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Paper 39
Entered: June 22, 2018

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICRON TECHNOLOGY, INC.,
INTEL CORPORATION, GLOBALFOUNDRIES U.S., INC., and
SAMSUNG ELECTRONICS COMPANY, LTD.
Petitioner,

v.

DANIEL L. FLAMM,
Patent Owner.

Case IPR2017-00391[1]
Patent 6,071,221

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

KOKOSKI, *Administrative Patent Judge.*

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

[1] Samsung Electronics Company, Ltd. was joined as a party to this proceeding via a Motion for Joinder in IPR2017-01746.

I. INTRODUCTION

We have jurisdiction to conduct this *inter partes* review under 35 U.S.C. § 6, and this Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–7 of U.S. Patent No. 6,071,221 ("the '221 patent," Ex. 1001) are unpatentable.

A. Procedural History

Micron Technology, Inc., Intel Corporation, and GLOBALFOUNDRIES U.S., Inc. (collectively, "Petitioner")[2] filed a Petition ("Pet.") to institute an *inter partes* review of claims 1–7 of the '221 patent. Paper 1. Daniel L. Flamm ("Patent Owner") filed a Preliminary Response ("Prelim. Resp."). Paper 9. Pursuant to 35 U.S.C. § 314(a), we instituted an *inter partes* review on the following grounds:

Reference(s)	Basis	Challenged Claim(s)
Lieberman[3]	§ 103(a)	1, 5–7
Lieberman and Dible[4]	§ 103(a)	1, 5–7

[2] On September 15, 2017, we granted the Motion for Joinder filed by Samsung Electronics Company, Ltd. ("Samsung") in IPR2017-01746, and authorized Samsung to participate in this proceeding only on a limited basis. *See* Paper 14. We refer to Micron Technology, Inc., Intel Corporation, GLOBALFOUNDRIES U.S., Inc., and Samsung collectively as "Petitioner" throughout this Decision.

[3] *Design of High-Density Plasma Sources for Materials Processing*, Plasma Sources for Thin Film Deposition and Etching (Physics of Thin Films Vol. 18, pp. 1–119), August 18, 1994 (Ex. 1006).

[4] US 5,573,595, issued Nov. 12, 1996 (Ex. 1007).

Reference(s)	Basis	Challenged Claim(s)
Lieberman and Hanawa[5]	§ 103(a)	2, 3
Lieberman, Dible, and Hanawa	§ 103(a)	2, 3
Lieberman and Collins[6]	§ 103(a)	4
Lieberman, Dible and Collins	§ 103(a)	4
Qian[7]	§ 103(a)	1, 5–7
Qian and Hanawa	§ 103(a)	2, 3
Qian and Collins	§ 103(a)	4

Paper 10 ("Dec. on Inst."), 29.

After institution of trial, Patent Owner filed a Corrected Patent Owner Response (Paper 34, "PO Resp."), and Petitioner filed a Reply (Paper 15, "Reply"). Petitioner relies on the Declaration of David B. Graves ("the Graves Declaration," Ex. 1003) and the Reply Declaration of Dr. David Graves ("the Graves Reply Declaration," Ex. 1034). Patent Owner relies on the Declaration of Daniel L. Flamm, Sc.D. ("the Flamm Declaration," Ex. 2001) and the Second Declaration of Daniel L. Flamm ("the Second Flamm Declaration," Ex. 2003). An oral hearing was held on March 7, 2018. A transcript of the hearing is included in the record. Paper 37.

B. Related Proceedings

Petitioner indicates that the '221 patent is "at issue in five related patent infringement actions, in which [Patent Owner] sued Petitioners and other defendants, in the Northern District of California, Case Nos. 5:16-cv-

[5] US 5,688,357, issued Nov. 18, 1997 (Ex.1010).
[6] US 5,065,118, issued Nov. 12, 1991 (Ex. 1008).
[7] US 5,683,539, issued Nov. 4, 1997 (Ex. 1009).

01578-BLF; 5:16-cv-01579-BLF; 5:16-cv-01580-BLF; 5:16-cv-01581-BLF; 5:16-cv-02252-BLF." Pet. 3; *see* Paper 7, 2. The '221 patent previously was the subject of IPR2015-01767 (terminated on December 15, 2016 at the joint request of the parties before a Final Written Decision was entered). *Lam Research Corp. v. Daniel L. Flamm*, Case IPR2015-01767, slip. op. at 3–6 (PTAB Dec. 15, 2016) (Paper 36).

C. The '221 Patent

The '221 patent, titled "Process Depending on Plasma Discharges Sustained by Inductive Coupling," is directed to a process for fabricating a product using plasma discharge. Ex. 1001, 6:14–16. The process "relies upon the control of the instantaneous plasma AC potential to selectively control a variety of plasma characteristics," such as "the amount of neutral species, the amount of charged species, overall plasma potential, the spatial extent and distribution of plasma density, the distribution of electrical current, and others." *Id.* at 6:16–22. The process "can be used in applications including chemical dry etching (e.g., stripping), ion-enhanced etching, plasma immersion ion implantation, chemical vapor deposition and material growth, and others." *Id.* at 6:22–26.

The process comprises subjecting a substrate to a composition of entities, where "[a]t least one of the entities emanates from a species generated by a gaseous discharge excited by a high frequency field in which the vector sum of phase and anti-phase capacitive coupled voltages (e.g., AC plasma voltage) from the inductive coupling structure substantially balances." *Id.* at 6:31–37. According to the '221 patent, "[t]his process provides for a technique that is substantially free from stray or parasitic

capacitive coupling from the plasma source to chamber bodies (e.g., substrate, walls, etc.) at or near ground potential." *Id.* at 6:37–41.

The '221 patent also describes a plasma discharge apparatus that includes a plasma source and a plasma applicator. *Id.* at 7:26–28. "A wave adjustment circuit (e.g., RLC circuit, coil, transmission line, etc.) is operably coupled to the plasma applicator" and "can selectively adjust phase and anti-phase potentials of the plasma from an rf power supply." *Id.* at 7:30–34.

Figure 2A of the '221 patent is reproduced below.

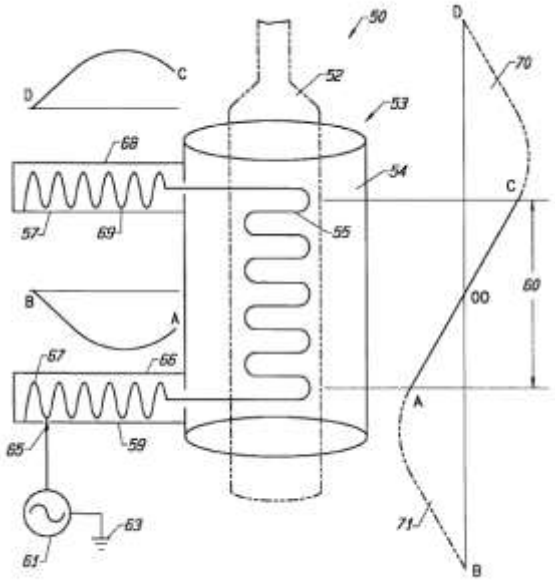

FIG. 2A

Figure 2A is a simplified configuration using wave adjustment circuits. *Id.* at 7:46–47. Embodiment 50 includes discharge tube 52, inductive applicator 55, exterior shield 54, upper wave adjustment circuit 57, lower wave adjustment circuit 59, plasma source region 60, and RF power supply 61. *Id.* at 10:3–8. "In this embodiment, the wave adjustment circuits are adjusted to provide substantially zero AC voltage at one point on the inductive coil (refer to point 00 in FIG. 2A)," providing "substantially equal phase 70 and

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