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Paper 52
Entered: June 29, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLIED MATERIALS, INC., INTEL CORPORATION,[1] and SAMSUNG ELECTRONICS CO., LTD.[2]
Petitioner,

v.

DEMARAY LLC,
Patent Owner.

IPR2021-00103
Patent 7,544,276 B2

Before CHRISTOPHER L. CRUMBLEY, KRISTINA M. KALAN, and KIMBERLY McGRAW, *Administrative Patent Judges*.

KALAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

[1] Intel Corporation was joined as a petitioner to this proceeding based on a petition and motion for joinder filed in IPR2021-01030.
[2] Samsung Electronics Co., Ltd. was joined as a petitioner to this proceeding based on a petition and motion for joinder filed in IPR2021- 01090.

I. INTRODUCTION

Applied Materials, Inc. ("Applied Materials") filed a Petition (Paper 1, "Pet.") requesting an *inter partes* review of claims 1–13 of U.S. Patent No. 7,544,276 B2 (Ex. 1001, "the '276 patent"). Demaray LLC ("Patent Owner") filed a Preliminary Response to the Petition (Paper 8). Pursuant to our authorization (Paper 9), Applied Materials filed a Reply (Paper 10), and Patent Owner filed a Sur-Reply (Paper 12). Applied Materials also filed a Petitioner's Notice Regarding Multiple Petitions (Paper 2) to which Patent Owner filed a Response (Paper 7).

We instituted an *inter partes* review of claims 1–13 of the '276 patent on the grounds of unpatentability alleged in the Petition. Paper 13 ("Dec."). After institution of trial, Patent Owner filed a Patent Owner Response. Paper 29 ("PO Resp."). Intel Corporation ("Intel") and Samsung Electronics Co., Ltd ("Samsung") were then joined as a petitioners. *See* Paper 31 (Intel); Paper 37 (Samsung). Applied Materials, Intel, and Samsung are collectively referred to as "Petitioner" in this Decision. Applied Materials filed a Reply. Paper 38 ("Reply"). Patent Owner filed a Sur-Reply. Paper 45 ("Sur-Reply"). An oral hearing was held on February 9, 2022, with IPR2021-00104, which challenges U.S. Patent No. 7,3381, 657 B2. A transcript of the hearing is included in the record. Paper 50 ("Tr.").

This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that follow, we determine that Petitioner has not shown by a preponderance of the evidence that claims 1–13 of the '276 patent are unpatentable.

A. Related Proceedings

Patent Owner identifies IPR2021-00104, which challenges U.S. Patent No. 7,381,657 B2, as a related matter. Paper 6, 1.

The parties also identify *Demaray LLC v. Samsung Electronics Co., Ltd.*, No. 6-20-cv-00636 (W.D. Tex.) ("Samsung Litigation"); *Demaray LLC v. Intel Corporation*, No. 6-20-cv-00634 (W.D. Tex.) ("Intel Litigation"); and *Applied Materials, Inc. v. Demaray LLC*, No. 5-20-cv-05676 (N.D. Cal.) ("California Litigation") as related matters. Pet. 1; Paper 6, 1. Each of these proceedings involves the '276 patent. *Id.*

B. Real Parties-In-Interest

Applied Materials identifies Intel Corporation, Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., Samsung Semiconductor, Inc., Samsung Austin Semiconductor, LLC, and itself as real parties-in-interest. Pet. 1. Patent Owner identifies itself as the real party-in-interest. Paper 6, 1.

C. The '276 Patent

The '276 patent, titled "Biased Pulse DC Reactive Sputtering of Oxide Films," relates to "deposition of oxide and oxynitride films and, in particular, to deposition of oxide and oxynitride films by pulsed DC reactive sputtering." Ex. 1001, code (54), 1:12–14. The '276 patent discloses that typically, radio frequency ("RF") sputtering has been used for deposition of oxide dielectric films, but arcing can occur between sputtering target tiles used to make such films, which causes contamination of the deposited films. *Id.* at 2:25–30. The '276 patent further states that reactors for RF sputtering, particularly their power systems, are complicated. *Id.* at 2:30–38. The '276 patent discloses that reactive DC magnetron sputtering of nonconductive

oxides "is done rarely" because insulating surfaces accumulate charge during deposition and result in arcing, which "can damage the power supply, produce particles and degrade the properties of deposited oxide films." *Id.* at 4:44–52.

Figure 1A of the '276 patent is reproduced below.

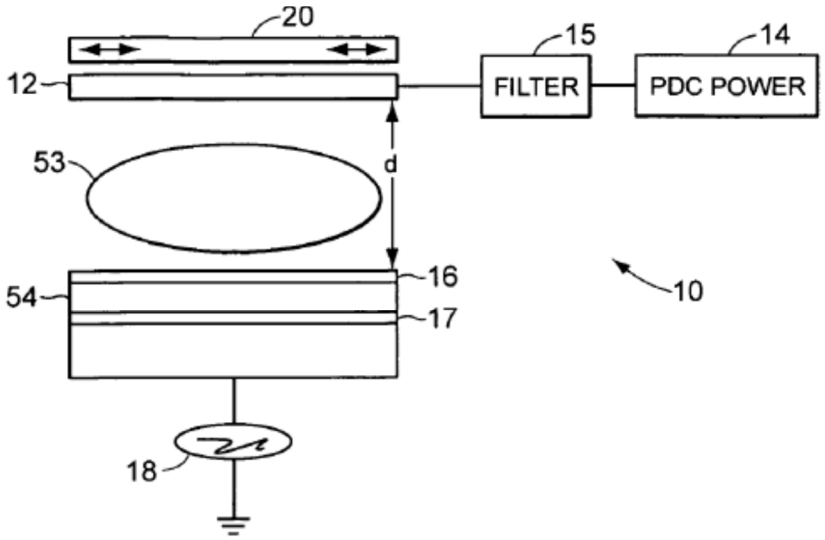

FIG. 1A

Figure 1A depicts a pulsed DC sputtering reactor. *Id.* at 3:26–27. The '276 patent describes reactor apparatus 10 for sputtering of material from target 12. *Id.* at 5:7–9. Magnet 20 is scanned across the top of target 12, which reduces local erosion of target 12 during sputtering. *Id.* at 5:28–29, 8:47–55. Substrate 16 is opposite and parallel to target 12. *Id.* at 5:23–24. Substrate 16 is capacitively coupled to electrode 17 via insulator 54. *Id.* at 5:26–27. Electrode 17 can be coupled to RF power supply 18. *Id.* at 5:27–28. The '276 patent explains that columnar structures in a deposited film can be detrimental for optical wave guide applications, but applying an RF bias on substrate 16 during deposition can substantially eliminate columnar structures. *Id.* at 5:60–67. The '276 patent discloses that target 12

functions as a cathode when power is applied to it, which creates plasma 53. *Id.* at 5:24–26.

Target 12 is electrically coupled through filter 15 to pulsed DC power supply 14. *Id.* at 5:19–20. The '276 patent discloses that the polarity of the power supplied to target 12 by the pulsed DC power supply 14 oscillates between negative and positive potentials. *Id.* at 5:30–33. According to the '276 patent, the insulating layer on the surface of target 12 discharges during the positive period, which prevents arcing. *Id.* at 5:33–35. The '276 patent discloses that the pulsing frequency must exceed a critical frequency, which depends on a target material, cathode current, and reverse time. *Id.* at 5:35–37.

Reactor apparatus 10 further includes filter 15, which prevents RF power supply 18 from coupling into pulsed DC power supply 14. *Id.* at 5:50–51. According to the '276 patent, filter 15 can be a 2 MHz band rejection filter when a 2 MHz power supply is used for RF power supply 18. *Id.* at 5:51–55. The '276 patent discloses that "the band width of the filter 15 can be approximately 100 kHz." *Id.* at 5:55–57.

D. Illustrative Claim

Claims 1 and 6 of the '276 patent are independent. Claim 1 is representative and is reproduced below:

> 1[a]. A reactor according to the present invention, comprising:
> 1[b] a target area for receiving a target;
> 1[c] a substrate area opposite the target area for receiving a substrate;
> 1[d] a pulsed DC power supply coupled to the target area, the pulsed DC power supply providing alternating negative and positive voltages to the target;
> 1[e] an RF bias power supply coupled to the substrate; and

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