

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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APPLIED MATERIALS, INC., INTEL CORPORATION,<sup>1</sup> and  
SAMSUNG ELECTRONICS CO., LTD.,<sup>2</sup>

Petitioner,

v.

DEMARAY LLC,  
Patent Owner.

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IPR2021-00104  
Patent 7,381,657 B2

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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)*

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<sup>1</sup> Intel Corporation was joined as a petitioner in this proceeding based on a petition and motion for joinder filed in IPR2021-01031.

<sup>2</sup> 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, Petitioner<sup>3</sup> 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-

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

reply. Paper 47 (“PO Sur-reply”). An oral hearing<sup>4</sup> 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

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<sup>4</sup> 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.

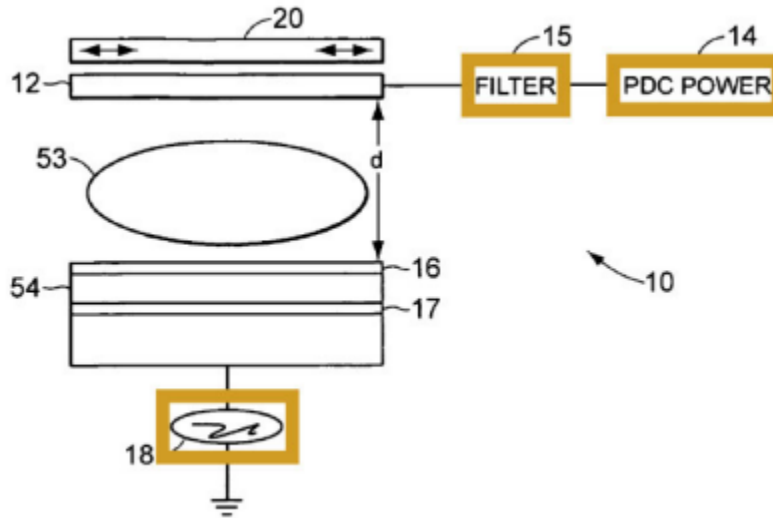


Figure 1A depicts a pulsed DC sputtering reactor apparatus 10 having RF power source 18 coupled to electrode 17 and substrate wafer 16 and target 12 electrically coupled through filter 15 to pulsed-DC power supply 14. *Id.* at 5:25–27, 5:32–36, Fig. 1; Pet. 10.

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

negative and positive potentials. *Id.* at 5:36–39. According to the '657 patent, the insulating layer on the surface of target 12 discharges during the positive period, which prevents arcing. *Id.* at 5:39–41. The '657 patent discloses that the pulsing frequency must exceed a critical frequency, which depends on a target material, cathode current, and reverse time. *Id.* at 5:41–43.

Reactor apparatus 10 further includes filter 15, which prevents the RF power supply from coupling to into pulsed DC power supply 14. *Id.* at 5:56–57. According to the '657 patent, filter 15 can be a rejection filter, such as a 2 MHz band rejection filter when a 2 MHz power supply is used for RF power supply 18. *Id.* at 5:57–61. The '657 patent also discloses that the bandwidth of filter 15 can be approximately 100 kHz. *Id.* at 5:61–63.

*E. Illustrative Claim*

Of the challenged claims, claims 1 and 2 are independent. Claim 2 is representative and is reproduced below with bracketed material<sup>5</sup> and formatting added.

2. [a] A method of depositing an insulating film on a substrate, comprising:
  - [b] providing a process gas between a target and a substrate;
  - [c] [c1] providing pulsed DC power to the target
    - [c2] through a narrow band rejection filter
  - [c1] such that the voltage on the target alternates between positive and negative voltages;
  - [d] providing an RF bias that corresponds to the narrow band rejection filter to the substrate; and
  - [e] providing a magnetic field to the target;

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<sup>5</sup> The added brackets reflect Petitioner's characterization of the claim elements.

[f] wherein an oxide material is deposited on the substrate, and the insulating film is formed by reactive sputtering in a mode between a metallic mode and a poison mode.

Ex. 1001, 23:16–27.

*F. Evidence*

In support of its unpatentability arguments, Petitioner relies on, *inter alia*, the declarations of Dr. Vivek Subramanian (Ex. 1002, “Subramanian Dec.”; Ex. 1108 (“Rebuttal Subramanian Dec.”)). In response, Patent Owner relies on, *inter alia*, the declaration of Dr. Alexander Glew (Ex. 2009 (“Glew Dec.”), the Declaration of Rajiv Pethe (Ex. 2020 “Pethe Dec.”), and the Declaration of Dr. Hongmei Zhang (Ex. 2019).

*G. Prior Art and Instituted Grounds*

We instituted *inter partes* review of claims 1–21 of the ’657 patent on the following grounds:

Claim(s) Challenged	35 U.S.C. § <sup>6</sup>	Reference(s)/Basis
2–4, 6, 8, 10–12, 21	103(a)	Barber, <sup>7</sup> Hirose <sup>8</sup>
5, 7	103(a)	Barber, Hirose, Dogheche <sup>9</sup>
9	103(a)	Barber, Hirose, Safi <sup>10</sup>

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<sup>6</sup> The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. §§ 102 and 103. Because the ’657 patent has an effective filing date prior to the effective date of the applicable AIA amendments, we refer to the pre-AIA versions of §§ 102 and 103.

<sup>7</sup> US 6,342,134 B1, issued Jan. 29, 2002 (Ex. 1005).

<sup>8</sup> US 6,485,602 B2, filed July 18, 2001, issued Nov. 26, 2002 (Ex. 1006).

<sup>9</sup> E. Dogheche, *Growth and Optical Characterization of Aluminum Nitride Thin Films Deposited on Silicon by Radio-Frequency Sputtering*, Appl. Phys. Lett. 74, 1209 (1999) (Ex. 1029).

<sup>10</sup> I. Safi, *A Novel Reactive Magnetron Sputtering Technique for Producing Insulating Oxides of Metal Alloys and Other Compound Thin Films*, Surface and Coatings Tech. 135, 48 (2000) (Ex. 1039).

Claim(s) Challenged	35 U.S.C. § <sup>6</sup>	Reference(s)/Basis
12, 13	103(a)	Barber, Hirose, Aokura <sup>11</sup>
14–18	103(a)	Barber, Hirose, Segal <sup>12</sup>
19	103(a)	Barber, Hirose, Segal, Sakawaki <sup>13</sup>
20	103(a)	Barber, Hirose, Sill <sup>14</sup>
1	103(a)	Barber, Hirose, Sellers <sup>15</sup>
2–4, 6, 8, 10, 11, 12, 21	103(a)	Barber, Hirose, Belkind <sup>16</sup>
5, 7	103(a)	Barber, Hirose, Belkind, Dogheche
9	103(a)	Barber, Hirose, Belkind, Safi
12, 13	103(a)	Barber, Hirose, Belkind, Aokura
14–18	103(a)	Barber, Hirose, Belkind, Segal
19	103(a)	Barber, Hirose, Belkind, Segal, Sakawaki
20	103(a)	Barber, Hirose, Belkind, Sill
1	103(a)	Barber, Hirose, Belkind, Sellers

## II. ANALYSIS

### A. Legal Standards

To prevail in this proceeding, Petitioner must demonstrate by a preponderance of the evidence that the challenged claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). “In an [*inter partes* review], the

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<sup>11</sup> JP H10102247 A, published Apr. 21, 1998 (Ex. 1068) ((English translation (pp. 1–12); Verified Statement of Translation (p. 13); Japanese language document (pp. 14–24).

<sup>12</sup> US 2001/0047838 A1, published Dec. 6, 2001 (Ex. 1069).

<sup>13</sup> US 2001/0031383 A1, published Oct. 18, 2001 (Ex. 1043).

<sup>14</sup> US 6,284,110 B1, issued Sept. 4, 2001 (Ex. 1057).

<sup>15</sup> US 5,651,865, issued July 29, 1997 (Ex. 1007).

<sup>16</sup> A. Belkind et al., *Pulsed-DC Reactive Sputtering of Dielectrics: Pulsing Parameter Effects*, Society of Vacuum Coaters, 43<sup>rd</sup> Annual Technical Conference Proceedings, 86 (2000) (Ex. 1008).

petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid. Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); *see also* 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”). That burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015); *see also In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1375–78 (Fed. Cir. 2016) (discussing the burden of proof in *inter partes* review proceedings). Furthermore, a petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.” *Magnum Oil*, 829 F.3d at 1380.

A claim is unpatentable for obviousness under § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) when in evidence, objective indicia of non-obviousness (i.e., secondary considerations).<sup>17</sup> *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). “An obviousness determination requires finding both ‘that a skilled artisan would have been motivated to combine

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<sup>17</sup> Because we determine Petitioner has not sufficiently shown the challenged claims would have been obvious, we do not reach Patent Owner’s asserted objective evidence of non-obviousness. PO Resp. 68–69.

the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.’” *CRFD Research, Inc. v. Matal*, 876 F.3d 1330, 1340 (Fed. Cir. 2017) (quoting *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1366 (Fed. Cir. 2016)).

We analyze Petitioner’s challenges according to the above-stated principles.

*B. Level of Ordinary Skill in the Art*

Petitioner argues:

A person of ordinary skill in the art (“POSITA”) would have had, at the time of the ’657 patent (March 2002): a Master’s degree in Electrical Engineering or Material Science (or an equivalent subject) plus at least two years of relevant experience (e.g., sputtering deposition of films on substrates (Ex. 1001, 1:10–14, 2:45–47)), or a Bachelor’s degree in Electrical Engineering or Material Science (or an equivalent subject) plus at least four years of relevant experience. More education can substitute for practical experience, and vice versa.

Pet. 9 (citing Ex. 1002 ¶¶ 19–20).

In our Decision on Institution, we adopted Petitioner’s proposal regarding the level of one of ordinary skill in the art, except that we deleted the qualifier “at least” to eliminate vagueness as to the appropriate amount of relevant experience. Inst. Dec. 10 (noting that the qualifier expands the range without an upper bound, i.e., encompassing an unlimited amount of years of experience, and thus, does not meaningfully indicate the level of ordinary skill in the art).

Neither party disputes our definition of a POSITA. *See generally* PO Resp.; Reply; *see also* Ex. 2009 ¶ 10 (applying Petitioner’s definition of a POSITA). Nor does either party argue that the outcome of this case would

differ based on our adoption of any particular definition of one of ordinary skill in the art.

We further note that the prior art itself demonstrates the level of skill in the art at the time of the invention. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that “specific findings on the level of skill in the art . . . [are not required] ‘where the prior art itself reflects an appropriate level and a need for testimony is not shown’” (quoting *Litton Indus. Prods., Inc. v. Solid State Sys. Corp.*, 755 F.2d 158, 163 (Fed. Cir. 1985))).

Upon review of the full record, we see no reason to modify, and we thus maintain, the definition of a POSITA applied in our Decision on Institution.

### *C. Claim Construction*

In an *inter partes* review, we construe a claim term “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b).” 37 C.F.R. § 42.100(b). Under that standard, the words of a claim “are generally given their ordinary and customary meaning,” which is “the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc).

Neither Petitioner nor Patent Owner assert that construction of any claim term is required to resolve any issues in dispute. *See* Pet. 11 (citing Ex. 1002 ¶ 54); PO Resp. 10–11.

In our Decision on Institution we invited the parties to address whether the claim term “providing an RF bias that corresponds to the narrow

band rejection filter to the substrate” requires that (1) the frequency of the RF bias be the same as the frequency at which the filter operates or whether (2) the frequency of the RF bias could be a shift from the frequency at which the filter operates. Inst. Dec. 37–38. Patent Owner states the term should be construed according to its plain and ordinary meaning, which the parties in the copending litigation allegedly agreed requires the claimed filter “to have a rejection band set at a frequency of the RF bias power supply.” PO Resp. 10 (citing Ex. 2021; Ex. 2022, 7–10). Petitioner “disputes PO’s suggestion of ‘agree[ment] (EX 2022, 10)’” but argues that Patent Owner’s “positions are not dispositive because they do not distinguish the prior art.” Reply 1.

On the full record now before us, we agree that express construction of this term is not necessary as resolution of the present dispute does not turn on whether the frequency of the RF bias is the same as, or a shift from, the frequency at which the filter operates. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (noting that “we need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’”) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

*D. Overview of Principal Prior Art References*

Petitioner asserts sixteen grounds relying on ten different references. *See* Pet. 3–5. Each of Petitioner’s grounds, however, relies on two principal prior art references—Barber and Hirose, which are addressed below. *Id.* Other than Hirose, Patent Owner does not challenge the prior art status of any of the asserted references. *See* PO Resp. 12–39 (asserting that Hirose does not qualify as pre-AIA § 102(e) prior art to the challenged claims).

1. *Barber*

Barber is a US patent titled “Method for Producing Piezoelectric Films with Rotating Magnetron Sputtering System.” Ex. 1005, code (54). Barber’s annotated Figure 2 is reproduced below.

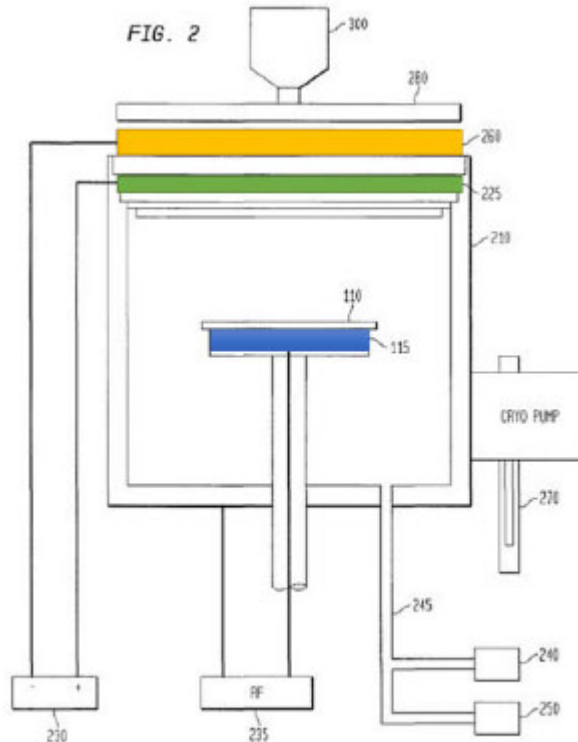


Figure 2 is a schematic diagram of a reactive sputtering arrangement with highlighting added by Patent Owner depicting DC power source 230 connected to, and providing pulsed DC power to, target 260 (orange) and anode ring 225 (green), RF power source 235 connected to, and providing an RF bias to, substrate platen 115 (blue). *Id.* at 3:22–24; PO Resp. 62.

The arrangement includes chamber 210 and a pair of electrodes (target 260 (shown in orange) and anode ring 225 (shown in green) within the chamber. Ex. 1005, 6:4–6. Barber discloses that an “electric potential applied to the electrodes may be controlled by a pulsed DC power source 230 or other suitable source.” *Id.* at 6:6–8. First flow control source 240 provides noble

gases to chamber 210 and second flow control source 250 provides a reactive gas to chamber 210. *Id.* at 6:9–12. Substrate 110 is positioned within chamber 210 adjacent to rotating magnet assembly 280. *Id.* at 6:14–18. Barber discloses RF power supply 235 to apply a bias voltage to substrate platen 115 (shown in blue) to control tensile film stress. *Id.* at 6:29–31. Barber further describes using a cross-over curve to optimize its reactive sputtering deposition process. *Id.* at 7:2–5. Specifically, Barber discloses introducing noble gas into its chamber and then introducing reactive gas incrementally so the flow rate of the reactive gas is a rate corresponding substantially to, but greater than, the flow rate for a cross-over point between producing a metallic film and an insulator. *Id.* at 7:17–29.

## 2. *Hirose*

Hirose is a US patent titled “Plasma Processing Apparatus.” Ex. 1006, code (54). Hirose “relates to a plasma processing apparatus capable of suppressing a damage due to sputtering to a wall surface of a processing chamber during plasma occurrence.” *Id.* at 1:14–17. Hirose discloses a conventional plasma processing apparatus that applies high-frequency power with two types of frequency. *Id.* at 1:19–23. Hirose teaches that simultaneously applying two types of high-frequency power decreases an effective ground area to one electrode in comparison to when a single frequency is used, and this causes sputter rate to increase for the ground area and more damage to the wall of a processing chamber. *Id.* at 2:1–9.

Hirose’s annotated Figure 1 is reproduced below.

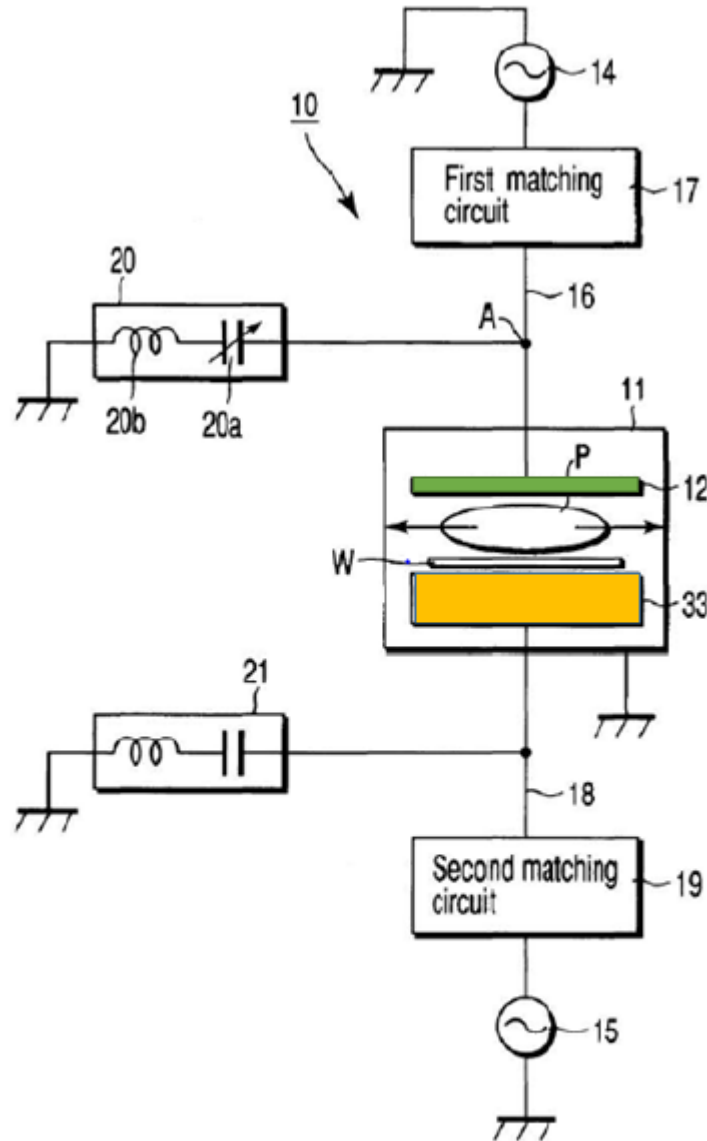


FIG. 1

Figure 1 is a configuration chart depicting a plasma processing apparatus, with color highlighting added by Patent Owner, having a first RF power supply (14) connected to, and applying RF power to, upper electrode 12 (green) and a second RF power supply (15) connected to, and applying 2 MHz power, to lower electrode 13 (orange); each RF power supply is connected to its respective filter (20, 21). *Id.* at 3:1–3; PO Resp. 62.

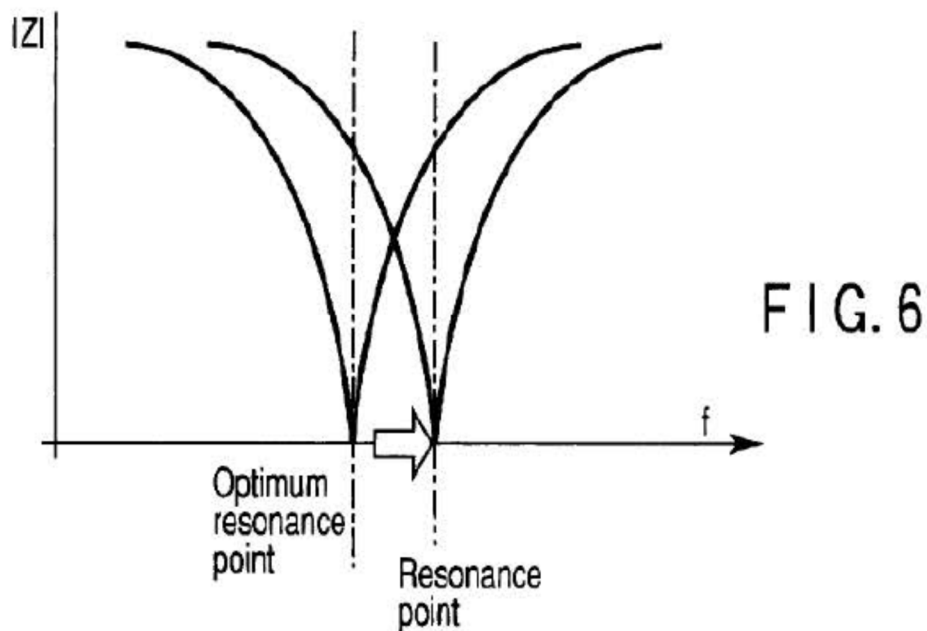
Hirose describes plasma processing apparatus 10 that includes processing chamber 11, upper electrode 12 (shown in green), and lower electrode 13 (shown in orange).<sup>18</sup> Ex. 1006, 3:45–51. Hirose discloses that lower electrode 13 functions as a mount for a processing object, such as a semiconductor wafer. *Id.* at 3:56–58. Upper electrode 12 is connected to first high-frequency power supply 14 and lower electrode 13 is connected to second high-frequency power supply 15. *Id.* at 3:51–56. Hirose discloses that first high-frequency power supply 14 may apply, for example, 60 MHz power to upper electrode 12, and second high-frequency power supply 15 may apply, for example, 2 MHz power to lower electrode 13. *Id.* at 3:59–60, 3:64–65.

Hirose describes first filter circuit 20 and second filter circuit 21. *Id.* at 4:9–11. First filter circuit 20 includes an inductor-capacitor (LC) resonant circuit with a varying circuit constant. *Id.* at 4:11–13. Hirose states that “[t]he LC series resonant circuit selectively filters a high-frequency current output from the second high-frequency power supply 15 for preventing the current from reaching the first high-frequency power supply 14.” *Id.* at 4:13–16. Hirose also discloses that second filter circuit 21 prevents high-frequency current from first high-frequency power supply 14 from reaching second high-frequency power supply 15. *Id.* at 4:18–21.

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<sup>18</sup> Hirose discloses lower electrode 13 for the embodiment depicted in Figure 1. Ex. 1006, 3:50. However, Figure 1 does not include reference numeral 13 but does include reference numeral 33. The embodiment depicted in Figure 7 includes lower electrode 33. *Id.* at 6:29. Figure 1’s reference numeral 33 appears to be typographical error and we presume that, in Figure 1, reference number 33 is intended to refer to lower electrode 13.

Hirose describes how to set the circuit constant of first filter circuit 20. *Id.* at 4:39–40. First and second high-frequency power supplies 14, 15 apply power to upper electrode 12 and lower electrode 13, respectively, and a capacitor capacity of first filter circuit 20 is varied by measuring a voltage waveform. *Id.* at 4:42–47. Hirose teaches that when first and second high-frequency power supplies 14, 15 provide power at respective frequencies of 60 MHz and 2 MHz, a capacitor capacity of 2500 pF for first filter circuit 20 provides an optimum resonance point. *Id.* at 4:51–57, 5:1–3. This effect is depicted in Hirose’s Figure 6, which is reproduced below.



Hirose states Figure 6 “shows a decrease in the sputter rate.” *Id.* at 3:24; Pet. 22 n.9. Hirose is concerned with sputtering the chamber wall of its device and examines the relationship between the sputter rate and the capacitor capacity. *Id.* at 2:1–10, 5:3–6, 5:11–12. Hirose determines that a capacitor capacity of 2000 pF for first filter circuit 20 “greatly decreases the sputter rate” compared to a capacitor capacity of 2500 pF, and first filter circuit 20 with a capacitor capacity of “2000 pF is superior to the optimally

resonant filter circuit” with 2500 pF. *Id.* at 5:49–52, 5:58–62. Comparing first filter circuit 20 with a capacitor capacity of 2000 pF with first filter circuit 20 with a capacitor capacity of 2500 pF, “the former is slightly inferior to the latter with respect to the resonance phenomenon.” *Id.* at 5:61–62.

3. *Whether Hirose Qualifies as Prior Art to the ’657 Patent*

The parties dispute whether Hirose qualifies as prior art to the ’657 patent. Petitioner, who bears the burden to show Hirose is prior art, asserts that Hirose qualifies as prior art under pre-AIA 35 U.S.C. § 102(e) because Hirose’s filing date of July 18, 2001 is before the March 16, 2002 effective filing date of the ’657 patent. *See* Pet. 5.

Patent Owner responds that Hirose does not qualify as prior art to the ’657 patent because the inventors of the ’657 patent conceived and reduced to practice the ’657 invention on or before Hirose’s filing date of July 18, 2001, likely as early as June 13, 2001. PO Resp. 12. To support this position, Patent Owner provides argument and evidence relating to the conception of the subject matter recited in claims 1–8 and 10–21. *Id.* at 15–39.

An inventor may antedate a § 102(e) reference by showing that the invention was conceived before the effective date of the reference, followed by reasonably continuous diligence until the constructive reduction to practice. *Monsanto Co. v. Mycogen Plant Sci., Inc.*, 261 F.3d 1356, 1362 (Fed. Cir. 2001). Evidence of such conception and reduction to practice must be provided on a claim-by-claim basis.

Petitioner met its burden of production to demonstrate that Hirose, which has a filing date prior to the filing date of the ’657 patent, was prior

art by asserting Hirose was prior art under § 102(e). *See Dynamic Drinkware*, 800 F.3d at 1379. Hirose’s earlier filing date shifts the burden of production to Patent Owner to produce evidence supporting a date of invention before Hirose’s filing date. *See id.* With its Response, Patent Owner presents evidence it contends shows a date of conception of claims 1–8 and 10–21 prior to July 18, 2001, followed by reasonably continuous diligence.

For the purposes of this decision, we need not determine whether Hirose qualifies as prior art, because, as explained below, even if Hirose qualifies as prior art, Petitioner has not sufficiently shown that all of the asserted claims would have been obvious over the grounds asserting Hirose.

*E. Asserted Obviousness of Claims 2–4, 6, 8, 10–12, and 21 over Barber and Hirose*

Petitioner contends claims 2–4, 6, 8, 10–12, and 21 would have been obvious over the combined teachings of Barber and Hirose. Pet. 12–41; Reply 25–38. Patent Owner opposes. PO Resp. 39–69; Sur-reply 19–28. For the reasons explained below, we determine Petitioner has not sufficiently shown that claims 2–4, 6, 8, 10–12, and 21 would have been obvious over the combined teachings of Barber and Hirose.

*1. Independent Claim 2*

Petitioner argues that Barber teaches every limitation of claim 2 other than the “narrow band-rejection filter” limitations that are recited in claim elements 2[c2] and 2[d]. For these claim elements, Petitioner relies on the combination of Barber and Hirose. Pet. 12–34.

We first address Petitioner’s contentions regarding the limitations taught by Barber alone and then address the limitations Petitioner asserts are taught by Barber in combination with Hirose.

*a) Petitioner's Contentions Regarding Barber Alone*

*2[a] A method of depositing an insulating film on a substrate, comprising:*

*2[b] providing a process gas between a target and a substrate;*

Petitioner contends Barber discloses a “method of depositing an insulating film on a substrate, comprising providing a process gas between a target and a substrate” as recited in claim elements 2[a]<sup>19</sup> and 2[b] by teaching the deposition of piezoelectric film 120 on substrate 110 by providing a process gas such as argon, nitrogen, or oxygen gas between a target 260 and substrate/wafer 110. Pet. 15.

*2[c1] providing pulsed DC power to the target . . . such that the voltage on the target alternates between positive and negative voltages;*

Claim element 2[c] recites:

[c1] providing pulsed DC power to the target

[c2] through a narrow band rejection filter

[c1] such that the voltage on the target alternates between positive and negative voltages;

Petitioner contends that Barber discloses claim element 2[c1] as one skilled in the art would have understood that the voltage of the pulsed DC power provided by Barber's pulsed-DC power supply (230) to target (260) alternates between positive voltages and negative voltages as required by claim element 2[c1]. Pet. 15–17.

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<sup>19</sup> The parties identify the preamble of claim 2 as claim element 2[a]. We need not, and do not, determine whether the preamble is limiting.

*2[d] providing an RF bias that corresponds to the narrow band rejection filter to the substrate;*

Petitioner contends that Barber teaches “providing an RF bias . . . to the substrate” as recited in claim element 2[d] because Barber states that its RF supply 235 applies “a bias voltage to the substrate platen 115” and that the bias is used to control the tensile strength of the deposited film. Pet. 28 (citing Ex. 1005, 6:29–31, 9:12; Ex. 1002 ¶ 101).

*2[e] providing a magnetic field to the target;*

Petitioner asserts Barber’s rotating magnet assembly 280 “provides a magnetic field” to target 260 as recited in claim element 2[e], which a POSITA would have recognized would have been implemented in the combined Barber-Hirose system. Pet. 28–29 (citing Ex. 1005, 6:17–27, 8:66–9:2; Ex. 1002 ¶ 102).

*2[f] wherein an oxide material is deposited on the substrate, and the insulating film is formed by reactive sputtering in a mode between a metallic mode and a poison mode.*

Petitioner asserts Barber’s system deposits an oxide material (e.g., silicon dioxide) on the substrate and forms an insulting film (e.g., aluminum nitride) by a reactive sputtering process that operates between a metallic mode and a poison mode (e.g., Barber’s poisoned target surface is continuously sputtered to expose the metallic/conductive surface for reactive sputtering) as required by claim element 2[f].

*b) Petitioner's Contentions Regarding Barber and Hirose*

*(1) claim elements 2[c2] - providing pulsed DC power to the target "through a narrow band-rejection filter"*

Petitioner admits that Barber's system does not use any filter and thus, Barber does not disclose providing pulsed-DC power to the target "*through a narrow band rejection filter*" as required by claim element 2[c2]. *See* Pet. 18–19. Petitioner asserts that this claim element is taught by Barber in combination with Hirose. Pet. 17–28.

Petitioner asserts that Barber teaches use of two power supplies that operate at different frequencies (i.e., pulsed DC supply 230 and RF power supply 235). Pet. 18 (citing Ex. 1005, 6:29–31, 8:45–48, 9:12; Ex. 1002 ¶¶ 75–76). Petitioner further asserts that in order to optimize deposition conditions to improve film quality, that "its pulsed-DC supply characteristics should be monitored/adjusted 'to achieve a stable waveform'" and that the "cross-over point" should be determined based on those characteristics. Pet. 17–18 (citing Ex. 1005, 7:36–40, 7:14–17, 7:40–47, 7:59–67, 8:54–59, 8:66–9:2; Ex. 1002 ¶ 77).

Petitioner contends that, although Barber does not disclose a filter, one of ordinary skill in the art "would have known the benefits of filters in plasma systems/processes to block interference/current of one power supply from another [power supply], which would have been considered when implementing Barber's dual-supply system/processes." Pet. 18–19 (citing Ex. 1002 ¶¶ 75–77).

Petitioner contends Hirose discloses a plasma processing apparatus having two power supplies (14, 15) of different frequencies that are

connected to respective filters (20, 21) and that “such filter’s optimum resonance point can be modified” to adjust plasma process conditions. Pet. 19 (citing Ex. 1006, 3:45–4:38, code (57); Ex. 1002 ¶¶ 77–78). Petitioner contends that Hirose’s first filter (filter circuit 20) is placed between power supply 14 and upper electrode 12 in order to selectively filter high-frequency current output from the second high-frequency power supply 15 “for preventing the current from reaching the first high-frequency power supply 14.” Pet. 20 (quoting Ex. 1006, 4:9–16). Petitioner also states that Hirose’s second filter (filter circuit 21) likewise isolates power supply 15 “from high-frequency current from power supply 14.” Pet. 20–21 (citing Ex. 1006, 4:9–21, 5:63–6:4; Ex. 1002 ¶ 79).

Petitioner further asserts that one of ordinary skill in the art “would have understood that *Hirose*’s filters are well-known **band-rejection filters.**” *Id.* at 21 (citing Ex. 1002 ¶¶ 81–82; Ex. 1006, 4:9–16; Ex. 1013, 4–6 (Fig. 2–9(F)) (emphasis in original). Petitioner further asserts that one of ordinary skill in the art “would have understood that *Hirose*’s filter is tuned to reject a narrow band of frequency, which operates like a narrow band-rejection filter (aka notch filter).” *Id.* at 22 (citing Ex. 1002 ¶¶ 81–82; Ex. 1006, 5:7–10, 8:34–38, Fig. 6; Ex. 1013, 5 (Fig. 2–9(G))).

(2) 2[d] – “*providing an RF bias that corresponds to the narrow band rejection filter*”

Petitioner contends that Barber in view of Hirose teaches claim element 2[d] for “similar reasons” explained for claim elements 2[a], [c]. Pet. 28 (citing Ex. 1002 ¶ 101). Petitioner further states that Barber’s RF power supply 235 applies a bias voltage to the substrate to control the deposited film’s tensile stress. *Id.* (citing Ex. 1005, 6:29–31, 9:12).

(3) *Reason to Combine Barber and Hirose*

Petitioner provides a number of reasons to support its contention that it would have been obvious to add a narrow band-rejection filter to Barber's system to arrive at the claimed invention recited in claim 2. *See* Pet. 23–28.

Petitioner first asserts that a POSITA would have found it obvious to modify Barber's system to include a narrow band-rejection filter in order “to prevent the RF power from RF supply 235 from affecting DC supply 230” during Barber's process. Pet. 23 (citing Ex. 1002 ¶ 83). Petitioner further asserts that “[t]his is true even if *Hirose* is not found to disclose a **narrow** band rejection filter, as the use of a ‘narrow’ type band rejection filter would have been obvious for the same reasons explained herein.” *Id.* at 23 n.10 (citing Ex. 1002 ¶¶ 73–100)(emphasis in original).

Petitioner also contends that a POSITA would have considered Hirose's teachings due to the “similar” arrangement between the Hirose and Barber systems, that a POSITA would have understood that “filters like that described in *Hirose* would have also been useful in other plasma process systems, like *Barber*'s,” that a narrow band-rejection filter was “a known type of filter used to suppress parasitic signals or to reduce interference,” and that “design concepts would have guided a POSITA to configure such a filter in the *Barber-Hirose* system to block the appropriate RF frequency corresponding to selected RF supply 235.” Pet. 23–24 (citing, *inter alia*, Ex. 1002 ¶¶ 83, 85–87; Ex. 1006, Fig. 1, 5:7–10, 8:1–8, 8:34–38; Ex. 1015, 3; Ex. 1057, 1:16–34, 1:56–58; Ex. 1010, 9:23–24; Ex. 1013, 5, 6).

Petitioner also asserts that “choosing to reject a specific frequency,” or a narrow band of frequencies, “depending on the bandwidth of *Barber*'s RF supply 235,” would have been a known way to achieve “the known

benefits” of Hirose. Pet. 24 (quoting Ex. 1023, 7:51–61 (“the type of filter is a mere design choice” and will necessarily be designed to reflect the frequency of operation); citing Ex. 1002 ¶ 89; Ex. 1006, Figs. 1, 6; Ex. 1013, 4–6; Ex. 1057, 7:23–34; Ex. 1058, 1:63–2:1; Pet. 57–60 (discussing claim 20 and configuring filter bandwidth based on the RF supply)).

Petitioner further contends that it would have been obvious to design and implement a narrow band-rejection filter in *Barber*’s system to “minimize the filter’s impact on the pulsed-DC waveform” while still protecting DC supply 230 from the specific frequency signals of RF supply 235. Pet. 25 (citing Ex. 1002 ¶ 89; Ex. 1016, 4:20–27).

Petitioner also points to the “known . . . benefits” of filters in plasma systems for blocking interference/current of one power supply from another. Pet. 25 (citing Ex. 1014, 3, Fig. 1; Ex. 1016, 3:53–63; Ex. 1017, 16:30–29; Ex. 1018, 24:29–32; Ex. 1019, 6:60–62, 7:40–42; Ex. 1020, 2:61–3:6, 4:26–31; Ex. 1021, 7:66–8:2; Ex. 1010, 6:40–41; Ex. 1002 ¶¶ 90–91).

Petitioner also points to manuals for DC power supplies manufactured by Advanced Energy (“AE”) (Exs. 1025, 1026, 1062, 1024) and other AE documents (Exs. 1065, 1066) as “guiding POSITAs” that you “***must place an ac blocking filter*** in series with the output of the dc power supply” if using a dc power supply in combination with an ac power supply to prevent damage to the dc power supply. Pet. 25–26 (quoting Ex. 1025, 23 (emphasis in Pet.)), 26–27 (citing Ex. 1025, Fig. 1–5; Ex. 1026, 116; Ex. 1062, 134; Ex. 1067, 141; Ex. 1024, 151; Ex. 1065, 2; Ex. 1066, 7; Ex. 1002 ¶¶ 91–96). Petitioner asserts that a POSITA, contemplating Barber’s system, would have had reasons “to consider such design concepts/guidance associated” with the known pulsed-DC supplies in systems having an RF source. Pet. 27

(citing Ex. 1001 (the '657 patent), 5:46–48; Ex. 1008 (Belkind), 1; Ex. 1011 (Sproul), 6:7–11; Ex. 1048 (Kelly), 2–3, Table 1; Ex. 1002 ¶¶ 97–98).

Petitioner asserts that “armed with such knowledge” a POSITA would have been motivated to implement a narrow band-rejection filter in Barber’s system to prevent power from Barber’s RF supply 235 from damaging DC power supply 230 and to reduce interference so that a stable waveform is provided to achieve optimal film deposition. Pet. 27 (citing Ex. 1005 (Barber), 7:59–60, 8:66–9:2; Ex. 1006 (Hirose), Figs. 2–3, 3:4–10, 4:57–61; Ex. 1002 ¶¶ 97–98; Ex. 1025, 23).

Finally, Petitioner asserts that modifying Barber would have involved combining known technologies, according to known methods, to yield a foreseeable system/process. Pet. 27–28 (citing Ex. 1002 ¶¶ 99–100).

*c) Patent Owner’s Contentions*

Patent Owner argues Petitioner fails to demonstrate that any challenged claim is unpatentable because, *inter alia*, the asserted references do not disclose either “providing a pulsed DC power to the target through a narrow band rejection filter” as recited in claim elements 2[c] or “providing an RF bias” at a frequency that “corresponds to the narrow band rejection filter” as recited in claim element 2[d]<sup>20</sup>. PO Resp. 39–46; PO Sur-reply 19–28. Patent Owner also argues Petitioner has not sufficiently shown a reason that one of ordinary skill in the art would have modified Barber’s system to add a narrow band-rejection filter. PO Resp. 48–69. For example, Patent Owner asserts that the “alleged general knowledge of filters’ benefits” is

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<sup>20</sup> Patent Owner also argues that Petitioner has not shown that the asserted art teaches the reconditioning step of claim element 2[f]. PO Resp. 46–48. We need not, and do not, reach Patent Owner’s arguments regarding claim element 2[f] to render this Decision.

“insufficient to establish that it would have been obvious to use filters in Barber’s process, let alone the claimed narrow band-rejection filter.” *Id.* at 48. Patent Owner also argues that use of a filter to decouple two *directly connected* power sources does not teach that decoupling two *remote* power sources would be beneficial. *See* PO Resp. 51–52; Ex. 2009 ¶ 144.

2. *Analysis*

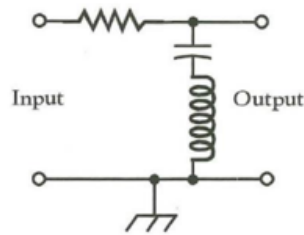
For the reasons that follow, we determine Petitioner has not shown that the combination of Barber and Hirose teaches or suggests “providing a pulsed DC power to the target through a narrow band rejection filter” as recited in claim element 2[c] or “providing an RF bias” at a frequency that “corresponds to the narrow band rejection filter” as required by claim element 2[d] and has not shown a reason to modify Barber and Hirose to arrive at these claim elements.

a) *Petitioner Fails to Show the Asserted Art Discloses or Suggests a Narrow Band-Rejection Filter as Recited in Claim Elements 2[c] and 2[d]*

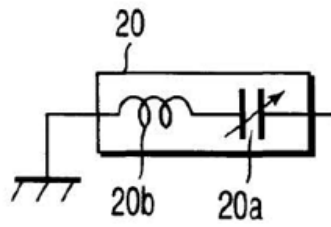
(1) *Hirose Does Not Teach a Narrow Band-Rejection Filter*

Upon review of the full record, we determine Petitioner’s contentions are insufficient to show that Hirose discloses or suggests a narrow band-rejection filter. Petitioner’s contentions that Hirose’s filters 20, 21 are narrow band-rejection filters are reproduced as follows:

A POSITA would have understood that *Hirose*’s filters are well-known **band-rejection filters**. (Ex. 1002, ¶¶81-82; Ex. 1006, 4:9-16; Ex. 1013, 4-6 (Figure 2-9(F) disclosing a filter similar to *Hirose*).)

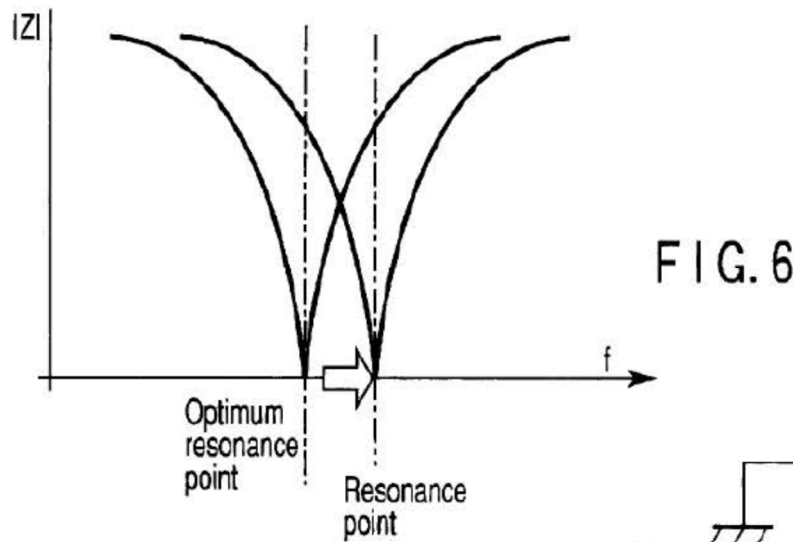


(Ex. 1013, Figure 2-9(F))



(Ex. 1006, Fig. 1 (excerpt))

(Ex. 1002, ¶¶81-82.) Additionally, *Hirose's* filter has a very narrow frequency response, as suggested by the V-shaped curve in Figure 6.



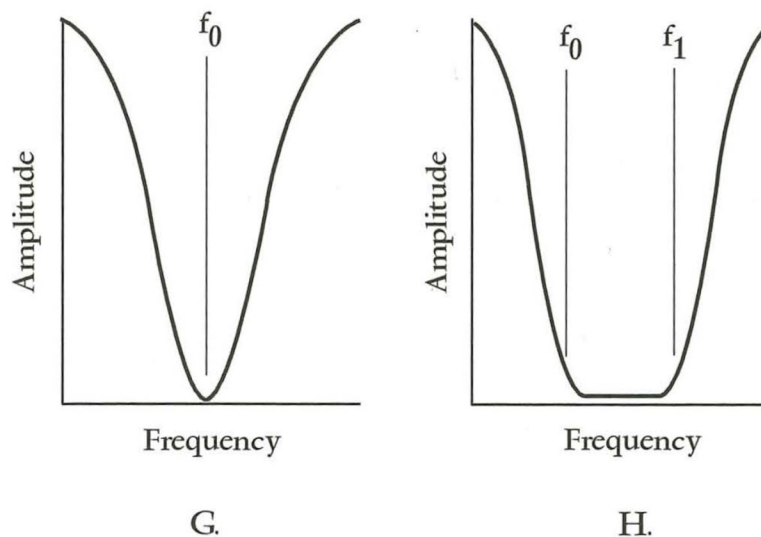
(Ex. 1006, FIG. 6.) Thus, a POSITA would have understood that *Hirose's* filter is tuned to reject a narrow band of frequency, which operates like a narrow band-rejection filter (aka notch filter) (*id.*, 5:7-10, 8:34-38). (Ex. 1002, ¶¶81-82; *compare* Ex. 1013, 5 at Fig. 2-9(G) (“sharp response . . . occurs at or near a single resonance frequency”) with Ex. 1006 (*Hirose*), Fig. 6).

Pet. 21-23 (emphasis in Petition; footnote omitted).

The record, however, does not support Petitioner's assertions that *Hirose's* V-shaped curve shown in Figure 6 *suggests* a very narrow frequency response and that a POSITA would have understood that *Hirose's* filter is “tuned to reject a narrow band of frequency,” which operates “like a

narrow band-rejection filter (aka notch filter).” Pet. 22–23. Petitioner’s expert, Dr. Subramanian, testified that the difference between a narrow band-rejection filter and a band-rejection filter depends on the relationship between the bandwidth and the center frequency. *See, e.g.*, Ex. 2030, 95:15–21 (explaining that the bandwidth is “much, much, much smaller than the center frequency”). There is inadequate evidence that the bandwidth of Hirose’s filter is sufficiently narrow to constitute a narrow band-rejection filter. Rather, the evidence of record shows that Hirose’s filter is a band-rejection filter, not a narrow band-rejection filter.

To support its contention that Hirose discloses or suggests a narrow band-rejection filter, Petitioner relies on Dr. Subramanian’s testimony, which analogizes Hirose’s Figure 6 curve to a curve depicted in Figure 2-9(G) of Gibilisco (Ex. 1013). Pet. 22–23; Ex. 1002 ¶¶ 81–82. Gibilisco’s Figure 2-9(G) and Figure 2-9(H) are reproduced below.



Figures 2-9G and H of Gibilisco show two types of band-rejection response: G shows a “sharp band-rejection response,” while H shows a “broad band-rejection response.” Ex. 1013, 9.

Petitioner's argument that Hirose discloses or suggests a narrow band-rejection filter is contained in this short portion of the Petition and relies on an inference that a V-shaped curve necessarily signifies a narrow band-rejection filter.

Any such inference that a V-shaped curve is sufficient to characterize a filter as a narrow band-rejection filter, however, is belied by Dr. Subramanian's own testimony. Indeed, Dr. Subramanian explains that the shape of a curve alone, including the shape of the curves of Figures 2-9(G) and (H) of Gibilisco, reproduced above, is *not sufficient* on its own to determine whether a filter corresponding to that curve is a narrow band-rejection filter or a broad band-rejection filter. *See, e.g.*, Ex. 2030, 69:13–18 (stating, just looking at the figure shown in 2-9(H), he could not tell if the figure corresponds to a narrow band-rejection filter because “I don't have enough information”).

Dr. Subramanian further testified that additional information beyond the mere shape of the curve is required to determine if the curve represents a narrow band-rejection filter; for example, Dr. Subramanian states that it was Gibilisco's characterization of Figure 2-9G as *having a sharp response* that led him to conclude it was a narrow band-rejection filter. *See* Ex. 2030, 68:20–69:4 (Dr. Subramanian testifying that he would not “characterize the figure depicted in G as a narrow band” based just on the figures, but “on all the information that's given,” which includes “this reference specifically [stating] at G, ‘sharp band rejection response’”); *see also id.* at 60:24–61:23, 61:6–63:11.

Significantly, Petitioner does not point to any statements in Hirose itself characterizing either the sharpness of its V-shaped curve or the

narrowness of its bandwidth to support its position that Hirose's filter is a narrow band-rejection filter. Instead, Petitioner merely asserts that the similarity of Hirose's Figure 6 curve to Gibilisco's Figure 2-9G curve *suggests* that Hirose's filter is a narrow band-rejection filter like the filter in Gibilisco. The only citations to the record to show a "sharp response," however, are to Gibilisco, not Hirose. *See* Pet. 21–23. We will not extrapolate such disclosures to Hirose.

Moreover, Petitioner's contention that Hirose discloses or teaches a narrow band-rejection filter is inconsistent with Dr. Subramanian's own declaration and deposition testimony that whether a filter is a narrow band-rejection filter or merely a band-rejection filter depends on the relationship of bandwidth to the center frequency of the filter. Dr. Subramanian states that "in general, narrow band-rejection filters will have bandwidths that are much, much, much smaller than the center frequency." Ex. 2030, 95:15–17. Dr. Subramanian explains that "if the bandwidth is in the same order of magnitude as the center frequency, that would not be considered a narrow band-rejection filter." *Id.* at 95:18–21. Dr. Subramanian further explains a filter corresponding to a center frequency of one megahertz and a bandwidth of hundreds of kilohertz, that such a filter "would not be considered a narrow band filter." Ex. 2030, 96:8–12; *see also id.* at 96:13–97:3 (stating that "barring the availability of some other information that would indicate otherwise" a center frequency of 1 megahertz and a bandwidth of 100 kilohertz would not be a narrow band-rejection filter); *see also id.* at 72:18–73:8 (testifying that whether a filter is narrow band or broad band does not depend only on attenuation ("the magnitude away from the center frequency versus at the center frequency") but also on the frequency response); *see*

*also* Ex. 1108 (Dr. Subramanian Rebuttal Dec.) ¶ 71 (stating that a POSITA would not consider a filter, corresponding to a 2 MHz center frequency and a bandwidth of approximately 2 MHz, to be a narrow band-rejection filter); *see also* Ex. 1108 ¶ 70 (describing a graph showing a bandwidth on the order of 2 MHz, which is the same order of magnitude as the center frequency of the filter, to be a “wide rejection bandwidth”); Ex. 2017, 355:18–24 (“assuming we had numbers on the axes [of Hirose’s Figure 6], we could calculate it, but without the numbers, I’m not even going to give you a specific number” for the bandwidth of the Hirose filter).

Also, although not directly on point, we look to cases indicating that we cannot infer dimensions or scale from a figure that does not explicitly provide the same. “[A]rguments based on drawings not explicitly made to scale in issued patents are unavailing.” *Nystrom v. TREX Co., Inc.*, 424 F.3d 1136, 1149 (Fed. Cir. 2005). The Federal Circuit has expressed its “disfavor in reading precise proportions into patent drawings which do not expressly provide such proportions.” *Id.* (citing *Hockerson-Halberstadt, Inc. v. Avia Group Int’l, Inc.*, 222 F.3d 951, 956 (Fed. Cir. 2000)). The written description can support an interpretation of a drawing’s disclosure, but “[a]bsent any written description in the specification of quantitative values, arguments based on measurement of a drawing are of little value.” *In re Wright*, 569 F.2d 1124, 1127 (CCPA 1977) (citing *In re Chitayat*, 408 F.2d 475 (CCPA 1969)).

Hirose’s Figure 6 does not provide any quantitative values indicating the relationship between the bandwidth and the center frequency of the curve depicted in the graph. *See* Ex. 2017, 355:18–24 (Dr. Subramanian testifying that “assuming we had numbers on the axes [of Hirose’s Figure 6], we could

calculate it, but without the numbers, I'm not even going to give you a specific number" for the bandwidth of the Hirose filter). Nor does Petitioner direct us to any other evidence regarding the relationship between the bandwidth and the center frequency of the graph shown in Hirose's Figure 6 sufficient for us to infer that Figure 6 depicts a narrow band-rejection filter. In sum, Petitioner's arguments for a narrow band-rejection filter depend on Hirose's Figure 6 having particular quantitative characteristics that are not supported by the written description of Hirose itself.

Petitioner also cites to portions of Hirose in support of its contention that Hirose's filter is "tuned to reject a narrow band of frequency, which operates like a narrow band-rejection filter." *See* Pet. 22 (citing Ex. 1006, 5:7–10, 8:34–38). Hirose, however, devotes very little discussion to its Figure 6, and the portions of Hirose cited by Petitioner merely discuss the filter's resonance point outside the context of Figure 6. Ex. 1006, 5:7–10, 8:34–38. Petitioner provides no explanation of how this resonance point argument relates to Figure 6, how Hirose's discussion of its filter's resonance point indicates that the filter's resonance point is a narrow band of frequency, or otherwise sufficiently explain how this disclosure shows Hirose's filter is a narrow band-rejection filter.

It is Petitioner's burden to demonstrate that the cited art teaches each limitation of the challenged claims and to show by a preponderance of the evidence that the claims are unpatentable. *See* 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d). This burden never shifts to Patent Owner. *See Dynamic Drinkware*, 800 F.3d 1378. Here, Petitioner does not sufficiently demonstrate that Hirose teaches or suggests a *narrow band-rejection filter* as recited in claim elements 2[c] and 2[d]. *See* Pet. 21–22.

*(2) Neither Barber nor Hirose Teach Providing Pulsed DC Power to a Target through any Type of Filter as Required by Claim Element 2[c] or Providing an RF Bias to the Substrate That Corresponds to the Narrow Band Rejection Filter as Required By Claim Element 2[d]*

In addition to not teaching a narrow band-rejection filter, Hirose's system does not disclose or suggest *providing pulsed DC power to a target* through a filter as required by claim element 2[c]. Hirose's filter is not connected to either a pulsed DC power source (because Hirose's filters are RF power supplies, not a pulsed DC power supply) or to a target (because no material is ejected from electrode 12 for deposition onto a substrate, and thus, electrode 12 cannot be a target). *See Ex. 1006.* As such, Hirose's filter, which is not placed between a pulsed DC power source and a target to reject an RF bias frequency, does not disclose a filter that meets the limitations recited in claim element 2[c]. Barber, which does disclose providing pulsed DC power to a target, does not teach providing that power through a filter, let alone a narrow band rejection filter. *See Ex. 1005.* Thus, neither Barber nor Hirose alone teach all of the limitations of claim element 2[c].

Similarly, neither Barber nor Hirose alone teach "providing an RF bias that corresponds to the narrow band rejection filter to the substrate" as recited in claim element 2[d]. Barber does not teach use of any filter and, thus, cannot teach providing an RF bias that *corresponds* to the narrow band rejection filter. Hirose does not teach providing an RF bias to a substrate.

Thus, Petitioner does not establish that either Hirose or Barber alone teach claim elements 2[c] or 2[d]. Because Petitioner does not rely solely on either Barber or Hirose for these limitations, but rather asserts that one

skilled in the art would have found it obvious to modify Barber's system to incorporate a narrow band-rejection filter (*see* Pet. 23–28), we now turn to whether Petitioner has met its burden to demonstrate that it would have been obvious to modify the teachings of Barber and Hirose to arrive at the invention recited in claim 2.

*b) Petitioner Does not Provide Sufficient Reason to Modify Barber to Either Provide Pulsed DC Power Through a Narrow Band-Rejection Filter or Providing an RF bias that Corresponds to the Narrow Band Rejection Filter*

*(1) Petitioner Has Not Sufficiently Shown a POSITA Would Have Added a Filter, Let Alone a Narrow Band-Rejection Filter, to Barber's System to Protect its DC Power Source*

Petitioner states a skilled artisan would have modified Barber's system to, *inter alia*, incorporate a narrow band-rejection filter to prevent Barber's RF power supply from “affecting” or “damaging” Barber's DC power supply 230 and to “minimize the filter's impact on [Barber's] pulsed-DC waveform (not significantly degrade the waveform signal through filtering).” Pet. 23–28.

Upon review of the full record, we determine Petitioner has not sufficiently shown that a skilled artisan would have had reason to modify the asserted art to arrive at the claimed invention.

First, Petitioner has not sufficiently shown that a skilled artisan would have used a filter, let alone a narrow band-rejection filter, to protect Barber's RF's power supply from affecting or damaging its DC power supply. *See, e.g.*, Pet. 23–25 (citing, *inter alia*, Ex. 1002 ¶¶ 83–84; Ex. 1005, Fig. 3; Ex. 1006, Fig. 1; Ex. 1015, 3; Ex. 1057, 1:16–34, 1:56–58; Ex. 1010, 9:23–34). Knowledge that a filter *can* be used to protect or isolate a power supply

or some other component from another power supply in various types of plasma systems is insufficient to show that a skilled artisan *would have been motivated* to use a narrow band-rejection filter in Barber's system to protect Barber's pulsed DC power source from its RF power supply. *See Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) (stating "obviousness concerns whether a skilled artisan not only could have made but would have been motivated to make the combinations or modifications of prior art to arrive at the claimed inventions").

Petitioner has not sufficiently shown that any of the alleged benefits of filters described in the prior art would be applicable to the system of Barber nor addressed any recognized problem with the system of Barber. Petitioner cites to a number of references (i.e., Licata (Ex. 1010), Joo (Ex. 1014), Celestino (Ex. 1016), Quon (Ex. 1017), Johnson (Ex. 1018), Hong (Ex. 1019), Ohmi (Ex. 1020), and Keller (Ex. 1021)) that use different types of filters in various plasma systems for the "known [] benefits of filters in plasma systems for blocking interference/current of one power supply from another." Pet. 25 (citing Ex. 1010, 6:40–41; Ex. 1014, 3, Fig. 1; Ex. 1016, 3:53–63; Ex. 1017, 16:20–29; Ex. 1018, 24:29–32; Ex. 1019, 6:60–62, 7:40–42; Ex. 1020, 2:61–3:6, 4:26–31; Ex. 1021, 7:66–8:2). Petitioner also asserts that a POSITA would have understood that choosing to reject a narrow band of frequencies, depending on the bandwidth of Barber's RF supply, would have been a known way to achieve "the benefits" of Hirose and known at the time. Pet. 24–25 (citing Ex. 1006, Figs. 1, 6; Ex. 1023 (Miller), 7:51–61; Ex. 1057 (Sill), 7:12–34; Ex. 1058 (Zennamo), 1:63–2:1; Ex 1010; Pet. § IX.G)

Petitioner, however, provides no adequate explanation as to how the plasma systems of any of these cited references relate to Barber's plasma system. *See* Pet. 24–25. Petitioner also fails to provide an adequate explanation as to why a skilled artisan would have understood that the benefits of using a filter in one of these systems would apply to Barber's system or identify any of the filters in these systems as a narrow band-rejection filter. *Id.*

Moreover, our review of these references indicates that the placement of filters in the disclosed systems do not support Petitioner's position, but rather support Patent Owner's argument that a POSITA would *not* have been motivated to provide a filter between Barber's pulsed DC power supply and the target. *See, e.g.,* PO Resp. 47–56 (explaining that the cited references do not suggest using a narrow band-rejection filter in series with a bipolar pulsed DC power supply to reject RF power); Ex. 2009 ¶ 144 (explaining that use of a filter to decouple two *directly connected* power sources does not show that it would be beneficial to decouple two *remote* power sources).

For example, Petitioner cites to Celestino as “isolating a 100 KHz power supply and a 13.56 MHz power supply to prevent damage” and as “disclosing a notch filter ‘intended to attenuate the 13.56 MHz’ signal.” Pet. 25 (citing Ex. 1016, 3:53–63, 4:20–27). In Celestino, however, the 100 KHz power supply and the 13.56 MHz power supply are *directly connected* as they are *connected to the same electrode*. Ex. 1016, Fig. 1, 3:21–25, 3:38–52; *see also* Ex. 2009 ¶¶ 143–44 (citing Ex. 1011). In contrast, the DC power source of Barber's system is connected to one electrode (the target) while the RF power source is connected to a separate electrode (the substrate) and the two power sources are not directly connected. Petitioner

does not adequately address this difference nor explain why a POSITA would have found the methods used on a single electrode to be applicable to Barber's multi-electrode arrangement.

Petitioner also cites to Hong as teaching an “RF blocking filter” to mitigate RF current flowing to a DC source.” Pet. 25 (citing Ex. 1019, 6:60–62, 7:40–42). Figure 1 of Hong is reproduced below.

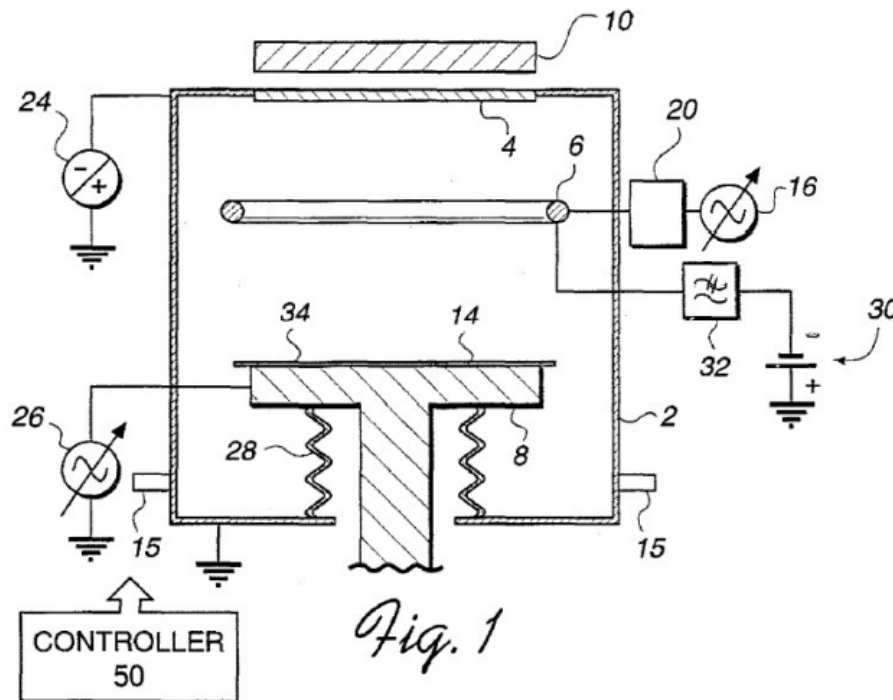


Figure 1 of Hong depicts a deposition apparatus having RF power supply 16 and DC voltage source 30 connected to coil 6 and RF blocking filter 32 connected between coil 6 and DC voltage source 30. Ex. 1019, 6:55–60. Also shown is AC voltage source 26, which provides a bias on target 6 and DC power source 24 which provides a bias on substrate 14. See Ex. 1019, 5:46–59.

In Hong, however, the filter (low-pass filter 32) is used in connection with DC power source 30 and AC power source 16, *both of which are connected to coil 6*. See Ex. 1019, Fig. 1, 6:58–62, 7:3–6. This is unlike the system in

Barber, in which the output of the DC power source is not directly connected to the output of the RF power source.

Moreover, Hong also discloses *another* DC power source (24), which is connected to target 4 and *remote* from RF power source 26. Ex. 1019, Fig. 1. Notably, *Hong does not disclose use of a filter to protect DC power source 24 from remote RF power source 16*. In other words, Hong teaches using a filter to protect DC power source 30 that is *directly connected* to an AC power source 16, but *does not use a filter to protect* DC power source 24 from remote RF power source 26. See Ex. 2009 ¶ 152. Thus, contrary to Petitioner’s assertions, Hong suggests that a filter is *not required* in a system in which the DC power source is remote from an RF power source.

We agree with Dr. Glew’s testimony that Hong, like Barber, does not suggest that a filter is required to protect a DC power source applied to a target from an RF power source applied to substrate. Ex. 2009 ¶ 152. We further agree that, rather than supporting Petitioner’s position, Hong supports Patent Owner’s position that at the time of the invention, one of ordinary skill in the art would not have thought that RF coupling into a remote pulsed DC power source was a concern or that it would have been desirable to place a filter between the DC power source and the substrate. *Id.* ¶ 153.

We also determine that Petitioner’s contention that one skilled in the art knew of “use and benefits of filters” to block interference/current from one power supply from another and Petitioner’s remaining citations to Licata (Ex. 1010), Joo (Ex. 1014), Quon (Ex. 1017), Johnson (Ex. 1018), Ohmi (Ex. 1020), and Keller (Ex. 1021) do not sufficiently explain how such teachings would have led a skilled artisan to incorporate a narrow band-

rejection filter into Barber's system. *See* Pet. 25 (citing Ex. 1010, 6:40–41; Ex. 1014, 3, Fig. 1; Ex. 1017, 16:20–29; Ex. 1018, 24:29–32; Ex. 1020, 2:61–3:6, 4:26–31; Ex. 1021, 7:66–8:2; Ex. 1002 ¶¶ 90–91). We credit Dr. Glew's testimony as to the differences between these systems and Barber and that these references do not discuss use of a narrow band-rejection filter. *See, e.g.*, 2009 ¶¶ 107, 148–149, 153–158. For example, Dr. Glew persuasively explains that unlike Barber, Licata does not suggest its DC power results in alternating positive and negative voltages on the target because the reactive gas in Licata reacts directly on the substrate, not the target and, further, that Licata provides no details about the RF filter's characteristics. *Id.* ¶107. We also credit Dr. Glew's testimony that Quon, Johnson, and Ohmi only involve RF, not DC, power supplies. *Id.* ¶¶ 148–149, 153–154; *see also id.* ¶ 149 (stating that the purpose of Johnson's filter is to keep high power signal out of a film thickness measurement circuit, not to protect a pulsed DC power source, and nothing suggests the filter is a narrow band-rejection filter), ¶¶ 153–154 (stating there is no suggestion that Ohmi's band rejection filters are narrow band rejection filters, that the band rejection filters are used with RF power sources, not DC power sources as required by claim 2, and the DC power supplies are connected to low pass filters). We also credit Dr. Glew's testimony that there is no pulsed DC power supply or target in Keller, that Keller's filter is used to filter signals from an RF source that would otherwise couple *directly* into the signal processing unit, and Keller does not suggest using a narrow band-rejection filter. *Id.* ¶¶ 155–158.

Petitioner also cites to Miller (Ex. 1023), Sill (Ex. 1057), and Zennamo (Ex. 1058) as support that a skilled artisan would have understood

that choosing to reject a specific frequency, or a narrow band of frequencies, was a known way to achieve the benefits of Hirose. *See* Pet. 24 (citing Pet. § IX.G (pp. 57–60) (addressing dependent claim 20 which further requires the narrow band-rejection filter of claim 2 to have a bandwidth of about 100 kHz); Ex. 1023, 7:51–61; Ex. 1057, 1:16–34, 1:56–58, 4:24–28, 5:17–21, 5:48–60, 5:61–6:12, 7:23–34, Fig. 6; Ex. 1058, 1:63–2:1; Ex. 1002 ¶ 166)). Petitioner, however, does not sufficiently explain how the systems of Miller, Sill, or Zennamo relate to Barber’s system. *See* Pet. 24, 57–60. We credit Dr. Glew’s testimony that filters in both Miller and Sill block frequency from a power source to which they are connected and do not speak to the need to filter frequencies from a remote power source. *See, e.g.*, 2009 ¶¶ 110–114, 134–137. We further credit Dr. Glew’s testimony that Zennamo suggests tuning a notch filter in the context of telecommunications signals, not high power delivery such as that used in Barber. Ex. 2009 ¶¶ 134–140. Petitioner does not persuasively explain how the teachings of Miller, Sill, or Zennamo would have led a POSITA to add a narrow band-rejection filter to Barber’s plasma processing system.

We further credit Dr. Glew’s testimony that reactor/processing systems are complex, that a skilled artisan would not treat components of the reactor systems as modular pieces to be added or removed at will, and that what is suitable for one system is often not suitable for another system. *Id.* ¶ 63.

As such, Petitioner has not sufficiently addressed the differences between the various prior art systems in which a filter was used and Barber’s system nor persuasively explained how the use of a filter in these systems

would lead one skilled in the art to use a filter, let alone a narrow band-rejection filter, in the Barber system as recited in claim 2.

*(2) Petitioner Has Not Sufficiently Shown that AE Manuals Would Have Guided a POSITA to Add an AC Blocking Filter, Let Alone a Narrow Band-Rejection Filter, to Barber's System to Protect its DC Power Source*

In addition to the references discussed above, Petitioner also relies on various manuals<sup>21</sup> by Advanced Energy, Inc. (“AE”), the manufacturer of the pulsed DC power supply identified in the ’657 patent, stating the manuals “had been guiding POSITAs since early 1990s that ‘[y]ou must place an ac blocking filter in series with the output of the dc power supply if . . . us[ing] a dc power supply in combination with an ac power supply . . .’” because 13.56 MHz can damage the typical dc magnetron power supply. Pet. 25–27 (emphases added by petitioner omitted) (quoting Ex. 1025, 23), 26–27 (citing Ex. 1025 (1993 manual), Fig. 1-5; Ex. 1026, 116 (May 2000 manual); Ex. 1062, 134 (2001 manual); Ex. 1067 (2002 manual), 141; Ex. 1024 (Pinnacle Plus March 2005), 151; Ex. 1002 ¶¶ 91–96); 10–11 (citing Ex. 1025, Figure 1-5 illustrating the need for an RF filter in systems similar to Barber).

We disagree with Petitioner that the AE manuals would have guided a POSITA to use a filter, let alone a narrow band-rejection filter, in Barber’s system in which the RF power supply is *remote* from the DC power supply. Rather, we agree with Patent Owner, supported by the testimony of Dr.

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<sup>21</sup> In addition to the manuals, Petitioner also cites to a 1999 data sheet (Ex. 1065, 2) and a Securities and Exchange Commission Form 10-K 2000 (Ex. 1066, 7). *See* Pet. 25–26. Neither of these references, however, discuss use of filters in connection with AE systems.

Glew, that a POSITA would have understood that warnings in the AE manuals refer to a configuration in which RF power is applied directly to the output of the DC power supply, such as when DC and RF power are applied *to the same electrode*, a situation not present in Barber. PO Resp. 56–57; Ex. 2009 ¶¶ 166–167. In particular, we credit Dr. Glew’s testimony that the same language recited in four of these manuals (i.e., “Do not apply RF power *directly* to the output of the Pinnacle Plus+ unit. Damage to the Pinnacle Plus+ unit could result.”) refers to a configuration in which the DC power source and the RF power source are *directly* connected, i.e., the DC and RF power are applied to the same electrode. Ex. 2009 ¶ 166 (citing Ex. 1026, 116; Ex. 1062, 134; Ex. 1067, 141; Ex. 1024, 151). Barber, however, does not have a direct connection between the RF power source and the DC power source. Rather, DC power is applied to the target and RF power is applied to the substrate, and there is no direct connection between the target and the substrate.

With respect to the 1993 manual (Ex. 1025), Petitioner asserts that Figure 1-5 shows a filter connected to the DC power source when the RF power source is not directly connected. Pet. 10–11. Figure 1-5, however, illustrates two configurations, one of which shows the RF power supply directly connected to the DC power supply. Ex. 1025, Fig. 1-5. Dr. Glew persuasively explains that the RF filter shown in Figure 1-5 remains in place in either configuration. Ex. 2009 ¶ 20.

Thus, while the AE manuals may show that a filter should be used when an AE DC power source is in direct connection with an RF power source, Petitioner has not sufficiently demonstrated that these manuals show that a filter should be used to protect a power source in a system like Barber

in which the RF and DC power source are not in direct connection, let alone use of a narrow band-rejection filter.

Additionally, none of the AE manuals disclose a narrow band-rejection filter; even Dr. Subramanian testified that a POSITA would “not be able to determine from the disclosures in those AE manual[s] what specific type of filter is described in those manuals” and that the “RF filter described in the AE[] manuals could encompass any type of filter that would provide the necessary blocking of the RF power to the DC supply unit.” Ex. 1108 ¶ 31.

Petitioner and Dr. Subramanian also cite to Belkind (Ex. 1008), Sproul (Ex. 1011), and Kelly (Ex. 1048) to support their contention that a POSITA would have “consider[ed] such design concepts/guidance” (Pet. 27) or known of the “design constraints and cautions” (Ex. 1002 ¶ 98) associated with known DC power systems, including power supplies from Advanced Energy, Inc. See Pet. 27 and Ex. 1002 ¶ 98 (citing *inter alia*, Ex. 1001, 5:46–48; Ex. 1008 (Belkind), 1; Ex. 1011 (Sproul), 6:7–11; Ex. 1048 (Kelly), 2–3, Table 1). Other than the challenged patent, however, none of these references use a filter to protect a pulsed DC power supply from a remote RF power source. See Ex. 1008 (Belkind), 1 (no mention of any filter to protect the DC power source from an RF power source); Ex. 1011 (Sproul), 6:7–11 (no filter between DC power source 32 and target to protect power source 32 from RF power source 50); Ex. 1048 (Kelly), 2–3, Table 1 (no disclosure of a filter used with the pulsed DC power source to reject the RF power). Again, generalized assertions that filters have been used in certain plasma systems to block power does not sufficiently support that a filter would have been needed or useful in Barber’s system to block power

from Barber's RF power supply from reaching its DC power supply. *See* Pet. 35; Ex. 1002 ¶¶ 90–91.

*(3) Petitioner Has Not Sufficiently Shown a POSITA Would Have Added a Narrow Band-Rejection Filter to Prevent Waveform Distortion in Barber*

Petitioner also asserts that a POSITA would have added a narrow band-rejection filter to prevent distortion to Barber's DC waveform because a narrow band-rejection filter was "a known type of filter used to suppress parasitic signals or to reduce interference" and that "design concepts would have guided a POSITA to configure such a filter in the *Barber-Hirose* system to block the appropriate RF frequency corresponding to selected RF supply 235." Pet. 24 (citing Ex. 1002 ¶¶ 86–89; Ex. 1006 (Hirose), 5:7–10, 8:34–38; Ex. 1013 (Gibilisco), 5–6). Petitioner further asserts that a POSITA would have understood that choosing to reject specific frequencies depending on the bandwidth of RF supply 235 in Barber's system would have been a known way to achieve the benefits of Hirose and known at the time (Pet. 24), including "to reduce interference so that a stable waveform is provided to achieve optimal film deposition" (Pet. 28). *See also* Pet. 24–28.

Based on a review of the full record, we are not persuaded by Petitioner's arguments.

First, other than pointing to the '657 patent itself, Petitioner has not cited to any reference, nor otherwise provided sufficient evidence, of any impact that a narrow band-rejection filter would have on a pulsed-DC waveform in a plasma processing system. It is well settled that the insight of an inventor does not support obviousness. *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983) (cautioning against the

“insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher”). *See W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983) (cautioning against the “insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher”).

Petitioner relies on Hirose to show use of a filter in a plasma processing system to prevent waveform distortion. *See, e.g.*, Pet. 21. However, the waveform in Hirose is an RF waveform, not a DC waveform. Petitioner has not sufficiently shown that Hirose’s teaching to use a filter to protect an RF waveform would be applicable to protecting the DC waveform in Barber, or that a POSITA would have understood the same. *See* Pet. 21; Ex. 1002 ¶ 80 (stating that Hirose shows the RF voltage waveform is distorted when the filter is removed).

Petitioner also cites to Gibilisco, which provides general information about filters in the context of radio and wireless technology. Pet. 24 (citing Ex. 1013, 5–6; Ex. 1002 ¶¶ 86–87). This reference, however, does not address the use of filters in plasma processing systems, and Petitioner does not persuasively explain why a POSITA would have considered its general teachings about narrow band-rejection filters in the context of radio and wireless technology to suggest using a narrow band-rejection filter to protect the pulsed DC waveform in Barber.

We agree with Dr. Glew that Barber “discloses that it supposedly already has a way to optimize its process, including a way to supposedly stabilize its waveform via adjustment of the power supply frequency.” Ex. 2009 ¶ 179 (citing Ex. 1005, Figure 5, 7:59–60, 8:66–9:2, 9:42–45). Petitioner has not shown that a POSITA would have understood that an

*additional* mechanism for improving the stability of Barber's waveform would have been necessary or even beneficial.

*c) Conclusion - Claim 2*

For the foregoing reasons, Petitioner does not show by a preponderance of the evidence that claim 2 would have been obvious over the combined teachings of Barber and Hirose.

*3. Dependent Claims 3, 4, 6, 8, 10–12, and 21*

Claims 3, 4, 6, 8, 10–12, and 21 depend from claim 2. None of Petitioner's arguments regarding these claims remedy the deficiencies discussed above. *See* Pet. 34–41. As such, Petitioner does not show by a preponderance of the evidence that claims 3–4, 6, 8, 10–12, and 21 would have been obvious over the combined teachings of Barber and Hirose.

*F. Remaining Grounds*

Petitioner challenges independent claim 1 in Ground 8, relying on Sellers to address limitations in independent claim 1 that are not found in independent claim 2. Pet. 60–67. In Grounds 2–7, Petitioner relies on various references to teach various limitations found in certain dependent claims 2–21. Pet. 41–67. In Grounds 9–16, Petitioner further relies on the teachings of Belkind to satisfy any deficiencies in Barber relating to the limitations in claims 1 and 2 that require providing pulsed DC power to the target such that the target alternates between positive and negative voltages. Pet. 67–73.

None of the remaining grounds, or the prior art references relied on therein, remedy the deficiencies discussed above. Accordingly, Petitioner has not shown by a preponderance of the evidence that any of the challenged claims would have been obvious under Grounds 2–16.

## CONCLUSION

For the foregoing reasons, we determine that Petitioner has not shown by a preponderance of the evidence that claims 1–21 are unpatentable.

In summary:

<b>Claim(s)</b>	<b>35 U.S.C. §</b>	<b>References/Basis</b>	<b>Claims Shown Unpatentable</b>	<b>Claim(s) Not shown Unpatentable</b>
2–4, 6, 8, 10–12, 21	103(a)	Barber, Hirose		2–4, 6, 8, 10– 12, 21
5, 7	103(a)	Barber, Hirose, Dogheche		5, 7
9	103(a)	Barber, Hirose, Safi		9
12, 13	103(a)	Barber, Hirose, Aokura		12, 13
14–18	103(a)	Barber, Hirose, Segal		14–18
19	103(a)	Barber, Hirose, Segal, Sakawaki		19
20	103(a)	Barber, Hirose, Sill		20
1	103(a)	Barber, Hirose, Sellers		1
2–4, 6, 8, 10, 11, 12, 21	103(a)	Barber, Hirose, Belkind		2–4, 6, 8, 10, 11, 12, 21
5, 7	103(a)	Barber, Hirose, Belkind, Dogheche		5, 7
9	103(a)	Barber, Hirose, Belkind, Safi		9
12, 13	103(a)	Barber, Hirose, Belkind, Aokura		12, 13
14–18	103(a)	Barber, Hirose, Belkind, Segal		14–18
19	103(a)	Barber, Hirose, Belkind, Segal, Sakawaki		19

20	103(a)	Barber, Hirose, Belkind, Sill		20
1	103(a)	Barber, Hirose, Belkind, Sellers		1
<b>Overall Outcome</b>				1–21

ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1–21 of U.S. Patent No. 7,381,657 B2 have not been shown to be unpatentable; and

FURTHER ORDERED that, because this is a final written decision, parties to this proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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