filing Date | March 16, 2002 |
| | | | | First Named Inventor | ZHANG, Hongmei |
| | | | | Art Unit | 2823 |
| (Use as many sheets as necessary) | | | | Examiner Name | ESTRADA, Michelle |
| Sheet | 9 | of | 9 | Attorney Docket Number | 9140.0016-00 |

| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| | | VON ROTTKAY et al. "Influence of stoichiometry on electrochromic cerium-titanium oxide compounds," Lawrence Berkeley National Laboratory, UC Berkeley, CA, (date unknown). | |
| | | WILKES, Kenneth T. "Gas Permeation Through Vacuum Barrier Films and its Effect on VIP Thermal Performance," Vacuum Insulation Panel Symp., Baltimore, Maryland, (May 3, 1999). | |
| | | YANAGAWA, H. et al., "Index-and-Dimensional Taper and Its Application to Photonic Devices," Journal of Lightwave Technology, 10(5):587-591 (1992). | |
| | | Response to Office Action filed on March 14, 2005 in U.S. Serial No. 10/291,179 (Attorney Docket No. 09140-0001-00). | |
| | | Office Action issued on June 15, 2005 in U.S. Serial No. 10/291,179 (Attorney Docket No. 09140-0001-00). | |
| | | Response to Office Action filed on September 3, 2002 in U.S. Patent No. 6,533,907 (Attorney Docket No. 09140-0004-00). | |
| | | Response to Office Action filed on August 10, 2004 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on February 12, 2004 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Amendment/RCE filed on March 10, 2005 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on March 17, 2005 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Response to Office Action filed on June 17, 2005 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on July 8, 2005 in U.S. Serial No. 09/903,081 (Attorney Docket No. 09140-0014-00). | |
| | | Office Action issued on May 14, 2003 in U.S. Serial No. 10/101,492 (Attorney Docket No. 09140-0015-00). | |
| | | Response to Office Action filed on August 14, 2003 in U.S. Serial No. 10/101,492 (Attorney Docket No. 09140-0015-00). | |
| | | Response to Office Action filed on March 3, 2004 in U.S. Serial No. 10/101,492 (Attorney Docket No. 09140-0015-00). | |
| | | Response to Office Action filed on February 23, 2004 in U.S. Serial No. 10/101,341 (Attorney Docket No. 09140-0017-00). | |
| | | Response to Office Action filed on December 08, 2004 in U.S. Serial No. 10/101,341 (Attorney Docket No. 09140-0017-00). | |
| | | Office Action issued on March 14, 2005 in U.S. Serial No. 10/789,953 (Attorney Docket No. 09140-0030-00). | |
| | | Office Action issued March 24, 2005 in U.S. Application No. 10/851,542 (Attorney Docket No. 09140.0033-00). | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /ME/

IDS Form PTO/SB/08: Substitute for form 1449A/PTO

# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

Sheet 1 of 2

| *Complete if Known* | |
|---|---|
| *Application Number* | 10/101,863 |
| *Filing Date* | March 16, 2002 |
| *First Named Inventor* | ZHANG, Hongmei |
| *Art Unit* | 2823 |
| *Examiner Name* | ESTRADA, Michelle |
| *Attorney Docket Number* | 9140.0016-00 |

**U.S. PATENTS AND PUBLISHED U.S. PATENT APPLICATIONS**

| Examiner Initials* | Cite No.[1] | Document Number Number-Kind Code[2] *(if known)* | Issue or Publication Date MM-DD-YYYY | Name of Patentee or Applicant of Cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|---|---|---|---|---|---|
| | | US 4,710,940 | 12-01-1987 | Sipes, Jr. | |
| | | US 4,785,459 | 11-15-1988 | Baer | |
| | | US 5,435,826 | 07-25-1995 | Sakakibara et al. | |
| | | US 5,512,147 | 04-30-1996 | Bates et al. | |
| | | US 5,569,520 | 10-29-1996 | Bates | |
| | | US 5,597,660 | 01-28-1997 | Bates et al. | |
| | | US 5,612,152 | 03-18-1997 | Bates | |
| | | US 6,168,884 B1 | 01-02-2001 | Neudecker et al. | |
| | | US 6,236,793 B1 | 05-22-2001 | Lawrence et al. | |
| | | US 6,242,132 B1 | 06-05-2001 | Neudecker et al. | |
| | | US 6,365,300 B1 | 04-02-2002 | Ota et al. | |
| | | US 6,760,520 B1 | 07-06-2004 | Medin et al. | |
| | | US 6,818,356 B1 | 11-16-2004 | Bates | |
| | | US 2001/0031122 A1 | 10-18-2001 | Lackritz et al. | |
| | | US 2003/0185266 A1 | 10-02-2003 | Henrichs | |
| | | US 2006/0134522 A1 | 06-22-2006 | Zhang et al. | |

**Note: Submission of copies of U.S. Patents and published U.S. Patent Applications is not required.**

**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 | Translation[6] |
|---|---|---|---|---|---|---|
| | | | | | | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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| IDS Form PTO/SB/08: Substitute for form 1449A/PTO | | | | Complete if Known | |
|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | *Application Number* | 10/101,863 |
| | | | | *Filing Date* | March 16, 2002 |
| | | | | *First Named Inventor* | ZHANG, Hongmei |
| *(Use as many sheets as necessary)* | | | | *Art Unit* | 2823 |
| | | | | *Examiner Name* | ESTRADA, Michelle |
| Sheet | 2 | of | 2 | *Attorney Docket Number* | 9140.0016-00 |



| NON PATENT LITERATURE DOCUMENTS | | | |
|---|---|---|---|
| Examiner Initials* | Cite No.[1] | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | Translation[6] |
| | | COCORULLO, G. et al., "Amorphous silicon waveguides and light modulators for integrated photonics realized by low-temperature plasma-enhanced chemical-vapor deposition," *Optics Lett. 21*(24):2002-2004 (1996). | |
| | | Notice of Allowance mailed August 6, 2002, for US Patent No. 6,506,289 (Atty. Docket No. 09140.0002-01). | |
| | | Final Office Action mailed June 9, 2006 in U.S. Appl. No. 11/100,856 (Atty. Docket No. 09140.0015-01). | |
| | | Office Action issued on March 23, 2006, in U.S. Application No. 10/650,461 (Atty. Docket No. 09140-0025-00). | |
| | | Specification as filed September 2, 2005, for U.S. Appl. No. 11/218,652 (Atty. Docket No. 09140.0052-00000). | |

| Examiner Signature | /Michelle Estrada/ | Date Considered | 02/21/2008 |
|---|---|---|---|

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/101,863 | 05/27/2008 | 7378356 | 10655.0016-00 | 6938 |

22852 7590 05/07/2008

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER
LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

# ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

**Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)**
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

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):

Hongmei Zhang, San Jose, CA;
Mukundan Narasimhan, San Jose, CA;
Ravi B. Mullapudi, San Jose, CA;
Richard E. Demaray, Portola Valley, CA;

PATENT
Customer No. 22,852
Attorney Docket No. 10655.0016-00

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| In re U.S. Patent No.: 7,378,356 | ) |
| | ) |
| Inventors: Hongmei ZHANG et al. | ) |
| | ) |
| Issue Date.: May 27, 2008 | ) |
| | ) |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) |

COMMISSIONER FOR PATENTS
OFFICE OF PATENT PUBLICATION
**ATTN: Certificate of Correction Branch**
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

**REQUEST FOR CERTIFICATE OF CORRECTION**

Pursuant to 35 U.S.C. § 254, and 37 C.F.R. §§ 1.322 and 1.323, this is a request for a Certificate of Correction in the above-identified patent. The mistake identified by a (*) below occurred through the fault of the U.S. Patent and Trademark Office, as clearly disclosed by the records of the application which matured into this patent. The mistakes identified by a (**) below are of a clerical or typographical nature, and resulted from errors made in good faith by the patentee. The Commissioner is hereby authorized to charge the fee of $100.00 to Deposit Account No. 06-0916 as set forth in 37 C.F.R. § 1.20(a).

(*) On the title page, item 57, Abstract, penultimate line, insert "using" before -- processes --.

(**) In claim 29, col. 24, line 43, "intermetllic" should read -- intermetallic --.

(**) In claim 33, col. 24, line 52, "claims" should read -- claim --.

The complete Certificate of Correction involves one (1) page. Issuance of a Certificate of Correction containing the correction is earnestly requested.

Please charge any required fees not included herewith to Deposit Account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.

Dated: June 16, 2008

By: _____

Gary J. Edwards
Reg. No. 41,008
(650) 849-6622

# UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION

| | | |
|---|---|---|
| PATENT NO. | 7,378,356 | Page 1 of 1 |
| APPLICATION NO.: | 10/101,863 | |
| ISSUE DATE: | May 27, 2008 | |
| INVENTOR(S): | Hongmei ZHANG et al. | |

It is hereby certified that an error or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the title page, item (57), Abstract, penultimate line, insert "using" before -- processes --.

In claim 29, col. 24, line 43, "intermetllic" should read -- intermetallic --.

In claim 33, column 24, line 52, "claims" should read -- claim --.

MAILING ADDRESS OF SENDER

Finnegan, Henderson, Farabow,
Garrett & Dunner, L.L.P.
901 New York Avenue, N.W.
Washington, D.C. 20001-4413

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | 10101863 |
| **Filing Date:** | 16-Mar-2002 |
| **Title of Invention:** | BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS |
| First Named Inventor/Applicant Name: | Hongmei Zhang |
| **Filer:** | Gary James Edwards/Annie Wong |
| **Attorney Docket Number:** | 10655.0016-00 |

Filed as Large Entity

**Utility Filing Fees**

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| **Pages:** | | | | |
| **Claims:** | | | | |
| **Miscellaneous-Filing:** | | | | |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| Post-Allowance-and-Post-Issuance: | | | | |
| Certificate of correction | 1811 | 1 | 100 | 100 |
| **Extension-of-Time:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Miscellaneous:** | | | | |
| | | | **Total in USD ($)** | **100** |

| Electronic Acknowledgement Receipt | |
|---|---|
| **EFS ID:** | 3465573 |
| **Application Number:** | 10101863 |
| **International Application Number:** | |
| **Confirmation Number:** | 6938 |
| **Title of Invention:** | BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS |
| **First Named Inventor/Applicant Name:** | Hongmei Zhang |
| **Customer Number:** | 22852 |
| **Filer:** | Gary James Edwards/Annie Wong |
| **Filer Authorized By:** | Gary James Edwards |
| **Attorney Docket Number:** | 10655.0016-00 |
| **Receipt Date:** | 16-JUN-2008 |
| **Filing Date:** | 16-MAR-2002 |
| **Time Stamp:** | 20:19:55 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Deposit Account |
| Payment was successfully received in RAM | $100 |
| RAM confirmation Number | 4243 |
| Deposit Account | 060916 |
| Authorized User | |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges) | |

## File Listing:

| Document Number | Document Description | File Name | File Size(Bytes) /Message Digest | Multi Part /.zip | Pages (if appl.) |
|---|---|---|---|---|---|
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| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Fee Worksheet (PTO-06) | fee-info.pdf | 8158<br>273e0dee7e5c5ea8dcd0679679f699d90c2c1f51 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 45831 | | |

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**New Applications Under 35 U.S.C. 111**
**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.**

**National Stage of an International Application under 35 U.S.C. 371**
**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.**

**New International Application Filed with the USPTO as a Receiving Office**
**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.**

UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION



PATENT NO. : 7,378,356 B2
APPLICATION NO. : 10/101863
DATED : May 27, 2008
INVENTOR(S) : Hongmei Zhang et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

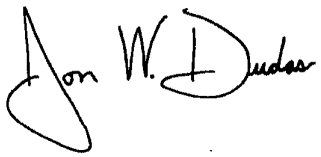
On the title page, item (57), Abstract, penultimate line or 9, insert -- using -- before "processes".

In claim 29, col. 24, line 43, "intermetllic" should read -- intermetallic --.

In claim 33, column 24, line 52, "claims" should read -- claim --.

Signed and Sealed this

Fifth Day of August, 2008



JON W. DUDAS
*Director of the United States Patent and Trademark Office*

PATENT
Attorney Docket No. 10655.0016-00000

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| In re Application of: | ) | |
| | ) | |
| Hongmei ZHANG et al. | ) | Group Art Unit: 2823 |
| | ) | |
| Application No.: 10/101,863 | ) | Examiner: Michelle ESTRADA |
| | ) | |
| Filed: March 16, 2002 | ) | |
| | ) | |
| For: BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS | ) | Confirmation No.: 6938 |
| | ) | |

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

Sir:

**REQUEST FOR WITHDRAWAL AS ATTORNEY OR AGENT AND CHANGE OF CORRESPONDENCE ADDRESS**

I hereby apply to withdraw myself and the practitioners associated with Customer Number 22,852 as attorney or agent for the above-identified patent application.

The reasons for this request are: The Assignee of Record has requested that this application be transferred to another law firm for further prosecution, therefore this request is made under the provision of 37 CFR 10.40(b)(4).

Please change the correspondence address and direct all future correspondence to: Haynes & Boone, LLP, **USPTO Customer Number 27,683**.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW,
GARRETT & DUNNER, L.L.P.

Dated: July 28, 2009

By: _____
C. Larry O'Rourke
Reg. No. 26,014
(650) 849-6600

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 5782144 |
| **Application Number:** | 10101863 |
| **International Application Number:** | |
| **Confirmation Number:** | 6938 |
| **Title of Invention:** | BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS |
| **First Named Inventor/Applicant Name:** | Hongmei Zhang |
| **Customer Number:** | 22852 |
| **Filer:** | Aaron James Capron/Drew Herndon |
| **Filer Authorized By:** | Aaron James Capron |
| **Attorney Docket Number:** | 10655.0016-00 |
| **Receipt Date:** | 28-JUL-2009 |
| **Filing Date:** | 16-MAR-2002 |
| **Time Stamp:** | 13:44:14 |
| **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 to withdraw attorney or agent (SB83) | Request_for_Withdrawal_10655-0016.PDF | 11918<br>87d0d88030358d5e5fc32a9583116dfd31f85219 | no | 1 |

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|---|---|
| **Warnings:** | |
| **Information:** | |

| Total Files Size (in bytes): | 11918 |
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**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.**

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**New International Application Filed with the USPTO as a Receiving Office**
**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.**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Via EFS-Web
COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

**POWER OF ATTORNEY TO PROSECUTE APPLIATIONS BEFORE THE USPTO**

Dear Sir:

I hereby appoint practitioners associated with Haynes and Boone Customer Number **27683,** as my/our attorney(s) or agent(s) to prosecute the applications identified in Attachment A, and to transact all business in the United States Patent and Trademark Office connected therewith.

Please recognize or change the correspondence address for the applications listed in Attachment A to Customer Number **27683**.

**SpringWorks, LLC**, is the Assignee of record of the entire interest in the applications identified in Attachment A by virtue of the assignment recorded in the Reel and Frame numbers listed, or for which a copy therefore is attached, in Attachment A.

**SPRINGWORKS, LLC**

By: _____
Name: Douglas A. Kelley
Title: Receiver

## Attachment A
## Power of Attorney to Prosecute Applications Before the USPTO

Applicant/Patent Owner: **SpringWorks LLC** hereby states that they are the assignee of the entire right, title and interest as listed below by virtue of an assignment from the inventor(s) of the patent application/patent. The assignment was recorded in the United States Patent and Trademark Office at the Reel and Frame number listed below or for which a copy therefore is attached.

| Attorney Docket No. | Application Number / Patent Number | Appl. Date/ Issued Date | Inventors | Title | Current Owner | Chain of Title | Assigment Reel/Frame | Recorded Date |
|---|---|---|---|---|---|---|---|---|
| 43668.3 | 11/191,643 | 7/27/2005 | H. Zhang<br>M. Narasimhan<br>R. Mullapudi<br>R. Demaray | Biased Pulse DC Reactive Sputtering Of Oxide Films | SpringWorks LLC | From Inventors to Symmorphix | 014766 / 0601 | 12/2/2003 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.4 | 11/100,856 | 4/6/2005 | T. Pan<br>R. Demaray<br>Y. Chen<br>Y. Xie<br>R. Pethe | Mode Size Converter For A Planar Waveguide | SpringWorks LLC | From Inventors to Symmorphix | 020035 / 0110 | 10/30/2007 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.5 | 10/850,968 | 5/20/2004 | R. Demaray<br>M. Narasimhan | Transparent Conductive Oxides | SpringWorks LLC | From Inventors to Symmorphix | 014945 / 0661 | 8/4/2004 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.22 | 10/650,461 | 8/27/2003 | D. Dawes | Optically Coupling Into Highly Uniform Waveguides | SpringWorks LLC | From Inventors to Symmorphix | 014897 / 0768 | 1/16/2007 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.39 | 11/726,972 | 3/22/2007 | R. Demaray<br>H. Zhang<br>M. Narasimhan<br>V. Milonopoulou | Energy Conversion And Storage Devices By Physical Vapor Deposition Of Titanium And Titanium Oxides And Sub-Oxides | SpringWorks LLC | From Inventors to Symmorphix | 014948 / 0097 | 8/5/2004 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.44 | 11/297,057 | 12/7/2005 | H. Zhang<br>R. Demaray<br>M. Shao | Deposition Of LiCoO2 | SpringWorks LLC | From Inventors to Symmorphix | 017196 / 0699 | 12/21/2006 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.53 | 11/218,652 | 9/2/2005 | H. Zhang<br>R. Demaray | Deposition Of Perovskite And Other Compound Ceramic Films From Dielectric Applications | SpringWorks LLC | From Inventors to Symmorphix | 016821 / 0220 | 11/28/2005 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.6 | 10/291,179 US Pat No. 7,404,877 | ISSUED - 7/29/08 | R. Demaray,<br>V. Milonopoulou | Low temperature zirconia based thermal barrier layer by PVD | SpringWorks LLC | From Inventors to Symmorphix | 014756 / 0416 | 12/2/2003 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |



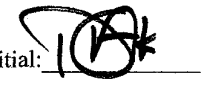
Initial: DAK

## Attachment A
## Power of Attorney to Prosecute Applications Before the USPTO

Applicant/Patent Owner: **SpringWorks LLC** hereby states that they are the assignee of the entire right, title and interest as listed below by virtue of an assignment from the inventor(s) of the patent application/patent. The assignment was recorded in the United States Patent and Trademark Office at the Reel and Frame number listed below or for which a copy therefore is attached.

| Attorney Docket No. | Application Number / Patent Number | Appl. Date/ Issued Date | Inventors | Title | Current Owner | Chain of Title | Assigment Reel/Frame | Recorded Date |
|---|---|---|---|---|---|---|---|---|
| 43668.8 | 09/903,050 US Pat No. 6,506,289 | ISSUED - 1/14/03 | R. Demaray, K. Wang, R. Mullapudi, D. Stadtler, H Zhang, R. Peth | Planar optical devices and methods for their manufacture | SpringWorks LLC | From Inventors to Symmorphix | 012010 / 0318 | 07/10/2001 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.9 | 10/288,278 US Pat No. 6,827,826 | ISSUED - 12/7/04 | R. Demaray, K. Wang, R. Mullapudi, D. Stadtler, H Zhang, R. Pethe | Planar optical devices and methods for their manufacture | SpringWorks LLC | From Inventors to Symmorphix | 012010 / 0318 | 07/10/2001 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.13 | 09/766,463 U.S. Pat No. 6,533,907 | ISSUED - 3/18/03 | R. Demaray, J. Shan, K. Wang, R. Mullapudi | Method of Producing amorphous silicon for hard mask and waveguide applications | SpringWorks LLC | From Inventors to Symmorphix | 011504 / 0738 | 01/19/2001 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.14 | 09/903,081 US Pat No. 7,469,558 | ISSUED - 12/30/08 | R. Demaray, K. Wang, R. Mullapudi, Q. Zhu, H. Zhang, H. Ackler, J. Egermeier, R. Pethe | As-deposited planar optical waveguides with low scattering loss and methods for their manufacture | SpringWorks LLC | From Inventors to Symmorphix | 012010 / 0752 | 07/10/2001 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.15 | 10/101,492 US Pat No. 6,884,327 | ISSUED - 4/26/05 | T. Pan, R. Demaray, Y. Chen, Y. Xie, R. Pethe | Mode size converter for a planar waveguide | SpringWorks LLC | From Inventors to Symmorphix | 020035 / 0110 | 10/30/2007 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.17 | 10/101,863 US Pat No. 7,378,356 | ISSUED - 5/27/08 | H. Zhang, M. Narasimhan, R. Mullapudi, R. Demaray | Biased pulse DC reactive sputtering of oxide films | SpringWorks LLC | From Inventors to Symmorphix | 014766 / 0601 | 12/2/2003 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.21 | 10/954,182 US Pat No. 7,381,657 | ISSUED - 6/30/08 | H. Zhang, M. Narasimhan, R. Mullapudi, R. Demaray | Biased pulse DC reactive sputtering of oxide films | SpringWorks LLC | From Inventors to Symmorphix | 014766 / 0601 | 12/2/2003 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.19 | 11/228,834 US Pat No. 7,544,276 | ISSUED - 6/9/09 | H. Zhang, M. Narasimhan, R. Mullapudi, R. Demaray | Biased pulse DC reactive sputtering of oxide films | SpringWorks LLC | From Inventors to Symmorphix | 014766 / 0601 | 12/2/2003 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |



Initial: 

## Attachment A
## Power of Attorney to Prosecute Applications Before the USPTO

Applicant/Patent Owner: **SpringWorks LLC** hereby states that they are the assignee of the entire right, title and interest as listed below by virtue of an assignment from the inventor(s) of the patent application/patent. The assignment was recorded in the United States Patent and Trademark Office at the Reel and Frame number listed below or for which a copy therefore is attached.

| Attorney Docket No. | Application Number / Patent Number | Appl. Date/ Issued Date | Inventors | Title | Current Owner | Chain of Title | Assigment Reel/Frame | Recorded Date |
|---|---|---|---|---|---|---|---|---|
| 43668.20 | 11/228,717 U.S. Pat No. 7,413,998 | ISSUED - 8/19/08 | H. Zhang, M. Narasimhan, R. Mullapudi, R. Demaray | Biased pulse DC reactive sputtering of oxide films | SpringWorks LLC | From Inventors to Symmorphix | 014766 / 0601 | 12/2/2003 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.25 | 10/789,953 US Pat No. 7,205,662 | ISSUED - 4/17/07 | M. Narasimhan, P. Brooks, R. Demaray | Dielectric Barrier Layer Films | SpringWorks LLC | From Inventors to Symmorphix | 014948 / 0111 | 08/05/2004 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.32 | 11/228,805 US Pat No. 7,262,131 | ISSUED - 8/28/07 | M. Narasimhan, P. Brooks, R. Demaray | Dielectric Barrier Layer Films | SpringWorks LLC | From Inventors to Symmorphix | 014948 / 0111 | 08/05/2004 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |
| 43668.34 | 10/851,542 US Pat No. 7,238,628 | ISSUED - 7/3/07 | R. Demaray, H. Zhang, M. Narasimhan, V. Milonopoulou | Energy Conversion and Storage Devices by Physical Vapor Deposition of Titanium and Titanium Oxides and Sub-Oxides | SpringWorks LLC | From Inventors to Symmorphix | 014948 / 0097 | 8/5/2004 |
| | | | | | | From Symmorphix to SpringWorks LLC | 20134 / 0102 | 11/19/2007 |

**SpringWorks LLC**

By: Douglas A. Kelley

Name: Douglas A. Kelley

Title: Receiver



Initial: DAK

PTO/SB/122 (11-08)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE


# CHANGE OF CORRESPONDENCE ADDRESS
## *Application*

Address to:
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

| | |
|---|---|
| Application Number | 10/101,863 |
| Filing Date | 3-16-2002 |
| First Named Inventor | H. Zhang |
| Art Unit | 2823 |
| Examiner Name | Michelle Estrada |
| Attorney Docket Number | 43668.17 |

Please change the Correspondence Address for the above-identified patent application to:

☑ The address associated with Customer Number: 27683

***OR***

☐ Firm or Individual Name

Address

| City | State | Zip |
|---|---|---|
| | | |

Country

| Telephone | Email |
|---|---|
| | |

This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).

I am the:

☐ Applicant/Inventor

☐ Assignee of record of the entire interest.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

☑ Attorney or agent of record. Registration Number 41008.

☐ Registered practitioner named in the application transmittal letter in an application without an executed oath or declaration. See 37 CFR 1.33(a)(1). Registration Number_____.

| | |
|---|---|
| Signature | /gary j. edwards/ |
| Typed or Printed Name | Gary J. Edwards |
| Date December 2, 2009 | Telephone 408-660-4120 |

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____forms are submitted.



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

# Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 6555033 |
| **Application Number:** | 10101863 |
| **International Application Number:** | |
| **Confirmation Number:** | 6938 |
| **Title of Invention:** | BIASED PULSE DC REACTIVE SPUTTERING OF OXIDE FILMS |
| **First Named Inventor/Applicant Name:** | Hongmei Zhang |
| **Customer Number:** | 22852 |
| **Filer:** | Gary James Edwards/Sheila Badon |
| **Filer Authorized By:** | Gary James Edwards |
| **Attorney Docket Number:** | 43668.17 |
| **Receipt Date:** | 02-DEC-2009 |
| **Filing Date:** | 16-MAR-2002 |
| **Time Stamp:** | 12:26:59 |
| **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 | | 43668_POA.pdf | 482094<br>50be7508dee6f2cb790d6ae139f6af2655b53fda | yes | 4 |

| | Multipart Description/PDF files in .zip description | | |
|---|---|---|---|
| | **Document Description** | **Start** | **End** |
| | Power of Attorney | 1 | 1 |
| | Assignee showing of ownership per 37 CFR 3.73(b). | 2 | 4 |

| | | | | | |
|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | Change of Address | 43668_17_COA.pdf | 298818<br>93b76369c0b54a23b201bfd71810fc3dfbfbe4b5 | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 780912 | | |

**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.**

**New Applications Under 35 U.S.C. 111**
**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.**

**National Stage of an International Application under 35 U.S.C. 371**
**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.**

**New International Application Filed with the USPTO as a Receiving Office**
**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.**

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 NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 43668.17 |

**CONFIRMATION NO. 6938**

27683
HAYNES AND BOONE, LLP
IP Section
2323 Victory Avenue
Suite 700
Dallas, TX 75219

**POA ACCEPTANCE LETTER**

*OC00000039120511*

Date Mailed: 12/10/2009

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/02/2009.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/mnguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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
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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 43668.17 |

**CONFIRMATION NO. 6938**

22852
FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER LLP
901 NEW YORK AVENUE, NW
WASHINGTON, DC 20001-4413

**POWER OF ATTORNEY NOTICE**

*OC000000039120482*

Date Mailed: 12/10/2009

## NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/02/2009.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/mnguyen/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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 NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY.DOCKET NO./TITLE | REQUEST ID |
|---|---|---|---|---|
| 10/101,863 | 03/16/2002 | Hongmei Zhang | 48604.18 | 93175 |

## Acknowledgement of Change to Small Entity Status

The entity status change request below filed through Private PAIR on 08/06/2019 has been accepted.

**CERTIFICATIONS:**

**Change of Entity Status:**

X Applicant asserting small entity status. See 37 CFR 1.27.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).**

| | |
|---|---|
| **Signature:** | /Gary Edwards/ |
| **Name:** | Gary Edwards |
| **Registration Number:** | 41008 |