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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

THE GILLETTE COMPANY, ADVANCED MICRO DEVICES, INC., RENESAS ELECTRONICS CORPORATION, RENESAS ELECTRONICS AMERICA, INC., GLOBAL FOUNDRIES U.S., INC., GLOBALFOUNDRIES DRESDEN MODULE ONE LLC & CO. KG, GLOBALFOUNDRIES DRESDEN MODULE TWO LLC & CO. KG, TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC., TOSHIBA AMERICA INC., TOSHIBA AMERICA INFORMATION SYSTEMS, INC., and TOSHIBA CORPORATION,
Petitioners,

v.

ZOND, LLC,
Patent Owner.

Case IPR2014-00861[1]
Patent 6,806,652 B1

Before KEVIN F. TURNER, JONI Y. CHANG, SUSAN L. C. MITCHELL, and JENNIFER MEYER CHAGNON, *Administrative Patent Judges*.

MITCHELL, *Administrative Patent Judge.*

FINAL WRITTEN DECISION
Inter Partes Review
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

[1] Cases IPR2014-00864, IPR2014-01003, and IPR2014-01066 have been joined with the instant *inter partes* review.

I. INTRODUCTION

We have jurisdiction under 35 U.S.C. § 6(c). This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons set forth below, we determine that Petitioners have shown, by a preponderance of the evidence, that claims 18–34 of U.S. Patent No. 6,806,652 B1 (Ex. 1101, "the '652 patent") are unpatentable under 35 U.S.C. § 103(a).

A. Procedural History

Taiwan Semiconductor Manufacturing Company, Ltd. and TSMC North America Corp. (collectively, "TSMC") filed a Petition (Paper 2, "Pet.") seeking *inter partes* review of claims 18–34 ("the challenged claims") of the '652 patent. TSMC included a Declaration of Dr. Uwe Kortshagen (Ex. 1102) to support its positions. Patent Owner Zond, LLC ("Zond") filed a Preliminary Response (Paper 8, "Prelim. Resp."). Pursuant to 35 U.S.C. § 314(a), on December 11, 2014, we instituted an *inter partes* review of the challenged claims to determine if the claims are unpatentable under 35 U.S.C. § 103 as obvious over various combinations of Mozgrin, Kudryavtsev, Fahey, Iwamura, and Campbell. Paper 12, 30–31 ("Dec.").

Subsequent to institution, we granted revised Motions for Joinder filed by other Petitioners (collectively, "GlobalFoundries") listed in the Caption above, joining Cases IPR2014-00864, IPR2014-01003, and IPR2014-01066 with the instant trial (Papers 16 and 17; IPR2014-00864, Paper 17), and also granted a Joint Motion to Terminate with respect to TSMC (Paper 31) and a second Joint Motion to Terminate with respect to Fujitsu Semiconductor

Limited and Fujitsu Semiconductor America, Inc. (Paper 53). Zond filed a Patent Owner Response (Paper 33, "PO Resp."), along with a Declaration of Larry D. Hartsough, Ph.D. (Ex. 2002) to support its positions. GlobalFoundries filed a Reply (Paper 40, "Reply") to the Patent Owner Response, along with a supplemental Declaration of Dr. Kortshagen (Ex. 1119). An oral hearing[2] was held on August 13, 2015. A transcript of the hearing is included in the record. Paper 50 ("Tr.").

B. Related Matters

GlobalFoundries indicates that the '652 patent was asserted in seven patent infringement actions in the District of Massachusetts, naming many of the Petitioners as defendants. Pet. 1; Paper 5, 1. GlobalFoundries also identifies Petitions for *inter partes* review that are related to this proceeding. Pet. 1; Paper 5, 2–3.

C. The '652 Patent

The '652 patent notes several problems with known magnetron sputtering systems, such as poor target utilization resulting from a relatively high concentration of positively charged ions in the region that results in a non-uniform plasma. Ex. 1101, 4:23–28. The '652 patent states that while increasing the power applied to the plasma may increase the uniformity and density of the plasma, doing so may significantly increase the probability of establishing an electrical breakdown condition of arcing. *Id.* at 4:31–37. The invention set forth in the '652 patent involves a plasma generation

[2] The oral arguments for the instant review and IPR2014-01088 and IPR2014-01089 were consolidated.

method that provides independent control of two or more co-existing plasmas in a system. *Id.* at 4:62–64.

One embodiment of the ’652 patent is shown in Figure 2A set forth below.

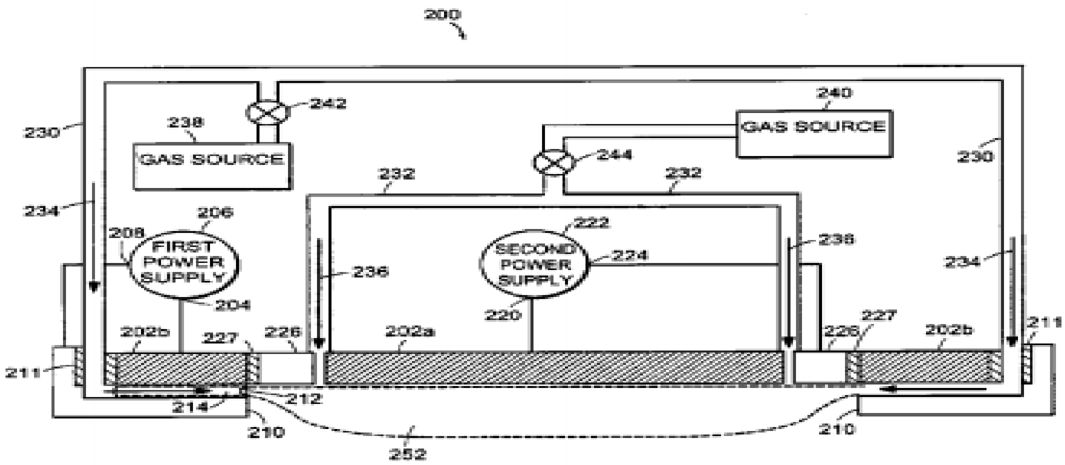

Figure 2A, reproduced above, shows a cross-sectional view of plasma generating apparatus 200 with segmented cathode 202. *Id.* at 5:43–45. Such segmented cathode has inner cathode section 202*a* and outer cathode section 202*b*. *Id.* at 5:45–47. Outer cathode 202*b* is coupled to first output 204 of first power supply 206, which can operate in a constant power mode or a constant voltage mode. *Id.* at 5:56–67. Second output 208 of first power supply 206 is coupled to first anode 210 that has insulator 211 to isolate it from outer cathode section 202*b*. *Id.* at 6:5–7.

Gap 212 is formed between first anode 210 and outer cathode section 202*b* that is sufficient to allow current to flow through region 214 within gap 212. *Id.* at 6:34–38. Gap 212 can be a plasma generator where plasma is ignited in gap 212 from feed gas 234, such as argon, fed from gas line 230. *Id.* at 6:59–61, 8:1–3, 10–11. Such an ignition condition and plasma development in the gap can be optimized by crossed electric and magnetic fields in gap 212 that trap electrons and ions improving the efficiency of the ionization process. *Id.* at 6:61–67. Gap 212 can be configured to generate excited atoms, which can increase the density of plasma, from ground state atoms. *Id.* at 6:44–46. "Since excited atoms generally require less energy to ionize than ground state gas atoms, a volume of excited atoms can generate higher density plasma than a similar volume of ground state feed gas atoms for the same input energy." *Id.* at 6:46–50.

Gap 212 facilitates high input power by having additional feed gas supplied to gap 212 that displaces some of the already developing plasma and absorbs any excess power applied to the plasma. *Id.* at 7:1–6. Such absorption prevents the plasma from contracting and terminating. *Id.* at 7:6–9. Feed gases 234, 236 are introduced into the chamber from more than one feed source, such as feed source 238, 240, through gas lines 230, 232 that may include in-line gas valves 242, 244 to control gas flow to the chamber. *Id.* at 8:1–5. Pulsing the feed gas can help generate excited atoms, including metastable atoms, by increasing the instantaneous pressure in gap 212, while the average pressure in the chamber is unchanged. *Id.* at 8:23–28.

Second power supply 222 applies high power pulses between inner cathode section 202*a* and second anode 226 after an appropriate volume of initial plasma is present in region 252. *Id.* at 12:1–5. "The high-power pulses create an electric field 254 between the inner cathode section 202*b* and the second anode 226 that strongly-ionizes the initial plasma thereby creating a high-density plasma in the region 252." *Id.* at 12:5–9. These high power pulses from second power supply 222, which add additional power to

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