

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.

IPR2021-00104
Patent 7,381,657 B2

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

McGRAW, *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 in this proceeding based on a petition and motion for joinder filed in IPR2021-01031.

² Samsung Electronics Co., Ltd. was joined as a petitioner in this proceeding based on a petition and motion for joinder filed in IPR2021-01091.

I. INTRODUCTION

We instituted this *inter partes* review pursuant to 35 U.S.C. § 314 to review claims 1–21 of U.S. Patent No. 7,381,657 B2 (Ex. 1001, “the ’657 patent”), owned by Demaray LLC (“Patent Owner”). 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 discussed below, Petitioner³ has not shown by a preponderance of the evidence that claims 1–21 are unpatentable.

A. Procedural History

Applied Materials, Inc. (“Applied Materials”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 1–21 of the ’657 patent. Patent Owner filed a Preliminary Response to the Petition (Paper 7). Pursuant to our authorization (Paper 9), Applied Materials filed a reply (Paper 10), and Patent Owner filed a sur-reply (Paper 12). We instituted this *inter partes* review of all challenged claims based on all grounds asserted in the Petition. Paper 13 (“Inst. Dec.”).

Patent Owner then filed a Patent Owner Response (Paper 29, “PO Resp.”) and Applied Materials filed a Reply (Paper 36, “Pet. Reply”). Intel Corporation (“Intel”) and Samsung Electronics Co., Ltd (“Samsung”) were then joined as a party petitioners. *See* Paper 38 (joining Intel to this proceeding based on a petition and motion for joinder filed in IPR2021-01031); Paper 42 (joining Samsung to this proceeding based on a petition and motion for joinder filed in IPR2021-01091). Patent Owner filed a Sur-

³ Applied Materials, Intel, and Samsung are collectively referred to as “Petitioner” in this Decision.

reply. Paper 47 (“PO Sur-reply”). An oral hearing⁴ was held on February 9, 2022, with IPR2021-00103, which challenges U.S. Patent No. 7,544,276 B2. A transcript of the hearing has been entered into the record as Paper 52 (“Tr.”).

B. Real Parties in Interest

In addition to the named parties, Applied Materials identifies Samsung Electronics America, Inc., Samsung Semiconductor, Inc., and Samsung Austin Semiconductor, LLC, as real parties-in-interest. *See* Pet. 1. Patent Owner identifies itself as the real party-in-interest. Paper 5.

C. Related Matters

The parties identify *Demaray LLC v. Samsung Electronics Co., Ltd.* et al., No. 6-20-cv-00636 (W.D. Tex.); *Demaray LLC v. Intel Corp.* No. 6-20-cv-00634 (W.D. Tex.); and *Applied Materials, Inc. v. Demaray LLC*, No. 5-20-cv-05676 (N.D. Cal.) as related matters. Pet. 1; Paper 5, 2. Each of these proceedings involves the ’657 patent. *Id.*

Patent Owner also identifies IPR2021-00106 (institution denied), which challenges the ’657 patent, as well as IPR2021-00105 (institution denied) and IPR2021-00103 (institution granted), both of which challenge related U.S. Patent No. 7,544,276. Paper 5, 3.

D. The ’657 Patent and Prosecution History

1. The ’657 Patent

The ’657 patent, titled “Biased Pulse DC Reactive Sputtering of Oxide Films” is directed to a pulsed direct current (“DC”) reactor for sputtering oxide films. Ex. 1001, code (54), 1:11–13. The reactor has a DC

⁴ Although we held a consolidated hearing, IPR2021-00103 and IPR2021-00104 are not consolidated.

power supply that couples pulsed-DC power to the target and an “RF power supply,” which is an alternating current (“AC”) power supply that supplies a radio frequency (“RF”) bias to a substrate. *See id.* at code (57). The reactor also has a filter located between the pulsed-DC power supply and the target for filtering out the effects of the RF bias power applied to the substrate and protecting the pulsed-DC power supply. *Id.* at code (57), Fig. 1.

The ’657 patent explains that RF sputtering typically had been used to deposit oxide dielectric films, but that RF systems used ceramic targets composed of multiple smaller tiles and that “arcing” between the tiles caused contamination in the deposited films. *Id.* at 2:25–30. The ’657 patent further explains that reactive DC magnetron sputtering of nonconductive oxides was done rarely because insulating oxide layers would form on the target surface causing charges to build up, resulting in arcing that can damage power supply and the production of particles that degrade the properties of deposited oxide films. *See id.* at 4:48–57. The ’657 patent states that there was a need for new methods of depositing oxide and oxide films. *Id.* at 2:39–41.

Figure 1A of the ’657 patent, depicting an embodiment of the invention, with highlighting added by Petitioner, is reproduced below.

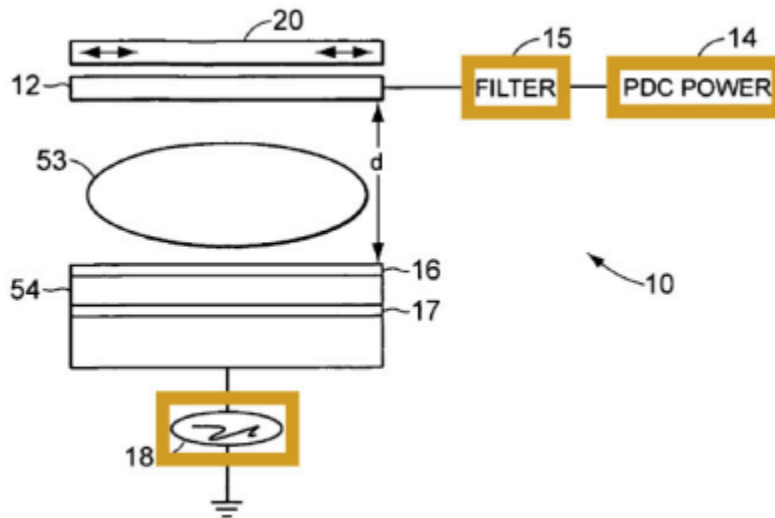


Figure 1A depicts a pulsed DC sputtering reactor apparatus 10 having RF power source 18 coupled to electrode 17 and substrate wafer 16 and target 12 electrically coupled through filter 15 to pulsed-DC power supply 14. *Id.* at 5:25–27, 5:32–36, Fig. 1; Pet. 10.

Magnet 20 is used to scan across the top of the target 12, which reduces local erosion of target 12 during sputtering. *Id.* at 5:35, 8:57–66. Substrate 16 is opposite and parallel to target 12. *Id.* at 5:29–30. Substrate 16 is capacitively coupled to electrode 17 via insulator 54. *Id.* at 5:32–36. Electrode 17 can be coupled to RF power supply 18. *Id.* at 5:34–35. The '657 patent explains that RF power supply 18 is used to avoid columnar structures in a deposited film, which can be detrimental for optical wave guide applications. *Id.* at 5:66–6:6. The '657 patent discloses that target 12 functions as a cathode when power is applied to the target 12, which creates plasma 53. *Id.* at 5:30–32.

Target 12, which comprises material to be deposited on the substrate, is electrically coupled through filter 15 to pulsed DC power supply 14. *Id.* at 2:55–57, 5:25–26. The '657 patent discloses that the polarity of the power supplied to target 12 by pulsed DC power supply 14 oscillates between

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