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Paper 54
Entered: September 30, 2015

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

THE GILLETTE COMPANY, FUJITSU SEMICONDUCTOR LIMITED, FUJITSU SEMICONDUCTOR AMERICA, INC., ADVANCED MICRO DEVICES, INC., RENESAS ELECTRONICS CORPORATION, RENASAS ELECTRONICS AMERICA, INC., GLOBALFOUNDRIES 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 IPR2014-00803[1]
Patent 7,808,184 B2

Before KEVIN F. TURNER, DEBRA K. STEPHENS, 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

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[1] Cases IPR2014-00858, IPR2014-00996, and IPR2014-01061 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 6–10 and 16–20 of U.S. Patent No. 7,808,184 B2 (Ex. 1101, "the '184 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 6–10 and 16–20 ("the challenged claims") of the '184 patent. TSMC included a Declaration of Mr. Richard DeVito (Ex. 1102) to support its positions. Patent Owner Zond, LLC ("Zond") filed a Preliminary Response (Paper 7, "Prelim. Resp."). Pursuant to 35 U.S.C. § 314(a), on October 1, 2014, we instituted an *inter partes* review of challenged claims 6, 7, 9, 10, 16, 17, 19, and 20 to determine if the claims are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Wang and Kudryavtsev, and of challenged claims 8 and 18 to determine if the claims are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Wang, Kudryavtsev, and Mozgrin. Paper 9 ("Dec.").

Subsequent to institution, we granted revised Motions for Joinder filed by other Petitioners (collectively, "Gillette") listed in the Caption above, joining Cases IPR2014-00858, IPR2014-00996, and IPR2014-01061 with the instant trial (Papers 16 and 17), and also granted a Joint Motion to Terminate with respect to TSMC (Paper 37). Zond filed a Patent Owner Response (Paper 32, "PO Resp."), along with a Declaration of Larry D. Hartsough, Ph.D. (Ex. 2015) to support its positions. Gillette filed a Reply (Paper 42, "Reply") to the Patent Owner Response, along with a supplemental Declaration of Dr. John Bravman (Ex. 1128). An oral hearing[2] was held on May 28, 2015. A transcript of the hearing is included in the record. Paper 53 ("Tr.").

B. Related Matters

Gillette indicates that the '184 patent was asserted against Petitioner, as well as other defendants, in seven district court lawsuits pending in the District of Massachusetts. Pet. 1.

C. The '184 Patent

The '184 patent relates to methods for generating strongly-ionized plasmas in a plasma generator. Ex. 1101, Abs. When creating a plasma in a chamber, a direct current ("DC") electrical discharge, which is generated between two electrodes with a feed gas, generates electrons in the feed gas, that ionize atoms to create the plasma. *Id.* at 1:16–20. For an application, such as magnetron plasma sputtering, a relatively high level of energy must be supplied, which may result in overheating the electrodes or the work piece. *Id.* at 1:21–26. Such overheating may be addressed by complex cooling mechanisms, but such cooling can cause temperature gradients in the

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[2] The oral arguments for the instant review and IPR2014-00477, IPR2014-00479, and IPR2014-00799 were consolidated.

chamber causing a non-uniform plasma process. *Id.* at 1:26–30. These temperature gradients may be reduced by pulsing the DC power, but high-power pulses may result in arcing at plasma ignition and termination. *Id.* at 1:31–36. Arcing is problematic because it can cause the release of undesirable particles in the chamber thereby contaminating the work piece. *Id.* at 1:36–37, 4:8–11.

According to the '184 patent, a pulsed power supply may include circuitry that minimizes or eliminates the probability of arcing in the chamber by limiting the plasma discharge current to a certain level and dropping the generated voltage for a certain period of time if the limit is exceeded. *Id.* at 4:6–15. Figure 2, reproduced below, shows measured data of discharge voltage as a function of discharge current for admitted prior-art, low-current plasma 152, and high-current plasma 154 created by the claimed methods using the pulsed power supply. *Id.* at 1:58–60.

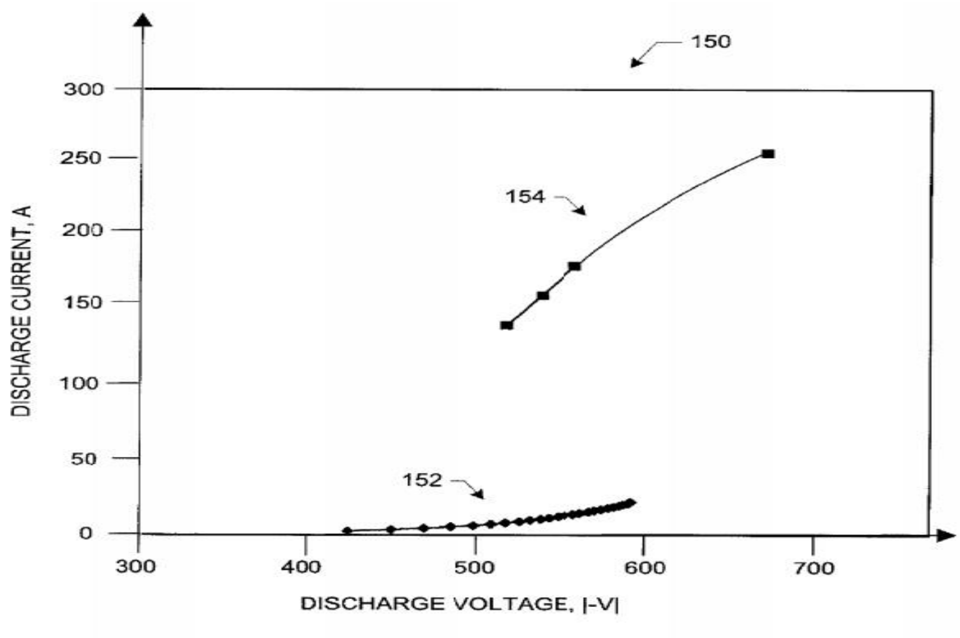

FIG. 2

Figure 2 shows current-voltage characteristic 154 that represents actual data for plasma generated by the pulsed power supply in the plasma sputtering system depicted in Figure 1 (not reproduced here). *Id.* at 5:28–30. The current-voltage characteristic 154 is in a high-current regime that generates a relatively high plasma density (greater than 10^{12}–10^{13} cm^{-3}). *Id.* at 5:40–43. The pulsed power supply generates waveforms that create and sustain the high-density plasma with current-voltage characteristics in the high-current regime. *Id.* at 5:55–59. The ’184 patent explicitly defines the term “high-current regime” as “the range of plasma discharge currents that are greater than about 0.5 A/cm^2 for typical sputtering voltages of between about -300V to -1000V. *Id.* at 5:43–46. The power density is greater than about 250 W/cm^2 for plasmas in the high-current regime.” *Id.* at 5:43–48.

The ’184 patent also describes a multi-stage ionization process wherein a multi-stage voltage pulse that is generated by the pulsed power supply creates a strongly-ionized plasma. *See id.* at 2:1–3, 7:4–7 (describing Figure 4 (not reproduced here) as such an example); *id.* at 14:50–15:46 (describing Figure 5C (not reproduced here) as an illustrative multi-stage voltage pulse). Such a multi-stage voltage pulse initially generates a weakly-ionized plasma in a low-current regime (shown as 152 in Figure 2 above), and then eventually generates a strongly-ionized or high-density plasma in a high-current regime. *Id.* at 7:10–13. “Weakly-ionized plasmas are generally plasmas having plasma densities that are less than about 10^{12}–10^{13} cm^{-3} and strongly-ionized plasmas are generally plasmas having plasma densities that are greater than about 10^{12}–10^{13} cm^{-3}.” *Id.* at 7:14–18.

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