Filed on behalf of Western Digital Technologies, Inc.
By: Michelle E. Armond
Douglas R. Wilson
Josepher Li
Monica Arnold
ARMOND WILSON LLP
4685 MacArthur Court, Suite 390
Newport Beach, CA 92660
Telephone: (949) 932-0778
Email: ipr@armondwilson.com

UNITED STATES PATENT AND TRADEMARK OFFICE

---

**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

---

WESTERN DIGITAL TECHNOLOGIES, INC.,
Petitioner,

v.

GODO KAISHA IP BRIDGE 1,
Patent Owner.

---

Case No. IPR2024-01447
U.S. Patent No. 8,405,134

---

# PETITIONER'S NOTICE OF APPEAL

Pursuant to 35 U.S.C. §§ 141(c), 142, and 319 and 37 C.F.R. § 90.2(a), Petitioner Western Digital Technologies, Inc. hereby provides notice of appeal to the United States Court of Appeals for the Federal Circuit from the Final Written Decision of the Patent Trial and Appeal Board entered on March 27, 2026 (Paper 53) ("Final Written Decision"), the Director Review Decision entered on July 21, 2026 (Paper 56), and from all underlying orders, decisions, rulings, and opinions relating to the *inter partes* review of U.S. Patent No. 8,405,134 ("'134 Patent") in Case No. IPR2024-01447. This Notice is timely under 37 C.F.R. § 90.3(a)(1), having been filed no later than sixty-three (63) days after issuance of the Director Review Decision. A copy of the Final Written Decision and Director Review Decision is attached hereto as Exhibits 1 and 2.

In accordance with 37 C.F.R. § 90.2(a)(3)(ii), Petitioner states that the issues on appeal include, but are not limited to:

- The determination that claims of the '134 Patent have not been shown unpatentable under 35 U.S.C. § 103, and any finding or determination supporting or relating to that determination; and
- All other issues decided adversely to Petitioner in any orders, decisions, rulings, and opinions.

Pursuant to 35 U.S.C. § 142 and 37 C.F.R. § 90.2(a)(1), this Notice is being filed with the Director of the United States Patent and Trademark Office, and a copy

of this Notice is being filed concurrently with the Board. In addition, a copy of this Notice and the required docketing fees are being filed with the Clerk's Office for the United States Court of Appeals for the Federal Circuit via CM/ECF in accordance with 37 C.F.R. § 90.2(a)(2), Federal Rule of Appellate Procedure 15, and Federal Circuit Rule 15.

ARMOND WILSON LLP

Dated: July 22, 2026

By: /Michelle E. Armond/
Michelle E. Armond (Reg. No. 53,954)
Douglas R. Wilson (Reg. No. 54,542)
Josepher Li (Reg. No. 74,998)
Monica Arnold (Reg. No. 77,262)
Attorneys for Western Digital Technologies, Inc.

**CERTIFICATE OF SERVICE**

I hereby certify that on July 22, 2026, in addition to being filed and served electronically through the Patent Trial and Appeal Board's P-TACTS System, the foregoing **PETITIONER'S NOTICE OF APPEAL** was filed with and served on the Director of the United States Patent and Trademark Office via e-mail at the following:

Office of the General Counsel
U.S. Patent and Trademark Office
efileSO@uspto.gov

I also hereby certify that on July 22, 2026, the foregoing **PETITIONER'S NOTICE OF APPEAL** and the requisite docketing fees were filed with the Clerk's Office of the United States Court of Appeals for the Federal Circuit via CM/ECF.

I further hereby certify that on July 22, 2026, the foregoing **PETITIONER'S NOTICE OF APPEAL** was served by electronic mail on the following counsel for Patent Owner:

Gerald B. Hrycyszyn
GHrycyszyn-PTAB@wolfgreenfield.com

Jie Xiang
JXiang-PTAB@wolfgreenfield.com

Thomas A. Franklin
TFranklin-PTAB@wolfgreenfield.com

Richard F. Giunta
RGiunta-PTAB@wolfgreenfield.com

Adam R. Wichman
AWichman-PTAB@wolfgreenfield.com

Scott A. McKeown
SMcKeown-PTAB@wolfgreenfield.com

ARMOND WILSON LLP

Dated: July 22, 2026

By: /Michelle E. Armond/
Michelle E. Armond (Reg. No. 53,954)
Douglas R. Wilson (Reg. No. 54,542)
Josepher Li (Reg. No. 74,998)
Monica Arnold (Reg. No. 77,262)
Attorneys for Western Digital Technologies, Inc.

# EXHIBIT 1

Trials@uspto.gov
571-272-7822

Paper: 53
Entered: March 27, 2026

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

WESTERN DIGITAL TECHNOLOGIES, INC.,
Petitioner,

v.

GODO KAISHA IP BRIDGE 1,
Patent Owner.

---

IPR2024-01447
Patent 8,405,134 B2

---

Before JUSTIN T. ARBES, SHEILA F. McSHANE, and JOHN D. HAMANN, *Administrative Patent Judges*.

McSHANE, *Administrative Patent Judge*.

# JUDGMENT
Determining Some Challenged Claims Unpatentable
Denying Petitioner's Motion to Strike
Denying Patent Owner's Motion to Strike
Denying Patent Owner's Motion to Exclude
*35 U.S.C. § 318(a); 37 C.F.R. § 42.5; 37 C.F.R. § 42.64(c)*

# I. INTRODUCTION

## *A. Background*

Western Digital Technologies, Inc. ("Petitioner") filed a Petition for *inter partes* review of claims 1–4 of U.S. Patent No. 8,405,134 B2 (Ex. 1005, "the '134 patent"), along with the Declaration of Jeffrey Bokor, Ph.D. Paper 1 ("Pet."); Ex. 1024. Godo Kaisha IP Bridge 1 ("Patent Owner") filed a Preliminary Response. Paper 8 ("Prelim. Resp.").

On April 21, 2025, the Board instituted an *inter partes* review of the challenged claims pursuant to 35 U.S.C. § 314. Paper 10 ("Dec.").

After institution, Patent Owner filed a Patent Owner Response (Paper 19, "PO Resp."), along with the Declaration of Caroline A. Ross, Ph.D. (Ex. 2053). Petitioner filed a Reply (Paper 25, "Pet. Reply"), along with the Reply Declaration of Dr. Bokor (Ex. 1105), and Patent Owner filed a Sur-reply (Paper 32, "PO Sur-reply").

Pursuant to the Board's authorization, Patent Owner filed a Motion to Strike (Paper 31, "PO Mot. Strike"), Petitioner filed an Opposition to the Motion to Strike (Paper 35, "Pet. Opp. Mot. Strike"), and Patent Owner filed a Reply (Paper 37, "PO Reply Mot. Strike"), in support of the Motion. Pursuant to the Board's authorization, Petitioner filed a Motion to Strike (Paper 36, "Pet. Mot. Strike"), Patent Owner filed an Opposition to the Motion to Strike (Paper 41, "PO Opp. Mot. Strike"), and Petitioner filed a Reply (Paper 43, "Pet. Reply Mot. Strike"), in support of the Motion. Patent Owner filed a Motion to Exclude (Paper 44, "PO Mot. Excl."), with Petitioner filing an Opposition (Paper 45, "Pet. Opp. Mot. Excl."), and Patent Owner filing a Reply to the Opposition (Paper 46).

The parties presented oral arguments at a hearing on January 23, 2025, and a transcript of it has been entered into the record (Paper 52, "Tr.").

For the reasons set forth in this Final Written Decision pursuant to 35 U.S.C. § 318(a), we determine that Petitioner has demonstrated, by a preponderance of the evidence, that claims 1 and 2 of the '134 patent are unpatentable and has not demonstrated, by a preponderance of the evidence, that claims 3 and 4 of the '134 patent are unpatentable.

*B. Real Party in Interest*

Petitioner identifies itself, Western Digital Technologies, Inc., and its related entity Western Digital Corporation, as the real parties in interest. Pet. 71. Patent Owner identifies itself, Godo Kaisha IP Bridge 1, as the sole real party in-interest. Paper 4 (Patent Owner Mandatory Notices), 1.

*C. Related Matters*

The parties indicate this Petition is related to the district court litigation, *Godo Kaisha IP Bridge 1 v. Western Digital Technologies, Inc.,* No. 3:24-cv-06555-RS (N.D. Cal.); and *Godo Kaisha IP Bridge 1 v. Seagate Technology LLC*, No. 24-cv-3691 (D. Minn.), both transferred from the District of Delaware. Paper 5, 1; Paper 9, 2.

*D. The '134 Patent (Ex. 1005)*

The '134 patent is titled "Magnetic Tunnel Junction Device," and issued on March 26, 2013, from an application filed February 20, 2012, claiming priority to a US application filed September 8, 2006. Ex. 1005, codes (22), (45), (54), (63). The patent also claims priority from Japanese Application Nos. 2004-071186 and 2004-313350 filed March 12, 2004, and October 28, 2004, respectively. *Id.* at code (30).

The Specification of the '134 patent states that it "relates to a magnetic tunnel junction device and a method of manufacturing the same, particularly to a magnetic tunnel junction device with a high magnetoresistance." Ex. 1005, 1:23–26.

The '134 patent describes that "[m]agnetoresistive random access memories (MRAMs) refer to a large-scale integrated memory circuit that is expected to replace the currently widely used DRAM memories." Ex. 1005, 1:28–31. The patent further explains that "a MTJ [magnetic tunnel junction] device comprises a tunnelling junction structure in which a tunnel barrier (to be hereafter also referred to as a 'barrier layer') made of an oxide is sandwiched between a first and a second electrode made of a ferromagnetic metal." *Id.* at 1:38–42. An object of the patent is stated as "to increase the output voltage of a MTJ device." *Id.* at 2:47–48.

According to the patent, "the MTJ device structure of the present embodiment comprises a first Fe (001) layer 1, a second Fe (001) layer 5, and a single-crystalline MgOx (001) layer 3 or a poly-crystalline MgOx (0<x<l) layer 3 sandwiched there between, the polycrystalline layer having the (001) crystal plane preferentially oriented therein." Ex. 1005, 5:27–33. This structure is shown in Figure 1(B), reproduced below.

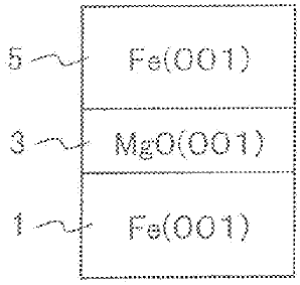



Figure 1(B), above, illustrates the structure of a MTJ device with first Fe (001) layer 1, a second Fe (001) layer 5, and a single-crystalline $MgO_x$ (001) layer 3. Ex. 1005, 5:27–33.

The '134 patent discloses a variation of the structure shown in Figure 1(B), as shown in Figure 11, reproduced below.

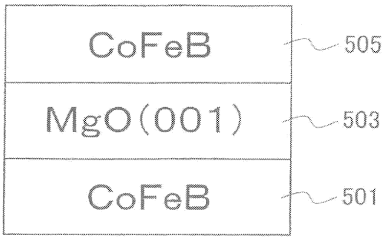



Figure 11, above, shows an MTJ device where "the electrodes disposed on either side of a single-crystal $MgO_x$ (001) layer 503 or an oxygen deficit poly-crystal $MgO_x$ ($0<x<1$) in which the (001) crystal plane is preferentially oriented comprises an amorphous ferromagnetic alloy, such as CoFeB layers 501 and 505." Ex. 1005, 8:60–66.

*E. Illustrative Claim*

Petitioner challenges claims 1–4 of the '134 patent. Claims 1 and 3 are independent. Claim 1 is reproduced below with bracketed designations added to limitations for reference purposes.

> 1[pre] A magnetoresistive device having a tunnel barrier junction structure, the magnetoresistive device comprising:
>
> 1[a] a first ferromagnetic material layer deposited on a

substrate;

1[b] a second ferromagnetic material layer; and

1[c] a tunnel barrier layer located between the first and second ferromagnetic material layers, and

1[d] wherein said tunnel barrier layer comprises a single-crystalline magnesium oxide in which (001) crystal plane is preferentially oriented or a poly-crystalline magnesium oxide in which (001) crystal plane is preferentially oriented, and

1[e] at least said first ferromagnetic material layer is crystallized and comprises CoFeB alloy.

Ex. 1005, 10:2–14.

*F. Asserted Grounds of Unpatentability*

Petitioner asserts that claims 1–4 are unpatentable based on the following grounds:

| Claim(s) Challenged | 35 U.S.C § | Reference(s)/Basis |
|---|---|---|
| 1–4 | 103(a)[1] | Bowen,[2] Sunai[3] |
| 1–4 | 103(a) | Bowen, Parkin[4] |

[1] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. § 103, and was effective on March 16, 2013. Because the '134 patent has an effective filing date prior to the effective date of the applicable AIA amendment, we refer to the pre-AIA version of 35 U.S.C. § 103.
[2] M. Bowen, "Large magnetoresistance in Fe/MgO/FeCo(001) epitaxial tunnel junctions on GaAs(001)," Appl. Phys. Lett., Vol. 79, No. 11, 1655–1657 (2001) (Ex. 1026, "Bowen").
[3] JP 2002/204004 A, published July 19, 2002 (Ex. 1030, "Sunai") (certified translation of the original in Ex. 1029).
[4] Parkin, US 7,270,896 B2, issued September 18, 2007 (Ex. 1062, "Parkin").

| Claim(s) Challenged | 35 U.S.C § | Reference(s)/Basis |
|---|---|---|
| 1–4 | 103(a) | Nagahama,[5] Sunai |
| 1–4 | 103(a) | Nagahama, Parkin |

Pet. 25.

## II. ANALYSIS

### *A. Level of Ordinary Skill in the Art*

Relying on the testimony of Dr. Bokor, Petitioner proposes that a person of ordinary skill in the art at the time of invention of the '134 patent would have had "a Ph.D. in electrical engineering, physics, materials science, or a related field, and at least one year of experience in the research, design, and/or development of magnetic/spintronic devices, or the equivalent," or "a Master's degree in electrical engineering, physics, materials science, or a related field, and four years of experience in the research, design, and/or development of magnetic/spintronic devices, or the equivalent." Pet. 27–28 (citing Ex. 1024 ¶ 25).

In the Preliminary Response, Patent Owner did "not challenge Petitioner's [person of ordinary skill in the art (POSA)] definition." Prelim. Resp. 23. Patent Owner did not present any arguments on the qualifications of one of ordinary skill in the art in its Response. *See generally* PO Resp.

In determining the level of ordinary skill in the art, various factors may be considered, including the "type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are

[5] Nagahama, EP 1391942 A1, published February 25, 2004 (Ex. 1027, "Nagahama").

made; sophistication of the technology; and educational level of active workers in the field." *In re GPAC Inc*., 57 F.3d 1573, 1579 (Fed. Cir. 1995) (citation omitted). The level of ordinary skill in the art is also reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). Consistent with the Institution Decision (Dec. 7), we adopt the assessment offered by Petitioner as it is consistent with the '134 patent and the asserted prior art.

Patent Owner does not dispute that Dr. Bokor is qualified as a person of ordinary skill in the art in accordance with the assessment adopted. *See* Tr. 90:9–15. Patent Owner, however, questions Dr. Bokor's knowledge on the formation of crystalline materials and seeks to exclude his related testimony. *See* PO Resp. 1–2, 27; PO Mot. Excl. 12–15. We address this issue *infra* Section V.

*B. Claim Construction*

In this *inter partes* review, claims are construed using the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2024). Under the principles set forth by our reviewing court, the "words of a claim 'are generally given their ordinary and customary meaning,'" as would be understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp*., 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting *Vitronics Corp. v. Conceptronic, Inc*., 90 F.3d 1576, 1582 (Fed. Cir. 1996)). "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek,*

*Inc*., 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

Petitioner "submits the claim terms should be given their plain and ordinary meaning and no claim construction is necessary to find the claims unpatentable." Pet. 24. Patent Owner does not raise any claim construction issues in its Response. *See generally* PO Resp.

We determine that we need not expressly construe any claim terms to resolve the parties' disputes. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co*., 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("[W]e need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.,* 200 F.3d 795, 803 (Fed. Cir. 1999))).

*C. Principles of Law*

A patent claim is unpatentable under 35 U.S.C. § 103 if "the differences between the [claimed] subject matter . . . and the prior art are such that the [claimed] 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." 35 U.S.C. § 103(a) (2011); *see also 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 ordinary skill in the art; and (4) when in evidence, objective indicia of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

*D. Asserted Obviousness of Claims 1–4 over Bowen and Parkin*

Petitioner contends that claims 1–4 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Bowen and Parkin. Pet. 28–49. In support, Petitioner also relies upon the Bokor Declaration and Reply Declaration. Ex. 1024; Ex. 1105. Patent Owner argues that the prior art does not teach that the modified magnetic tunnel junction device would have had a crystalline magnesium oxide layer with 001 orientation nor does Petitioner demonstrate a rationale to combine the references. PO Resp. 1–10, 18–58. Patent Owner also asserts that objective secondary indicia favor a finding of nonobviousness of the claims. *Id*. at 60–71. Patent Owner relies upon the Ross Declaration. Ex. 2053.

We begin our discussion with summaries of Bowen and Parkin and then address some of the evidence and arguments presented.

*1. Bowen (Ex. 1026)*

Bowen describes that "magnetoresistance of magnetic tunnel junctions (MTJs) is of uncontested interest for important applications with, in particular, promising perspectives for the fabrication of nonvolatile memories (Magnetic RAM)." Ex. 1026, 1655 (footnote omitted). Bowen "present[s] tunneling experiments on Fe(001)/MgO(20 Å)/FeCo(001) single-crystal epitaxial junctions of high quality grown by sputtering and laser ablation." *Id.* at Abstr.

Bowen discloses that "numerical calculations of spin-dependent tunneling and TMR [tunneling magnetoresistance] have been developed for single crystal MTJs such as $Co/Al_2O_3/Co(100)$, Fe/ZnSe(100), or Fe/MgO(100)," and that all these "emphasize that a correct depiction of the spin-dependent tunneling properties of epitaxial MTJs must transcend the

simple potential barrier image and take into account the interplay of electronic structure between metal and insulator." Ex. 1026, 1655. Bowen describes that "much work has been expended to characterize the growth and electrical behavior of ultrathin MgO layers," and presents "experimental results showing large TMR values in Fe(001)/MgO(001)/FeCo(001) epitaxial tunnel junctions." *Id.*

*2. Parkin (Ex. 1062)*

Parkin is titled "High Performance Magnetic Tunnel Barriers with Amorphous Materials." Ex. 1062, code (54). Parkin discloses a "magnetic tunneling element is constructed from a MgO or Mg-ZnO tunnel barrier and an amorphous magnetic layer in proximity with the tunnel baffler," where the "amorphous magnetic layer includes Co and at least one additional element selected to make the layer amorphous." *Id.* at code (57).

Parkin "relates to magnetic tunnel junction (MTJ) magnetoresistive (MR) devices for use as magnetic field sensors such as read heads for reading magnetically recorded data, as memory cells in nonvolatile magnetic random access memory (MRAM) cells, and for magnetic logic and spintronic applications." Ex. 1062, 1:13–18. Parkin explains that "[f]or applications of magnetic tunnel junctions for either magnetic recording heads or for non-volatile magnetic memory storage cells, high TMR values are needed for improving the performance of these devices." *Id.* at 2:65–3:1.

To address this, Parkin discloses "a structure that includes at least one tunnel barrier selected from the group of tunnel barriers consisting of MgO and Mg-ZnO, preferably a tunnel barrier that is oriented in the (100) direction." Ex. 1062, 6:20–24. This structure is disclosed as including "an amorphous magnetic layer of Co and at least one additional element selected

to make the layer amorphous, in which the amorphous layer is in proximity with the tunnel barrier, thereby permitting spin-polarized current to pass between the tunnel barrier and the magnetic layer." *Id.* at 6:24–29. Parkin states that a ferromagnetic layer may be comprised of $(Co_{73}Fe_{27})_{74}B_{26}$. *Id*. at 17:40–44. Parkin also discloses that the "structure may further include a crystalline layer sandwiched between the amorphous layer and the tunnel barrier." *Id.* at 6:35–37.

*3. Claim 1*

*i. Petitioner's Assertions*

The Petition asserts that the combination of Bowen and Parkin teaches all the limitations of claims 1–4 and that there is a rationale to combine the references. Pet. 28–49.

For the preamble, Petitioner argues that, to the extent it is limiting, Bowen discloses a magnetoresistive device having a tunnel barrier junction structure. Pet. 28 (citing Ex. 1026, Abstr., 1655, Fig. 1; Ex. 1024 ¶¶ 105–109).

For limitation 1[a], Petitioner asserts that Bowen discloses a first ferromagnetic material layer deposited on a substrate. Pet. 29 (citing Ex. 1026, Abstr., 1655, Fig. 1; Ex. 1024 ¶¶ 110–115). Petitioner further asserts that, as to limitation 1[e], which recites that the first ferromagnetic material layer "is crystallized and comprises CoFeB alloy," the limitation would have been obvious over Bowen in view of Parkin. *Id*. at 34. Petitioner contends that Parkin teaches a ferromagnetic "CoFeB layer 175," as shown in annotated Figure 3A of Parkin, reproduced below. *Id*. at 39.

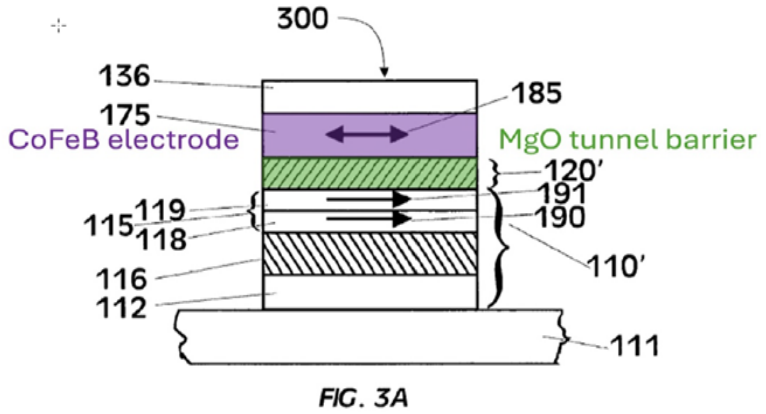



FIG. 3A

As depicted in annotated Figure 3A of Parkin, Petitioner asserts that Parkin teaches a ferromagnetic CoFeB layer 175. Pet. 39 (citing Ex. 1062, 19:16, Fig. 3A; Ex. 1024 ¶ 144). Petitioner argues that Parkin teaches that "the top and bottom electrodes in Figure 3A may be 'inverted.'" *Id*. at 40 (citing Ex. 1062, 17:7–10). Petitioner also asserts that Parkin teaches a CoFeB layer adjoining the MgO crystalline layer. *Id*. at 39 (citing Ex. 1062, 19:16–17, Fig. 3A).

Petitioner asserts that one of ordinary skill in the art would have been motivated "to replace either or both of Bowen's electrodes with CoFeB to increase TMR and lower $H_f$ and $H_c$." Pet. 39–40 (citing Ex. 1055, 2270; Ex. 1056 ¶¶ 67–68; Ex. 1035, 3274). Petitioner contends that CoFeB was known to increase TMR compared to CoFe. *Id*. at 35–36 (citing Ex. 1030 ¶¶ 27–28; Ex. 1061, Abstr.; Ex. 1024 ¶ 135); *id*. at 36 (citing Ex. 1055, 2269–70; Ex. 1056 ¶¶ 39, 78, 103–104, Fig. 7). Dr. Bokor testifies that Bowen aimed to increase TMR in its device, so this "would have provided a strong motivation to modify Bowen's MTJ to include a CoFeB electrode to increase the TMR." Ex. 1024 ¶ 136 (citing Ex. 1026, 1655, 1657).

Additionally for limitation 1[e], Petitioner asserts that one of skill would have been motivated to anneal Bowen's MTJ with CoFeB to obtain a

crystalline ferromagnetic layer. Pet. 38 (citing Ex. 1024 ¶¶ 139–143). Petitioner contends that annealing CoFeB electrodes to crystallize them was known, and it was also known that TMR ratios were enhanced by annealing. *Id*. at 37–38 (citing Ex. 1060, 309, 311; Ex. 1061, Abstr., 2272–2273). Dr. Bokor testifies that skilled artisans would have been motivated to anneal Bowen's CoFeB electrodes to improve tunneling and TMR. Ex. 1024 ¶¶ 139–142. Dr. Bokor further testifies that Parkin teaches crystallization of the CoFeB electrode where "crystalline CoFeB is 'lower in B content' because 'the B diffuses away from the interface with the MgO layer, during the thermal anneal treatments.'" *Id*. ¶ 145 (citing Ex. 1062, 19:19–22). Petitioner also asserts that a skilled artisan would have looked to Parkin's teachings to improve Bowen's MTJ because Bowen and Parkin both focus on improving the TMR of magnetoresistive devices. Pet. 40–41 (citing Ex. 1026, Abstr., 1655; Ex. 1062, 1:18–21; Ex. 1024 ¶ 149).

For limitation 1[b], Petitioner contends that Bowen discloses or suggests a "second ferromagnetic material layer." Pet. 30–31. Petitioner refers to Bowen's disclosure that "the 'ferromagnetic material layer' refers to an 'electrode made of a ferromagnetic metal.'" *Id*. (citing Ex. 1005, 1:38–42, Fig. 8(a); Ex. 1024 ¶ 116; Pet. § II.B). Petitioner argues that the "second" layer refers to the "upper" ferromagnetic electrode of Bowen. *Id*. at 31 (citing Ex. 1024 ¶ 116).

For limitation 1[c], Petitioner asserts that Bowen teaches "a tunnel barrier layer located between the first and second ferromagnetic material layers" by its disclosure of its "single-crystal epitaxial junct[ure]." Pet. 31 (citing Ex. 1026, Abstr., 1655 ("[T]he MgO barrier is grown at 400 °C in order to obtain good crystallinity."), Fig. 1; Ex. 1024 ¶ 120); *see also id*. at

32 (citing Ex. 1026, 1655; Ex. 1024 ¶ 121). For limitation 1[d], Petitioner asserts, in part, that Bowen teaches that its "tunnel barrier layer comprises a single-crystalline magnesium oxide in which (001) crystal plane is preferentially oriented" by its disclosure of single-crystal epitaxially grown structures and its Fe(001)/MgO(001)/FeCo(001) epitaxial tunnel junctions structure. *Id*. at 32–33 (citing Ex. 1026, Abstr., 1655; Ex. 1025 ¶ 124). Petitioner also asserts that "if . . . Parkin's CoFeB electrodes are used as described in Claims 1[e] and 2 in this Ground, one of skill would understand that the MgO could be polycrystalline or single-crystal but would still have the same (001) orientation." *Id*. at 33–34 (citing Ex. 1024 ¶ 129; Ex. 1062, 9:58–10:2, 18:49–51; Ex. 1005, 4:30–32).

*ii. Analysis*

*(1) Alleged Improper Petitioner Arguments and Evidence in the Reply*

Patent Owner asserts in its Sur-reply that Petitioner advances new arguments based on new evidence to attempt to establish *prima facie* obviousness and also moves to strike arguments in the Reply that are directed to MgO(001) formation on amorphous CoFeB. PO Sur-reply 2–4, 9; PO Mot. Strike.

More specifically, Patent Owner argues that Petitioner's Reply relies on new evidence that: "(1) Parkin discloses MgO(001) formed on amorphous CoFeB (Reply, 2–5) and (2) MgO(001) allegedly forming on different amorphous substrates gave POSAs a reasonable expectation of success in forming an MgO(001) barrier on amorphous CoFeB (*id*., 5–9, 12–13)." PO Sur-reply 9 (emphasis omitted). As to the first issue, Patent Owner contends that Petitioner's first ground mapped limitation 1[d] to the unmodified Bowen MgO layer formed on crystalline Fe(001), with

Petitioner asserting that Bowen's crystalline Fe(001) layer would be replaced with amorphous CoFeB, but Petitioner never explains why a person of ordinary skill in the art would understand that MgO would have the same 001 orientation as in Bowen. PO Mot. Strike 1 (citing Pet. 32–34, 37, 45). Patent Owner asserts that the Petition never argued that Parkin discloses "forming an MgO(100) tunnel over an amorphous CoFeB," as asserted in Petitioner's Reply, and the only Parkin disclosure cited for the MgO(001) limitation taught forming MgO on a templating crystalline(001) underlayer. *Id*. at 4 (citing Pet. Reply 5; PO Mot. Strike Sec. II.A.1 (citing Ex. 1062, 18:49–51; Ex. 2053 ¶¶ 104–108; PO Resp. 23)). Patent Owner contends that the Petition never cited to Parkin's Figure 11 or its interface layer 520, so Patent Owner argues that the allegations in Petitioner's Reply based on Parkin's Figure 11 are improper new arguments. *Id*. at 4–5 (citing Pet. Reply 4; Ex. 1062, 22:29–23:11; Ex. 2085, 117:14–119:17). Patent Owner asserts that Petitioner's Reply obfuscates what the Petition stated by referring to the Petition's assertions on Parkin's Figure 3 being inverted, which was in the Petition's discussion of limitation 1[e], which deals with crystallized CoFeB, but was not addressed in the sections on the MgO(001) limitations. *Id*. at 5 (citing Pet. 39–41, 60–61; Prelim. Resp. 47; Dec. 28). Patent Owner argues that "[e]ven if ***all*** Reply arguments about Parkin Figs. 3 and 11 allegedly teaching MgO(001) on CoFeB are not stricken, striking Petitioner's argument that Fig. 11's '"interface layer 520" is optional' (Reply, 4) is critical because it is clearly new." *Id*. (citing, *inter alia*, Ex. 1062, 16:47–17:7, 17:3–17:25, 23:6–11). Patent Owner contends that "[t]he Petition's citation to Parkin does not entitle Petitioner to cite ***different*** parts of Parkin (including Fig. 11's allegedly 'optional' interface layer 520)

in the Reply to advance a ***different*** argument not in the Petition." *Id*. at 6 (citing *Ariosa Diagnostics v. Verinata Health, Inc*., 805 F.3d 1359, 1367 (Fed. Circ. 2015)).

"A reply may only respond to arguments raised" in the patent owner response. 37 C.F.R § 42.23(b). The Consolidated Trial Practice Guide states that responding "does not mean proceed[ing] in a new direction with a new approach," and "[w]hile replies . . . can help crystalize issues for decision, a reply . . . that raises a new issue or belatedly presents evidence may not be considered," that is, "Petitioner may not submit new evidence or argument in reply that it could have presented earlier, e.g. to make out a prima facie case of unpatentability." Consolidated Trial Practice Guide § II.I (last updated Dec. 12, 2025) ("CTPG"), *available at* https://www.uspto.gov/patents/ptab/trial-practice-guide.

We are not persuaded by Patent Owner's assertions that Petitioner's reply arguments on Parkin should not be considered. As discussed *supra* Section II.D.3.i above, the Petition includes the assertion that if Parkin's CoFeB electrodes were used to modify Bowen, the MgO polycrystalline or single-crystal layer would still have the same 001 orientation. Pet. 33–34 (citing Ex. 1024 ¶ 129; Ex. 1062, 9:58–10:2, 18:49–51; Ex. 1005, 4:30–32). Petitioner's support in the Petition references disclosures relating to Parkin's Figure 3A (Ex. 1062, 18:49–51), which discloses a MgO(100) tunnel barrier, and the Petition also notes that the structure of Figure 3A may be inverted. Pet. 40 (citing Ex. 1062, 17:7–10). Patent Owner's arguments, in large part, are related to Petitioner's arguments in the Reply relating to Parkin's Figure 11. Parkin's Figure 11 is an embodiment where the structure of the devices of Figure 3A is inverted. *See* Ex. 1062, 22:29–33. We do not find that

Petitioner's arguments that are at issue in the Reply represent a new direction in its approach—the Petition is clearly based on the assertion that if Parkin's CoFeB electrodes are used in Bowen, the device would have a MgO(001) tunnel barrier layer. Further, the Petition refers to Parkin's disclosure that the device in Figure 3A may be inverted, which would be encompassed by the Figure 11 embodiment. Moreover, in the Institution Decision, we invited additional briefing on whether Parkin's storage magnetic electrode was an amorphous ferromagnetic electrode, which relates to Parkin's Figure 11 (Dec. 28–29). We are also not persuaded by Patent Owner's argument that the Petition's assertions do not correspond to what Petitioner argues in the Reply because they were referred to in the section pertaining to limitation 1[e]. The Petition includes a cross-reference in the limitation 1[d] discussion on the tunnel barrier layer limitation: "if Sunai's or Parkin's CoFeB electrodes are used as described in Claims 1[e] and 2 in this Ground, one of skill would understand that the MgO . . . would still have the same (001) orientation." Pet. 33.

Further, Petitioner's arguments in its Reply properly respond to arguments made on contested issues. Patent Owner's contentions on the merits in its Response are largely based upon the assertion that the modified MTJ of Bowen would not have a MgO(001) layer as claimed. *See* PO Resp. 4–10, 18–48. Petitioner's reply arguments on Parkin relate to whether there would be a MgO(001) layer in its structure, so we find that Petitioner's arguments on Parkin in its Reply (Pet. Reply 2–5) and the related evidence are appropriately responsive.

Patent Owner also asserts that Petitioner's arguments in its Reply relating to whether MgO(001) allegedly could form on different amorphous

substrates are based on new arguments and are improper. PO Sur-reply 9; PO Mot. Strike. Patent Owner contends that the Petition never alleged that MgO(001) would form on other amorphous substrates, and the related argument and evidence on this issue are impermissible. *See* PO Mot. Strike 6–7. Patent Owner's arguments in its Response are predominantly based upon the assertion that the modified MTJ of Bowen combined with either Sunai or Parkin would not have a MgO(001) layer as claimed because MgO(001) would not form on amorphous CoFeB, and, as discussed above, we have determined that Petitioner's responding argument and evidence are permissible in the Reply. We similarly determine that evidence that MgO(001) may form on other substrates is also permissible, as it relates to arguments about the formation of MgO(001) on CoFeB.

Accordingly, Petitioner's argument and related evidence in Petitioner's Reply are permissible.

*(2) Parkin's Teachings of a MgO(001) Tunnel Barrier*

As discussed *supra* Section II.D.3.i, Petitioner asserts that if Parkin's CoFeB electrodes are used in Bowen, the MgO tunnel barrier layer would be in a (001) orientation. *See* Pet. 33–34. Petitioner argues that Parkin discloses that its MgO layer is in 100 form. *Id*. (citing Ex. 1062, 18:49–51). Petitioner further contends that Patent Owner indicates that MgO(001) and Mg(100) are the same. Pet. Reply 2 (citing PO Resp. 10 n.4). Petitioner contends that Figure 3A of Parkin teaches a CoFeB layer over a "highly (100) textured MgO layer." *Id*. (citing Pet. 33–34, 39; Ex. 1062, Fig. 3A, 9:58–10:2, 18:49–51, 19:16–17; Ex. 1024 ¶¶ 129, 144). Petitioner asserts that Parkin discloses that its electrodes may be inverted: "[t]he MTJ device of FIG. 3A may also be inverted, such that the reference ferromagnetic

electrode is formed above the tunnel barrier and the storage layer is formed beneath the tunnel barrier." *Id*. at 2–3 (quoting Ex. 1062, 17:7–10; citing Pet. 39–40) (emphasis omitted). Petitioner argues that Parkin's Figure 11 confirms Figure 3A's "inverted" embodiment expressly discloses an MgO(100) layer over an amorphous CoFeB layer, and refers to annotated Figure 11, reproduced below. *Id*. at 4.

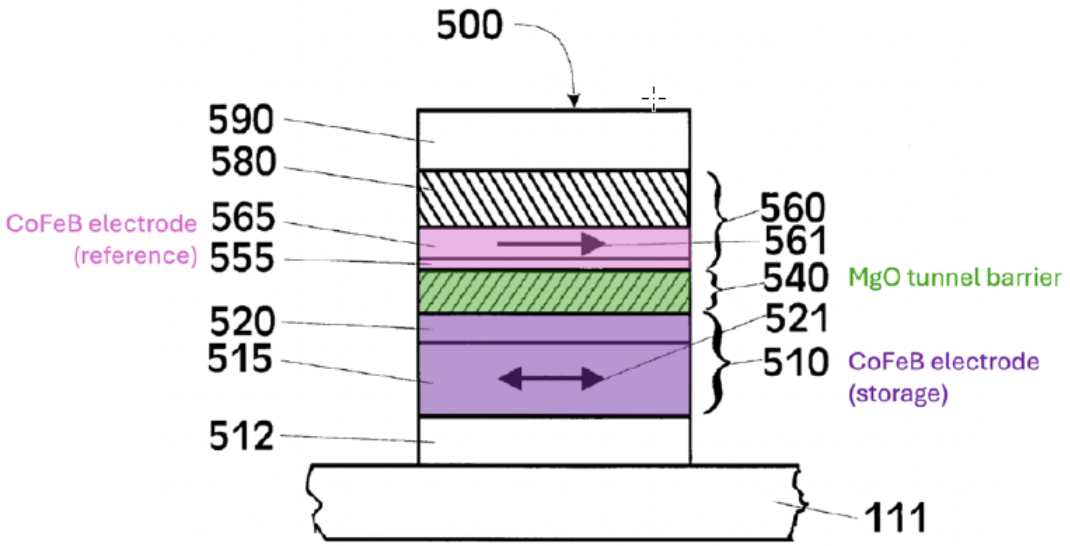



FIG. 11

Annotated Figure 11, above, shows a cross-sectional view of an MTJ of Parkin. Ex. 1062, 11:3–4. Petitioner contends that Figure 11 depicts the storage and reference electrodes in Figures 3A and 3B's devices that are inverted. Pet. Reply 4 (citing Ex. 1062, 22:29–33). Petitioner refers to Parkin's disclosure that "storage magnetic electrode 510 is formed on the underlayer 512 by deposition of a layer 515 comprising an amorphous ferromagnetic alloy" of "CoFeB." *Id*. (citing Ex. 1062, 22:56–58, 22:62–63) (emphasis omitted). Petitioner contends that in Parkin, "[a]n 'MgO tunnel barrier 540' is formed atop storage layer 510, . . . and a 'reference magnetic

electrode 560' is placed atop the MgO." *Id*. (citing Ex. 1062, 23:6, 23:15) (emphasis omitted). Petitioner argues that the interface layer 520 is optional. *Id*. (citing Ex. 1062, 22:66–67).

We find that the evidence Petitioner relies upon supports its contention that, with the use of Parkin's CoFeB electrodes in the Bowen-Parkin combination, the MgO tunnel barrier layer would be in a (001) orientation. Specifically, the descriptions of Parkin disclose that its device would include layer 515 in an amorphous form, while the MgO tunnel barrier layer would be in a (001) orientation.[6] *See* Ex. 1062, 18:49–51, 19:16–22, 22:56–58, 22:62–63.

Patent Owner asserts that the modified Bowen-Parkin device does not disclose a MgO(001) layer as claimed, and, more specifically, Parkin does not teach that a MgO(001) layer can be formed on amorphous CoFeB. PO Resp. 4–5, 22–27, 30–43; PO Sur-reply 1–3, 6–8, 9–16. On this issue, Patent Owner contends that: (1) contrary to Petitioner's contentions, interface layer 520 shown in Figure 11 of Parkin is not optional; (2) Parkin teaches formation of Figure 11's MgO(001) layer by the methods disclosed in Exhibits 2080 and 2081, which do not disclose forming MgO(001) on amorphous CoFeB; and (3) multiple publications acknowledge Parkin's work, but attribute the discovery of Mg(001) formed on amorphous CoFeB to the named inventor of the '134 patent, Shinji Yuasa. PO Sur-reply 14–16.

---

[6] It is undisputed that MgO(001) and Mg(100) are the same. *See* Pet. Reply 2; PO Resp. 10 n.4, 23; *see also* Ex. 1005, 4:30–32 ("because MgO has a cubic crystal structure (NaCl structure), the (001) plane, the (100) plane, and the (010) plane are all equivalent").

On the first issue, Patent Owner alleges that "Parkin's disclosure that '[a]n interface layer 520 of a crystalline CoFe alloy may be used' (Parkin, 22:66–67) does not say interface layer 520 is 'optional.'" PO Sur-reply 15 (emphasis omitted). Patent Owner asserts that the statement means that the interface layer "may be" CoFe. *Id*. Patent Owner contends that this statement comports with Parkin's disclosure that another crystalline(001) layer "may be formed from $Co_{70}Fe_{30}$," so the teaching that different materials can be formed from different crystalline materials does not say that interface layer 520 is optional. *Id*. (citing Ex. 1062, 13:10–13). Patent Owner also asserts that Dr. Bokor "conceded POSAs could read Parkin as saying 'an interface layer of something else may also be used.'" *Id*. (citing Ex. 2085, 52:3–20, 53:3–14). Patent Owner also contends that Dr. Bokor's testimony is unreliable because he is not qualified to offer testimony on MgO(001) crystal formation. *Id*. at 9–10.

We do not find Patent Owner's arguments persuasive. Parkin states that:

> The *storage magnetic electrode 510* is formed on the underlayer 512 by deposition of a layer 515 comprising an *amorphous ferromagnetic alloy*. The *electrode* may be formed from a wide variety of *amorphous ferromagnetic materials* but particularly the family of 3d transition metal ferromagnetic alloys combined with glass forming elements, such as B, Hf, Zr and Si. In FIG. 11 a layer 515 of CoFeB is deposited which is 60 A thick. The composition of the layer as determined by RBS analysis is $Co_{57}Fe_{23}B_{20}$ (or $(Co_{60}Fe_{40})_{80}B_{20}$ where a sputtering target with a nominal composition of $Co_{59.5}Fe_{25.5}B_{15}$ was used). An *interface layer 520 of a crystalline CoFe alloy may also* be used.

Ex. 1062, 22:56–67 (emphasis added). We read the plain language of the statement that "[a]n interface layer 520 of a crystalline CoFe alloy may also be used" to mean that layer 520 may or may not be used, that is, it is

optional. *Id*. at 22:58–60, 22:66–67. That reading is consistent with the disclosure of Parkin above which states that layer 515 is amorphous and, additionally, that the entire electrode, that is, storage magnetic electrode 510, may also be formed from amorphous ferromagnetic materials. *Id*. at 22:57–62 ("[t]he electrode may be formed from . . . amorphous ferromagnetic materials"). That is, the entire storage electrode 510 may be amorphous. This provides support for Petitioner's assertion that the entire lower storage electrode in Parkin is amorphous CoFeB. Further, the beginning portion of the cited section above discusses the use of *amorphous* ferromagnetic alloys and then concludes for interface layer 520 that a *crystalline* ferromagnetic alloy may also be used as one of the layers of the electrode. *See id*. at 22:56–67. So a fair reading of the sentence "[a]n interface layer 520 of a crystalline CoFe alloy may also be used" is that the form of the alloy is the differentiating characteristic, not the use of a different material than CoFe, as Patent Owner asserts. Additionally, Dr. Bokor testifies that a person of ordinary skill in the art would understand that the statement that "an interface layer 520 of a crystalline CoFe alloy may also be used" would mean that "it may also be used" or "it may also not be used. So the interface layer 520 is optional." *See* Ex. 2085, 52:13–18.

On the second issue, Patent Owner asserts that Parkin does not form MgO(001) on amorphous CoFeB and refers to Exhibits 2080 and 2081,[7] which are applications referenced in Parkin, where a crystalline ferromagnetic layer with a (100) orientation is used to form a MgO(001)

[7] Petitioner filed a Motion to Strike these exhibits, as well as related portions of the Sur-reply. *See* Pet. Mot. Strike. As discussed *supra* Section III, we deny this Motion.

barrier. PO Sur-reply 2, 10–13, 16–17; *see also* PO Resp. 9–10, 24, 30. Patent Owner contends that Petitioner's views of Parkin's teachings on MgO(001) formation as depicted in Figure 11 are inconsistent with these exhibits. PO Sur-reply 16. Patent Owner contends that Parkin discloses methods for forming MgO, but it is formed on a crystalline(001) electrode layer by templating. *See id*. at 1, 11, 16 (citing Ex. 1062, 3:24–41; Ex. 2080, 26:5–19, 58:1–5, 25:8–10, 24:21–25:1, 27:10–18, 35:10–18, 45:19–46:12; Ex. 2081, 91:5–21; Ex. 2053 ¶¶ 104–105; Ex. 2085, 55:1–56:15, 63:20–64:6, 65:21–68:7, 57:12–60:24, 68:18–70:19, 75:2–16, 97:16–98:1, 103:14–107:2).

We agree with Patent Owner that Exhibits 2080 and 2081 include several disclosures where the adjoining ferromagnetic materials and MgO tunnel barriers are 100 oriented. *See* Ex. 2080, 26:5–19, 25:8–10, 27:10–18, 35:10–18, 45:19–46:12; Ex. 2081, 91:5–21. However, Exhibit 2080 also discloses that "highly oriented (100) MgO barriers are formed *without* using single crystalline substrates or high deposition temperatures, thereby facilitating the manufacture of devices using standard deposition techniques on polycrystalline or amorphous thermal films," and "[p]ost anneal treatments are preferred to improve the tunneling magnetoresistance," where thermal annealing is used "so that the structure prior to annealing may not be substantially (100) oriented" but after thermal anneal treatments "the crystallographic texture becomes substantially (100) oriented." *See* Ex. 2080, 22:23–23:4, 47:13–17 (emphasis added). We agree with Petitioner that this disclosure provides support for alternate formation of MgO(001) on amorphous CoFeB that does not include forming it by

templating on a crystalline ferromagnetic layer with (100) orientation. *See* Tr. 21:13–23:17.

Patent Owner also refers to Parkin's disclosure on the use of templating (epitaxy) for formation of MgO(100) on (100) textured CoFe alloy. S*ee* PO Sur-reply 10–11, 16–17. In support, Patent Owner relies upon Parkin's disclosure of forming highly oriented crystalline tunnel barriers on a CoFe electrode that is (100) textured. *See id.* at 10–11 (citing, *inter alia*, Ex. 1062, 13:2–25). Parkin's disclosures appear to refer to the formation of Figure 2A (*see* Ex. 1062, 12:34–13:25), and Patent Owner asserts that it refers to the layers that are also shown in Figure 3A, but does not assert that this disclosure applies to all embodiments. *See* Tr. 57:17–19. Even if the disclosure was found to apply to Figure 3A, this is not sufficient to persuade us to disregard the additional explicit disclosures on amorphous CoFeB related to Figure 11 discussed above.

On the third issue, Patent Owner argues that although multiple publications acknowledged Parkin's work, they attribute the discovery of Mg(001) on amorphous CoFeB to Dr. Yuasa. PO Sur-reply 16, 28–31; PO Resp. 60–71. Patent Owner asserts that Dr. Yuasa disclosed the claimed device of the '134 patent in a research article published in Applied Physics Letters ("APL"), which states that the growth of MgO(001) on CoFeB is "surprising." PO Resp. 61–64 (citing Ex. 2006, 2 ("the APL paper")). Patent Owner contends that Dr. Yuasa's invention drew praise and attention, and Dr. Yuasa stated that a "fundamental problem" with the prior art was "a problem concerning crystal growth," and credited the method disclosed in the APL paper as "solv[ing] this problem" "by using a sputtering deposition technique" to make a "CoFeB/MgO/CoFeB" "MTJ structure," where the

"as-grown state" of the CoFeB was "amorphous," and the APL paper further states that "[s]urprisingly," the MgO barrier became "a (001)-oriented polycrystal" despite being grown on an "amorphous CoFeB" underlayer. *Id*. at 62–64 (citing Ex. 1057, 46–48 (Chap. 2 authored by Dr. Yuasa of Dieny book); Ex. 2053 ¶ 264). Patent Owner refers to a paper coauthored by Chando Park of "Western Digital Corporation" that cites to the APL paper, and characterized the solution as epitaxially induced crystallization of CoFeB layers with well-matched lattice to MgO with (001) texture. *Id*. at 64 (citing Ex. 2005, 39–40); PO Sur-reply 28 (citing Ex. 2005, 36, 39–40). Patent Owner also refers to a Zheng Gao paper that cited the APL paper for "the 'significance' of making that MTJ using 'amorphous (a)-CoFeB . . . to promote strong (001) MgO texture in the as-deposited state' where 'post annealing transforms' the CoFeB layer to a polycrystalline layer." PO Resp. 64–65 (citing Ex. 2022, 106–108, 110). Patent Owner also refers to a TDK paper that "made the technology transition from Al2O3 to MgO barrier much easier thanks to the use of simple CoFeB amorphous magnetic electrodes . . . . Upon annealing CoFeB and MgO can be crystallized." *Id*. at 65 (citing Ex. 2023, 2). Patent Owner references a publication with Albert Fert as a contributor that characterized the APL paper as "an 'important breakthrough' and 'the most important step [of] the transition from MTJ with amorphous tunnel barrier (alumina) to . . . MTJ with MgO barrier." *Id*. (citing Ex. 2020, 8, 15 n.30).

We do not agree with Patent Owner that the cited references refer to or "acknowledge" the contents of the Parkin patent, the prior art asserted here; rather the publication that Patent Owner cites to in the publications is Parkin's paper published in Nature Materials (*see* Ex. 2060). More

specifically, the Yuasa book chapter references the Nature Materials article, not the Parkin patent. *See* Ex. 1057, 46, 52. The references to "Parkin" in the article coauthored by Park also refer to the Nature Materials article, not to his patent. *See* Ex. 2005, 38, 45. Similarly, Gao refers only to the Nature Materials article. *See* Ex. 2022, 107, 110. And the TDK paper has the same reliance. *See* Ex. 2023, 2, 7. The Fert publication also contains no reference to the Parkin prior art patent. *See* Ex. 2020. Patent Owner does not direct us to any disclosures in Parkin's Nature Materials article that are the same or similar to those discussed above for the disclosures related to Figure 11 in the Parkin prior art patent regarding the formation of the MgO(100) layer over an amorphous CoFeB layer. As such, we find no "acknowledgment" in the cited publications for Parkin's prior art patent, which is at issue here.

Additionally, as Patent Owner argues, Dr. Yuasa stated in the APL paper and in a book chapter that "[s]urprisingly, the MgO barrier layer grown on the amorphous CoFeB is a (001)-oriented polycrystal (textured structure)" in reference to the APL paper, and the other publications cited by Patent Owner refer to the APL paper's disclosure of a MgO(001) layer on amorphous CoFeB. *See* PO Resp. 26, 61–65 (citing, *inter alia*, Ex. 1057, 47); PO Sur-reply 28–31. Petitioner characterized Dr. Yuasa's characterization as "self-praise of his own purported invention." Pet. Reply 25; *see also* Tr. 35:15–17. Patent Owner argues that the APL journal was peer-reviewed and prestigious and the APL paper has been frequently cited (*see* Tr. 64:19–65:1). Patent Owner also asserts that the publications citing to the APL paper never disputed the "surprising" result, "[s]o it's not just speculation about what the sentences mean" and "[t]here's objective

evidence that corroborates or confirms this was a surprising result." *Id*. at 65:1–4.

We note that the publications referring to the APL paper that are cited by Patent Owner are book chapters or articles that are reviews of the development of the progress of magnetoresistive technology. *See* Ex. 2005; Ex. 2020; Ex. 2022; Ex. 2023. The publications written by others note that the APL paper stated that it found that large TMR ratios could be obtained with crystalline MgO MTJ of very high structural quality (Ex. 2020, 8; Ex. 2023, 2; Ex. 2022, 107; Ex. 2005, 39–40), or that amorphous CoFeB was used with the formation of MgO(001) (Ex. 2002, 107; Ex. 2005, 39–40; Ex. 1057, 47–48, 52). The articles that note the "surprising" discovery therefore rely on the APL paper and its characterization of the work done, so contrary to Patent's Owner's arguments, we do not find that the citations to the APL paper represent independent corroboration of the nature of the result. Further, there are no references in the cited publications to the asserted Parkin prior art patent. We do not speculate as to if or why reviewers were not aware of the Parkin patent, but, as discussed above, we have determined that the prior art patent disclosed the teaching of MgO(001) formation on amorphous CoFeB prior to the '134 patent and the APL paper.

Finding Patent Owner's arguments unpersuasive, we accordingly determine that Petitioner has demonstrated that Parkin discloses the formation of an MgO(100) layer over an amorphous CoFeB layer.

Further, we determine that the combination of Bowen and Parkin teaches all the elements of claim 1; the combination teaches first and second ferromagnetic material layers, with the first material layer crystallized

CoFeB alloy after annealing, and the tunnel layer comprised of MgO(001), with the layers oriented as claimed.

*(3) Rationale to Combine Bowen and Parkin*

As discussed *supra* Section II.D.3.i, Petitioner asserts that one of ordinary skill in the art would have been motivated to replace Bowen's electrodes with CoFeB to increase TMR and lower $H_f$ and $H_c$. Pet. 39–40 (citing Ex. 1055, 2270; Ex. 1056 ¶¶ 67–68; Ex. 1035, 3274). Petitioner contends that annealing CoFeB electrodes to crystallize them was known, where TMR ratios were enhanced by annealing, so skilled artisans would have been motivated to anneal Bowen's CoFeB electrodes to improve tunneling and TMR. *Id.* at 37–38 (citing Ex. 1060, 309, 311; Ex. 1061, Abstr., 2272–2273; Ex. 1024 ¶¶ 139–142). Petitioner also refers to Parkin's disclosure of its inverted Figure 3A, shown in Figure 11, which taught the benefits of using amorphous electrodes of CoFeB and crystallizing them. Pet. Reply 5–6, 16–17 (citing, *inter alia*, Ex. 1062, 17:7–20, 18:49–55, 19:17–19, 22:29–23:13).

Patent Owner contends that Bowen discloses an MTJ device with crystalline electrodes that do not comprise CoFeB, and Bowen "had no boron in [its] electrodes because it was well known that boron 'inhibited' crystallization." PO Resp. 2 (citing Pet. 37). Patent Owner argues that Bowen took a different approach to Parkin, which used boron to make the electrode amorphous, and that "Petitioner's assertion that these disparate teachings in the art would have led a POSA to a ferromagnetic electrode layer that is crystallized and comprises CoFeB is baseless." *Id*. at 2–3. Patent Owner asserts that Petitioner improperly picks and chooses isolated teachings in the prior art using hindsight. *Id*. at 3. Patent Owner argues that

the Parkin reference would not have motivated a person of skill to modify Bowen to use a ferromagnetic layer with boron because adding boron yielded a non-crystalline electrode, which was the exact opposite of what Bowen was trying to achieve. *Id*. at 3; *see also id.* at 42–43. Patent Owner further argues that a person of skill in the art would not have combined the references in the manner that Petitioner asserts because Bowen went to heroic efforts to achieve crystalline ferromagnetic electrodes with a crystalline MgO layer. *Id*. at 44–45. Patent Owner contends that Parkin teaches that its increased switching properties are due to its use of amorphous electrodes. *Id*. at 47–48.

Patent Owner additionally asserts that Petitioner has not provided a credible reason why a person of skill would have modified Bowen's lower electrode with amorphous CoFeB and crystallized it. PO Resp. 49–50. In addition to the arguments presented for the substitution of CoFeB, Patent Owner asserts that crystallization of the CoFeB goes against the teaching of why boron was used in the first place. *Id*. at 50. Patent Owner argues that to the extent that Parkin teaches that CoFeB is beneficial to increase TMR and lower $H_f$ and $H_c$, it is because the CoFeB electrode is amorphous. *Id*. at 51 (citing Pet. 36, 39, 57, 61). Patent Owner asserts that Petitioner provides no reason why a person of skill would have crystallized the CoFeB electrode in the Bowen-Parkin combination, short of it being known. *Id*. (citing Pet. 36; Ex. 1060; Ex. 1061). Patent Owner contends that Petitioner misapplies *KSR* because *KSR* only applies when the elements are combined without a change to their function and the results are predictable, but Petitioner's ground does not use Parkin's amorphous CoFeB electrode without changing its function because Parkin teaches that its electrode should be amorphous. *Id*. at 57–58.

Patent Owner further argues that the technology was in its infancy, poorly understood, and the results Dr. Yuasa achieved surprised those in the field, so *KSR*'s predictable results rationale does not apply. *Id*. at 58.

We find that there is sufficient evidence in support of Petitioner's assertion of the rationale to replace Bowen's electrodes with CoFeB and anneal them. As discussed *supra* Section II.D.ii.2, Parkin's Figure 11 depicts and describes a storage electrode that may be composed of amorphous CoFeB, with the formation of a MgO(001) barrier layer atop it. *See* Ex. 1062, 22:29–66. Patent Owner argues that Parkin's benefits are because its CoFeB electrode is amorphous (PO Resp. 51–52), but this is not accurate. In Parkin, the CoFeB amorphous electrode crystallized at the interface layer between the barrier and the electrode. *Id*. at 19:6–19. Parkin discloses that higher TMRs were attributable to the crystallization of CoFeB. *Id*. at 18:63–19:22. Parkin also discloses that its completed CoFeB-MgOH(001)-CoFeB device was annealed with resulting high TMRs. *Id*. at 17:60–18:16. These disclosures provide support that one of skill in the art would have been motivated to replace Bowen's electrodes with CoFeB and anneal to crystallize them because of the known improvements of TMR. Additionally, Parkin's disclosures support that the results of the combination would have been predictable. That is, Parkin actually discloses an amorphous CoFeB electrode, formation of a MgO(001) tunnel barrier on the amorphous electrode, and annealing the assembly, with a resulting high TMR.

Accordingly, Petitioner has provided reasoning with rationale underpinning for the motivation to combine. *See KSR*, 550 U.S. at 415

("[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results").

*(4) Objective Indicia of Nonobviousness*

We consider objective indicia of nonobviousness, which is also referred to as secondary considerations. "The objective indicia of non-obviousness play an important role as a guard against the statutorily proscribed hindsight reasoning in the obviousness analysis." *WBIP, LLC v. Kohler Co*., 829 F.3d 1317, 1328 (Fed. Cir. 2016). "In order to accord substantial weight to secondary considerations in an obviousness analysis, 'the evidence of secondary considerations must have a "nexus" to the claims, i.e., there must be "a legally and factually sufficient connection" between the evidence and the patented invention.'" *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373 (Fed. Cir. 2019) (citing *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed. Cir. 2019)). "The patentee bears the burden of showing that a nexus exists." *WMS Gaming Inc. v. Int'l Game Tech*., 184 F.3d 1339, 1359 (Fed. Cir. 1999). Nexus is a legally and factually sufficient connection between the objective evidence and the claimed invention, such that the objective evidence should be considered in determining nonobviousness. *Demaco Corp. v. F. Von Langsdorff Licensing Ltd*., 851 F.2d 1387, 1392 (Fed. Cir. 1988). A nexus is presumed when "the patentee shows that the asserted objective evidence is tied to a specific product and that product 'embodies the claimed features, and is coextensive with them.'" *Fox Factory*, 944 F.3d at 1373 (quoting *Polaris Indus., Inc. v. Arctic Cat, Inc*., 882 F.3d 1056, 1072 (Fed. Cir. 2018)). "A finding that a presumption of nexus is inappropriate does not end the inquiry into secondary considerations," as "the patent owner is still

afforded an opportunity to prove nexus by showing that the evidence of secondary considerations is the 'direct result of the unique characteristics of the claimed invention.'" *Id*. at 1373–74 (citing *In re Huang*, 100 F.3d 135, 140 (Fed. Cir. 1996)).

Here, Patent Owner contends that the claimed invention was disclosed in the APL paper co-authored by Dr. Yuasa. PO Resp. 61 (citing Ex. 2006). Patent Owner presents the alleged disclosures of the elements of claim 1 in the APL paper. *Id*. at 61–62.

Patent Owner asserts that the claimed technology has received industry-wide praise. PO Resp. 61–67. Patent Owner argues that the APL paper has been cited more than 1,200 times. *Id*. at 62 (citing Ex. 2052; Ex. 2053 ¶ 260). Patent Owner refers to a 2005 article reviewing the APL paper that praised its "unprecedentedly large TMR ratios." *Id*. at 62–63 (citing Ex. 2019, 591–592). Patent Owner asserts that there is a direct nexus between this praise and the claimed invention. *Id*. at 63 (citing Ex. 2053 ¶ 261). Patent Owner also points to a Yuasa-authored chapter in a textbook for support that the invention disclosed in the APL paper allegedly "unleashed a new era of skyrocketing TMRs." *Id*. at 63 (citing Ex. 1057, 46; Ex. 2053 ¶ 262). Patent Owner contends that the chapter credited the method of the APL paper as using a deposition technique "to make a 'CoFeB/MgO/CoFeB' 'MTJ structure,' where the 'as-grown state' of the CoFeB was 'amorphous.'" *Id*. at 63–64 (citing Ex. 1057, 47). Patent Owner asserts that "[t]he chapter explains that, '[s]urprisingly,' the MgO barrier became 'a (001)-oriented polycrystal' despite being grown on an 'amorphous CoFeB' underlayer." *Id*. at 64 (citing Ex. 1057, 47; Ex. 2053 ¶ 263). Patent Owner also asserts industry praise for the APL paper from

Petitioner (Western Digital Corporation, an identified real party in interest in this proceeding), as well as others. *See id*. at 64–65 (citing Ex. 2005, 36, 39–40; Ex. 2022, 106–108, 110; Ex. 2023, 1, 2, 7; Ex. 2020, 8, 15 n.30; Ex. 2053 ¶¶ 266–267). Patent Owner contends that in recognition of "his groundbreaking work related to the invention of the '134 patent," Dr. Yuasa has been awarded or co-awarded many prizes. *See id*. at 65–67 (citing, *inter alia*, Ex. 2053 ¶¶ 268–272; Ex. 2024, 2–3; Ex. 2026, 1; Ex. 2027; Ex. 2055; Ex. 2029, 2; Ex. 2030, 3; Ex. 2031, 1; Ex. 2032, 1; Ex. 2034, 1; Ex. 2035, 1).

Patent Owner argues that the claimed technology also solved a long-felt need and, in support, refers to efforts made to make MTJ devices after the discovery of the giant magnetoresistance (GMR) effect in 1998. PO Resp. 67–69. Patent Owner refers to attempts to make MTJs using MgO tunnels to achieve theoretical high TMR predictions that were unsuccessful and failed to address manufacturability problems. *Id*. at 69. Patent Owner alleges that the '134 patent's invention solved these long-felt but unmet needs by achieving a TMR of 88%, which represented the highest TMR achieved at room temperature, and MTJs claimed by the patent using CoFeB electrodes achieved even higher 230% TMR. *Id*. (citing Ex. 1005, 7:55–8:3, 8:56–9:10; Ex. 2053 ¶ 273; Ex. 2006, 1–2). Patent Owner contends that "TMRs skyrocketed after the world learned of" Dr. Yuasa's invention. *Id*. at 69–70 (citing Ex. 1057, 46–47; Fig. 2.21; Ex. 2053 ¶ 273). Patent Owner also asserts that the claimed invention "represented a breakthrough for commercial manufacturing of MTJs" because "[g]one were the days of 'strenuously high temperature deposition with single crystal structures'" and instead because "the devices were formed using an amorphous CoFeB

electrode layer later crystallized through annealing, it allowed for use of a 'conventional sputtering method instead of an MBE system.'" *Id*. at 70–71 (citing Ex. 2023, 2; Ex. 2024, 4; Ex. 2053 ¶ 274).

Patent Owner's arguments are based, in large part, on the APL paper's statement that "[s]urprisingly, the MgO layer, grown on the amorphous CoFeB layer, showed a good crystalline structure with a (001) fiber texture." Ex. 2006, 2. The Yuasa-authored chapter relies on the same reason for the alleged "surprise[e]." Ex. 1057, 47. Patent Owner alleges that the finding that a MgO(001) barrier layer can be grown on the amorphous CoFeB was the reason for the "breakthrough for commercial manufacturing of MTJs." *See* PO Resp. 70–71. However, as discussed *supra* Section II.D.ii.2, the prior art Parkin patent taught the formation of a MgO(001) layer grown on the amorphous CoFeB.

A showing of sufficient nexus is required in order to establish that the evidence relied upon traces its basis to a novel element in the claim, not to something in the prior art. *Institut Pasteur & Universite Pierre Et Marie Curie v. Focarino*, 738 F.3d 1337, 1347 (Fed. Cir. 2013). Objective evidence that results from something that is not "both claimed and novel in the claim" lacks a nexus to the merits of the invention. *In re Kao*, 639 F.3d 1057, 1068 (Fed. Cir. 2011) (emphasis omitted). Thus, establishing nexus involves a showing that novel elements in the claim, not prior-art elements, account for the objective evidence of nonobviousness. *Id*. Here, Patent Owner alleges that the formation of the MgO(001) layer grown on the amorphous CoFeB described in the APL paper was the reason for industry praise and improving manufacturing, and thus solved the long-felt need, but because the growth of the MgO(001) on amorphous CoFeB was known in

the prior art, as evidenced by Parkin's disclosures, then a nexus based on that factor has not been demonstrated.

Patent Owner also relies on the increase of TMR disclosed in the APL paper as the basis of industry praise and solving the long-felt need. We do not find the TMR increase to strongly favor affording substantial weight to these considerations. This is because Parkin (Ex. 1062, 18:45–46, Fig. 6) disclosed TMRs of more than 220%, which is close to the reported TMR of the Yuasa APL paper of 230% (*see* Ex. 2006, Abstr.).

Patent Owner also argues that the APL paper, and its statement of the "surprising" results, should be afforded weight for industry praise because Applied Physics Letters is a prestigious journal and is peer-reviewed. *See* Tr. 64:20–25. Further, Patent Owner asserts that the APL paper has been cited extensively and no citing reference ever disputed the "surprising" result representation. *See id*. at 64:25–65:2.

We recognize that there appears to be a discrepancy between the industry recognition of the APL paper for its disclosures of a MgO(001) layer grown on the amorphous CoFeB and increased TMR and the apparent lack of public recognition for the Parkin prior art patent,[8] which discloses the same or very similar benefits. Nonetheless, as discussed *supra*, Parkin explicitly discloses the benefits that Patent Owner relies upon, and, therefore, we do not find the purported secondary considerations persuasive.

---

[8] As discussed *supra* Section II.D.ii.2, the references to "Parkin" in all the references cited by Patent Owner for secondary considerations are directed to Parkin's paper published in Nature Materials, not to the Parkin prior art patent. It has not been demonstrated that the disclosures in the Nature Materials article include those of the Parkin prior art patent which disclose MgO(100) layer formation over an amorphous CoFeB layer.

*(5) Conclusion for Claim 1*

Weighing the record as a whole in view of the findings and analysis above, we conclude that Petitioner has met its burden to show, by a preponderance of the evidence, that independent claim 1 would have been obvious over the combination of Bowen and Parkin. Petitioner establishes that an ordinarily skilled artisan would have had a motivation to replace Bowen's electrodes with those of Parkin, and Petitioner demonstrates that the proposed combination of Bowen and Parkin teaches each limitation of the claim. Patent Owner fails to establish that the objective indicia asserted should be afforded substantial weight. On balance, Petitioner's evidence of obviousness is not outweighed by Patent Owner's evidence that is asserted to show nonobviousness.

Accordingly, we determine that Petitioner has shown by a preponderance of the evidence that claim 1 is unpatentable.

*4. Claim 2*

Claim 2 recites "[t]he magnetoresistive device according to claim 1, wherein said second ferromagnetic material layer is also crystallized and comprises CoFeB alloy." Petitioner asserts that this limitation would have been obvious over the combination of Bowen and Parkin because Parkin discloses a second ferromagnetic CoFeB layer that contains an interface of crystalline CoFeB. Pet. 43 (citing Ex. 1062, 19:16–22, Fig. 3; Ex. 1024 ¶¶ 157–158). Patent Owner presents no arguments specific to claim 2. *See generally* PO Resp.

We are persuaded by Petitioner's arguments as to claim 2 and find they are supported by the cited evidence. Petitioner has shown sufficiently that the combination of Bowen and Parkin teaches the limitations of claim 2

and sufficient reasoning with rational underpinning has been provided for the motivation to combine the references. For the reasons discussed for claim 1, that is, that Patent Owner fails to establishes that the objective indicia asserted should be afforded substantial weight, Petitioner's evidence of obviousness is not outweighed by Patent Owner's evidence that is asserted to show nonobviousness. Accordingly, Petitioner has shown by a preponderance of the evidence that claim 2 is unpatentable as obvious over Bowen and Parkin.

*5. Claims 3 and 4*

Claim 3, in part, recites "wherein at least said first ferromagnetic material layer is entirely crystallized and comprises CoFeB alloy" and claim 4 recites "[t]he magnetoresistive device according to claim 3, wherein said second ferromagnetic material layer is also entirely crystallized and comprises CoFeB alloy."

Petitioner asserts that Patent Owner argued in a litigation that annealing CoFeB results in ferromagnetic material layers that are entirely annealed. Pet. 45–46 (citing Ex. 1072, 6–7). Petitioner contends that skilled artisans knew the benefits of crystallized CoFeB layers for MTJs. *Id*. at 47 (citing Ex. 1061, 2272, 2274). Petitioner points to Cardoso (Ex. 1061) where testing showed the annealed layers were crystallized and not amorphous. Pet. 45–46 (citing Ex. 1061, 2273). Petitioner also asserts that Parkin discloses that the cubic crystalline MgO layer provides a template for the formation of a thin crystalline ferromagnetic layer which has a bcc structure and orientation that is in the same (100) direction as the MgO layer. *Id*. (citing Ex. 1062, 18:55–59). Petitioner asserts that Parkin discloses that "[t]he TMR of these devices was found to increase

substantially on annealing as shown in FIG. 5." *Id*. at 47–48 (citing Ex. 1062, 18:47–48, Fig. 5).

Petitioner also contends that Patent Owner never refuted that Parkin teaches the "entirely crystallized" limitations. Pet. Reply 21. Petitioner asserts that the experts agree that "a few monolayers" of "crystallized" CoFeB in an "otherwise amorphous" CoFeB layer satisfies the claims' requirements for entire crystallization. *Id*. at 21–22 (citing Ex. 1101, 185:9–19, 187:4–188:2; IPR2024-01493, Paper 18, 59–60 (citing Ex. 2053 ¶¶ 295–96); Pet. 45–48 (quoting Ex. 1072, 6–7)). Petitioner argues that Parkin provides more disclosure on crystallization of the CoFeB layers than the '134 patent or the APL paper. *Id*. at 22 (citing Ex. 1062, 18:49–59; Ex. 2006, 2; Ex. 1005, 8:60–66).

Patent Owner argues that no reference teaches a CoFeB alloy that is completely crystallized. PO Resp. 59 (citing Ex. 2053 ¶¶ 245–254). Patent Owner also contends that Petitioner's expert presents no opinion on complete crystallization. *Id*. We agree.

Cardoso discloses that upon annealing, X-ray measurements "confirmed that the CoFeB films are not amorphous." Ex. 1061, 2273. Cardoso, however, does not disclose an MTJ configuration that is exactly the same as that of the Bowen-Parkin combination. We also do not agree with Petitioner's assertion that crystallization of a portion of Parkin's layer 175 meets the limitations of a "layer [that] is entirely crystallized." Parkin discloses only that a portion of the layer 175 is crystallized, and this is insufficient to support a teaching of the claim limitations of a layer that is entirely crystallized. *See* Ex. 1062, 18:51–55. In view of the failure of the references to teach that the ferromagnetic metal layer is entirely crystallized

and the lack of expert testimony on the showing of the entire crystallization of the CoFeB electrode after annealing, we determine that Petitioner has not sufficiently shown that the Bowen-Parkin combination teaches all the limitations of claims 3 and 4. Accordingly, Petitioner has not shown by a preponderance of the evidence that claims 3 and 4 are unpatentable as obvious over Bowen and Parkin.

*E. Asserted Obviousness of Claims 1–4 over Bowen and Sunai*

Petitioner contends that claims 1–4 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Bowen and Sunai. Pet. 28–49. In support, Petitioner also relies upon the Bokor Declaration and Reply Declaration. Ex. 1024; Ex. 1105. Patent Owner argues that the prior art does not teach that the modified magnetic tunnel junction device would have had a crystalline magnesium oxide layer with 001 orientation, and Petitioner does not demonstrate a rationale for the combination. PO Resp. 1–10, 22–58. Patent Owner also asserts that objective secondary indicia favor a finding of nonobviousness of the claims. *Id*. at 60–71. Patent Owner also relies upon the Ross Declaration. Ex. 2053.

We begin our discussion with a summary of Sunai and then address some of the evidence and arguments presented.

*1. Sunai (Ex. 1030)*

Sunai is directed to "a magnetoresistance effect element, magnetic memory, magnetic head, and magnetic reproducing device that can maintain a sufficiently high magnetoresistance ratio and prevent an increase in the reversal magnetic field even when the size is reduced." Ex. 1030, code (57).

Sunai explains that when using this type of device in solid-state magnetic random access memory (MRAM), "MRAM has a problem in that

when the size of the memory cell is reduced to increase the capacity, the magnetic field required to reverse the magnetization direction of the free layer, the so-called reversal magnetic field, becomes larger, and a larger write current is required." Ex. 1030 ¶¶ 4–5. Sunai further explains, "in the prior art, when the size of the memory cell is reduced, it is not possible to prevent an increase in the reversal magnetic field of the free layer while maintaining a sufficiently high magnetoresistance ratio." *Id.* ¶ 9.

To address this, Sunai discloses:

> In order to solve the above problem, the present invention provides a magnetoresistance effect element comprising a first ferromagnetic layer that maintains the direction of magnetization when a predetermined external magnetic field is not applied, a second ferromagnetic layer that can change the direction of magnetization when the external magnetic field is not applied, and a first tunnel barrier layer interposed between the first ferromagnetic layer and the second ferromagnetic layer, wherein the first ferromagnetic layer, the first tunnel barrier layer, and the second ferromagnetic layer form a ferromagnetic tunnel junction, and wherein the composition of the ferromagnetic material contained in the second ferromagnetic layer is expressed by the general formula $(CoFe)_{100-x}Y_x$ or the general formula $(CoFeNi)_{100-x}Y_x$, where Y is at least one element selected from the group consisting of B, Si, Zr, P, Mo, Al, and Nb.

Ex. 1030 ¶ 11.

Sunai discloses that "[i]n a normal film formation method at room temperature, the lower limit of the film thickness at which a $Co_9Fe$ film that does not contain B can be formed as a continuous film is about 1.5 nm." Ex. 1030 ¶ 27. But, "when B is added to $Co_9Fe$, a continuous film can be formed up to a film thickness of about 0.5 nm." *Id.* ¶ 28. Sunai explains that the "reason that an extremely thin continuous film can be formed when the element Y [such as boron (B)] is added is that the addition of the element

Y suppresses the diffusion or movement of atoms that reach the film formation surface during the film formation process, thereby suppressing crystallization." *Id.* ¶ 30. Conversely, Sunai states that in the prior art, when Y is not added, "when the film thickness is thinned, island structures are formed in which each island has a diameter of about several nanometers, and although each island is a ferromagnetic material, it exhibits superparamagnetism, in which the magnetization direction fluctuates, resulting in a significantly low magnetoresistance change rate." *Id.*

*2. Claims 1–4*

Petitioner asserts that the combination of Bowen and Sunai teaches the limitations of claim 1, where one of ordinary skill in the art would have replaced Bowen's first ferromagnetic material layer with Sunai's CoFeB layer to increase TMR and the MTJ would be annealed to crystallize the CoFeB layer. Pet. 34–39. Petitioner relies upon Bowen alone for the teaching of the tunnel barrier comprising a single crystal MgO layer in a 001 orientation. *See id*. at 31–32. Petitioner asserts:

> if Sunai's or Parkin's CoFeB electrodes are used as described in Claims 1[e] and 2 in this Ground, one of skill would understand that the MgO could be polycrystalline or single-crystal but would still have the same (001) orientation. EX1024 ¶129; EX1062 at 9:58–10:2 (describing use of polycrystalline or single- crystal MgO), 18:49-51 ("highly textured (100) MgO tunnel barriers"); EX1005 at 4:30–32 (MgO (001), (100), (010) planes are the same).

Pet. 33–34.

Patent Owner argues that Petitioner fails to show that a person of ordinary skill in the art would have reasonably expected that the Bowen-Sunai combination would have had the claimed MgO(001) layer, where the

MgO layer would be formed on a CoFeB layer rather than Bowen's crystalline Fe(001) layer. *See* PO Resp. 22. Patent Owner asserts that the Petition's assertion that if Sunai's electrodes are used in Bowen the MgO layer would still have the same 001 orientation is conclusory. *Id*. (citing Pet. 33–34, 45). Patent Owner also contends that a person of ordinary skill in the art would not have reasonably expected that annealing the Bowen-Sunai MTJ would result in a MgO(001) layer. *Id*. at 32–34.

Petitioner asserts that, in the combination of Bowen-Sunai, the tunnel barrier would be MgO(001) based on Parkin's disclosures or those of the '134 patent. *See* Pet. 33–34. Dr. Bokor's testimony also refers to the use of MgO(100) in Parkin's disclosures. *See* Ex. 1024 ¶ 129; *see also id*. at ¶¶ 133–143. Petitioner further argues that a person of ordinary skill in the art would have known how to grow a MgO(001) layer on CoFeB and would have expected success, and the '134 patent itself does not have instructions for forming MgO(100) on CoFeB. Pet. Reply 5–10. Petitioner also refers to disclosures in Parkin, Nagahama, the APL paper, Wang, Wulff, Petrov, and Aboelfotoh, which are alleged to provide support that a person of ordinary skill in the art would have been aware of how to grow MgO(001) on amorphous layers, including CoFeB. *Id*. Petitioner asserts that a skilled artisan is not an automaton but instead "a person of ordinary creativity," and obviousness based on multiple references does not require actual, physical substitution. *Id*. at 11–12 (citing *KSR*, 550 U.S. at 420–421 (2007); *ClassCo v. Apple*, 838 F.3d 1214, 1219 (Fed. Cir. 2016)).

We are persuaded by Petitioner's arguments because the evidence supports that MgO(001) can be formed on amorphous substrates, including CoFeB. As discussed *supra* Section II.D.ii.2, Parkin includes a method for

accomplishing the formation of MgO(001) on amorphous substrates and Petitioner relies on Parkin for its teachings as reflected in the references to it. Pet. 33–34 (citing, *inter alia*, Ex. 1062, 18:49–51). We determine that one of ordinary skill in the art would have been motivated to combine the CoFeB electrodes of Sunai with Bowen, with its MgO tunnel barrier, using knowledge based on Parkin's teachings. *See* Ex. 1024 ¶ 129. We therefore find that the evidence provides support that the Bowen-Sunai combination teaches the limitations of claim 1, with a rationale to combine, for reasons similar to those discussed above for Parkin.

Petitioner relies upon similar reasons for the limitations of claims 2–4. *See* Pet. 41–49. We determine that the showing of obviousness is sufficient for claim 2, but not sufficient for claims 3 and 4, for similar reasons to those discussed *supra* Sections II.D.ii.4 and II.D.ii.5.

Accordingly, we are persuaded by Petitioner's arguments as to claims 1 and 2 and find they are supported by the evidence. Petitioner has shown sufficiently that the combination of Bowen and Sunai teaches claims 1 and 2 and sufficient reasoning with rational underpinning has been provided for the motivation to combine the references. For the reasons discussed for claim 1 for the Bowen-Parkin combination, Patent Owner fails to establish that the objective indicia asserted should be afforded substantial weight, and Petitioner's evidence of obviousness is not outweighed by Patent Owner's evidence that is asserted to show nonobviousness. Accordingly, Petitioner has shown by a preponderance of the evidence that claims 1 and 2 are unpatentable as obvious over Bowen and Sunai. Petitioner has not sufficiently demonstrated that Bowen and Sunai teach all the limitations of claims 3 and 4. Therefore, Petitioner has not shown by a preponderance of

the evidence that claims 3 and 4 are unpatentable as obvious over Bowen and Sunai.

*F. Asserted Obviousness of Claims 1–4 over Nagahama and Sunai or Parkin*

Petitioner contends that claims 1–4 are unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Nagahama with either Sunai or Parkin. Pet. 49–65. In support, Petitioner also relies upon the Bokor Declaration and Reply Declaration. Ex. 1024; Ex. 1105. Patent Owner argues that Petitioner does not demonstrate a rationale for either combination in the manner Petitioner alleges nor does the prior art teach that the modified magnetic tunnel junction device would have had a crystalline magnesium oxide layer with 001 orientation. PO Resp. 18–22, 27–36, 45–46, 49–47. Patent Owner also asserts that objective secondary indicia favor a finding of nonobviousness of the claims. *Id*. at 60–71. Patent Owner also relies upon the Ross Declaration. Ex. 2053.

We begin our discussion with a summary of Nagahama and then address some of the evidence and arguments presented.

*1. Nagahama (Ex. 1027)*

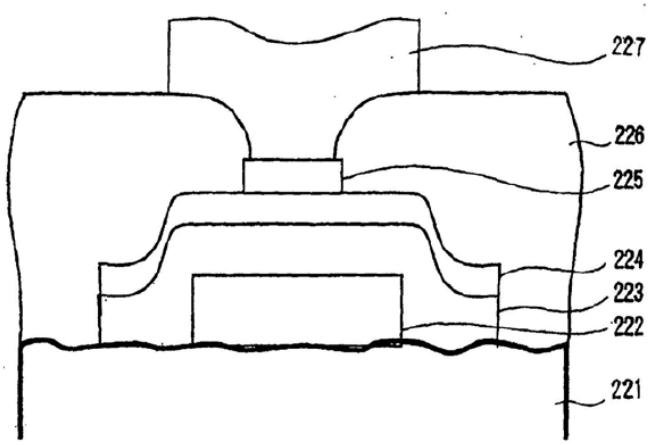
Nagahama describes a "tunnel magnetoresistance element," where "[b]y varying only the thickness of a known material having superior magnetic characteristics to increase spin polarization without changing the chemical composition, a tunnel magnetoresistive element capable of producing a larger magnetoresistive effect is provided." Ex. 1027, code (57). Nagahama

> relates to tunnel magnetoresistive elements, and particularly to a ferromagnetic tunnel magnetoresistive element outputting a large signal, a tunnel magnetoresistive element in which the

> dependence of the magnetoresistive effect on bias voltage is controlled, and a tunnel magnetoresistive element whose crystal orientation is set to the (001) direction of a body-centered cubic lattice, a face-centered cubic lattice, or a tetragonal lattice.

*Id.* ¶ 1. Nagahama describes that "[i]n order to achieve a magnetic sensor or ferromagnetic random access memory using this effect, a large magnetoresistive effect is required." *Id.* ¶ 3. But, Nagahama describes that "the tunnel magnetoresistive effect, first, has a problem in that it is limited by spin polarization." *Id.* ¶ 4. Thus, "in order to obtain a high magnetoresistive effect, a material with a high spin polarization has to be used." *Id.* ¶ 6.

Nagahama discloses a magnetoresistive element "which includes a (001)-highly-oriented lower ferromagnetic electrode layer, a (001)-highly-oriented MgO barrier layer, and a (001)-highly-oriented upper ferromagnetic electrode layer on the MgO double underlayer." Ex. 1027 ¶ 73. Figure 17, reproduced below, illustrates this embodiment.

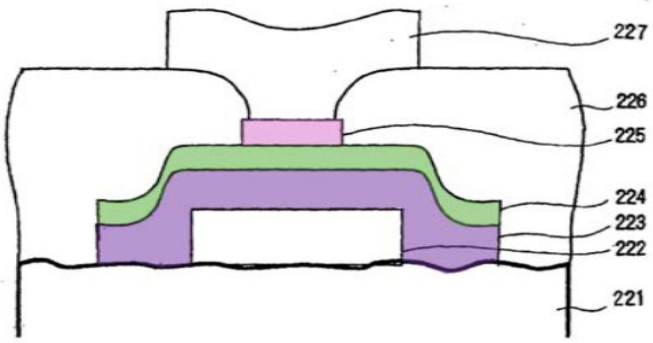



In Figure 17, above, "reference numeral 221 designates a lower electrical wire; 222, a MgO double underlayer; 223, a lower ferromagnetic electrode; 224, a barrier layer; 225, an upper ferromagnetic electrode; 226, an electrical insulating layer; and 227, an upper electrical wire." Ex. 1027 ¶ 76.

*2. Claims 1–4*

Petitioner relies on Nagahama for all the teachings of all the limitations of claim 1, except for limitation 1[e] where Petitioner asserts that one of ordinary skill in the art would have found it obvious to replace Nagahama's ferromagnetic electrodes with CoFeB as taught by Sunai or Parkin to increase TMR. Pet. 50–61. Petitioner asserts that Nagahama discloses a polycrystalline MgO(001) tunnel barrier layer, as shown by element 224 in Figure 17, reproduced below. *Id.* at 53–54 (citing Ex. 1027 ¶¶ 73–76; Ex. 1024 ¶¶ 169–170).

FIG. 17



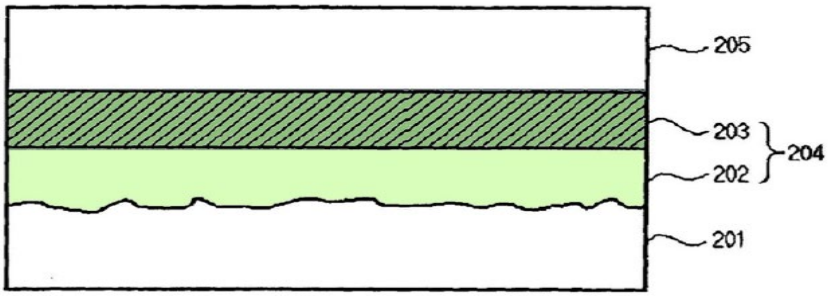

Annotated Figure 17, above, depicts a section of a tunnel magnetoresistive element with lower electrical wire 221, MgO double underlayer 222, lower ferromagnetic electrode 223, barrier layer 224, upper ferromagnetic electrode 225, electrical insulating layer 226, and upper electrical wire 227. Ex. 1027 ¶¶ 75–76.

Patent Owner asserts that Petitioner relies on Nagahama, without Sunai or Parkin, to teach limitation 1[d]. PO Resp. 19. Patent Owner contends that Nagahama's MgO(001) layer is achieved by depositing on a (001) ferromagnetic electrode, but in the combination the (001)

ferromagnetic electrode is replaced by CoFeB electrodes, which Petitioner never alleges have a (001) crystalline structure. *Id*. at 20 (citing Ex. 1027 ¶¶ 62, 65, 73; Ex. 2053 ¶ 115; Pet. 51; Ex. 2018, 196:4–200:4). Patent Owner argues that Petitioner does not allege that a MgO(001) layer would form on a CoFeB electrode. *Id*. (citing Pet. 57; Ex. 2053 ¶¶ 116–117). Patent Owner argues that the Petition fails to explain how or why the Nagahama-Sunai/Parkin combination would meet the MgO(001) limitation, and a person of ordinary skill in the art would not have expected it to do so. *Id*. at 21, 29 (citing Ex. 2053 ¶ 123 ("[I]t was well known that MgO crystallization is highly sensitive to the conditions of the underlayer on which it is formed . . . especially for ultrathin MgO layers in MTJ devices like . . . Nagahama's.")).

We do not find that Petitioner has sufficiently demonstrated that a MgO(001) layer is formed in the combination of Nagahama with Parkin or Sunai. In the Petition, Petitioner points to the use of "a (001)-highly-oriented MgO barrier layer" in Nagahama. *See* Pet. 54, 56 (citing Ex. 1027 ¶¶ 21–22, 73–74, Fig. 3, Fig. 17; Ex. 1024 ¶¶ 179, 181–182). In the Reply, Petitioner argues that Patent Owner admits that Nagahama teaches growing MgO(001) seed layers on amorphous surfaces, referring to Figure 12 of Nagahama, reproduced below. Pet. Reply 6 (citing PO Resp. 45–46; Ex. 1027 ¶¶ 55–59, 61, 67; Ex. 2053 ¶ 188; Ex. 1105 ¶ 20).

FIG. 12




As shown in annotated Figure 12 of Nagahama, above, amorphous MgO layer 202 is formed on a substrate (Si LSI, $SiO_2$ or the like) and covered by a MgO(001) crystal layer 203, which is covered by magnetoresistive element 205 with a highly oriented even surface. Ex. 1027 ¶ 56. Petitioner refers to Dr. Yuasa's own publication (citing Inaba), Wang, and Wulff (citing Tonouchi), to provide support that MgO(001) could be formed on amorphous CoFeB. Pet. Reply 6–8. Petitioner also refers to Parkin's teachings of forming a MgO(001) layer on CoFeB. *Id*. at 5–6, 12. Petitioner further argues that the '134 patent does not provide any instructions for forming MgO(001) on CoFeB. *Id*. at 9–10.

Petitioner has failed to provide sufficient evidence and supporting argument that the MgO(001) layer of Nagahama would form with the substitution of CoFeB in the electrodes. The Petition refers to disclosures on MgO(001) disclosures (*see* Pet. 54, 56 (citing Ex. 1027 ¶¶ 21–22, 73–74)), but those references only disclose a MgO(001) layer with highly-oriented upper and lower electrodes and Petitioner does not address the combination of Nagahama's MgO layer with the substitution of CoFeB (Pet. 56 (citing Ex. 1027 ¶ 73; Ex. 1024 ¶¶ 181–182)). Petitioner does not rely on any other

reference than Nagahama for teaching the MgO(001) layer as claimed. In the Reply, Petitioner refers to Nagahama's disclosures on growing MgO(001) seed layers on amorphous surfaces by a two-step process which forms a MgO double underlayer, that is, amorphous MgO covered by a (001)-oriented highly oriented Mg layer, as shown in Figure 12. Pet. Reply 6. We do not find Petitioner's assertion persuasive because the MgO(001) layer in Nagahama is formed by a two-layering method on a substrate that is not CoFeB, or even an amorphous ferrometallic. *See* Ex. 1027 ¶¶ 56, 73 (MgO formed on "Si LSI, $SiO_2$ or the like" in Figure 12 and formed on Si in Figure 13). Moreover, we cannot credit Dr. Bokor's testimony because he only opines in a conclusory manner that "Nagahama confirms that one of skill in the art understood and knew how to grow MgO(001) on amorphous substrates such as CoFeB." Ex. 1105 ¶ 22.

We also note that Nagahama consistently states that the layers formed by the two-stage formation consist of the separate and distinct "amorphous MgO layer" and "MgO(001) layer." *See* Ex. 1027 ¶¶ 18[15] ("double underlayer including an amorphous MgO layer and a (001)-highly-oriented MgO layer"), 18[16] (identifying the thicknesses of the amorphous and (001) MgO layers), 56, 58–59). Petitioner fails to provide evidence that the amorphous seed layers in Nagahama are MgO(001) layers that meet the tunnel barrier layer limitations with CoFeB electrodes, as mapped by Petitioner. *See* Pet. 53–56.

Petitioner contends that the Wang publication observed that MgO(001) could be grown on amorphous material. Pet. Reply 7 (citing Ex. 1097, Abstr., 2955, Fig. 1(a)–(c); Ex. 1105 ¶¶ 8–11). Petitioner asserts that Wang's teachings are relevant, have been cited for the growth of

MgO(001) on an amorphous substrate, and disclose the formation of crystalline MgO molecules. *Id*. But, in Wang, the MgO layer was formed on $Si_3N_4$, and Dr. Bokor does not explain how its findings apply to MgO formation on CoFeB. *See* Ex. 1097, Abstr.; Ex. 1105 ¶¶ 8–11.

Similarly, Wulff taught forming MgO(001) only on alumina, sapphire, and float glass. *See* Ex. 1036, 150. Petitioner asserts that Wulff's citations to Tonouchi "confirmed" that MgO(100) grew "regardless of the substrate selection," but Petitioner misreads Wulff. *See* Pet. Reply 8 (citing Ex. 1099, 962, 964; Ex. 1105 ¶¶ 17–19). Wulff presents a discussion of MgO formation in studies that used different substrates, and the Wulff statement merely refers to the reported results for some specific substrates in those studies, not as a general proposition that MgO(001) grows regardless of substrate selection. *See* Ex. 1036, 148. Further, Tonouchi discloses that MgO(001) formed on $SiO_2$, but did not form on other substrates. *See* Ex. 1099, 963–964.

Petitioner also refers to Dr. Yuasa's Nature Materials article that cited Inaba, that is alleged to "recognize [that] textured Fe/MgO/Fe MTJs with (001) orientation[] [may] be prepared on any kinds of substrates by using a highly oriented MgO(001) seed layer." Pet. Reply 8 (citing Ex. 2008, 870 n.21; Ex. 1098, 2373; Ex. 1105 ¶ 13–16) (emphasis omitted). However, similar to Nagahama, in Inaba there is no disclosure of structure in the amorphous underlayer. *See* Ex. 1098, 2373 ("MgO initial layer shows no clear crystallographic structure up to around a few nm from the Si substrate"). Dr. Bokor also testifies that "one of skill in the art would understand that MgO(001) is the same crystalline substance and structure, whether used as a seed layer or a tunnel barrier layer" but that "the

MgO(001) seed layer is *not* a tunnel barrier layer." Ex. 1105 ¶ 13 (emphasis added).

Petitioner also refers to Parkin's teachings of forming a MgO(001) layer on CoFeB. Pet. Reply 5–6, 12. As discussed above, Petitioner relies on Nagahama only for the teaching of the tunnel barrier, and, as discussed, a MgO(001) layer of Nagahama is formed either by forming on a 001-oriented ferromagnetic layer or by the two-step MgO layering process. S*ee* Ex. 1027 ¶¶ 56–58, 73. Petitioner fails to explain how a device would be formed using CoFeB electrodes in Nagahama's Figure 17 configuration (*see* Pet. 54) using Nagahama's methods of forming a MgO tunnel.

Thus, we find that Petitioner's evidence and supporting arguments are insufficient to demonstrate the teaching of the limitations of claim 1 by the combination of Nagahama with Sunai or Parkin. Petitioner does not present additional evidence to cure the deficiencies for claim 1 in its assertions for claims 2–4 (Pet. 61–65), so we find insufficient showing of the teachings of these claims by dependency to claim 1. Accordingly, Petitioner has not shown by a preponderance of the evidence that claims 1–4 are unpatentable as obvious over Nagahama with Sunai or Parkin.

## III. PETITIONER'S MOTION TO STRIKE

Petitioner moves to strike Exhibits 2080 and 2081 and portions of Patent Owner's Sur-reply that rely on these exhibits. Pet. Mot. Strike 1. Petitioner argues that there is good cause to strike these exhibits because they were filed with Patent Owner's Sur-reply, and the filing was not authorized by the Board. *Id*. at 1–2. Petitioner contends that Patent Owner had knowledge that it was required to seek prior authorization, and indicated that it would seek to do so by email with Petitioner, but instead filed the

exhibits with its Motion to Strike, which was not authorized by the Board. *Id*. at 2 (citing Ex. 3102). Petitioner asserts that the filing is contrary to the requirements of 37 C.F.R. § 42.23(b) and the Consolidated Trial Practice Guide. *Id*. (citing 37 C.F.R. § 42.23(b); CTPG § II.I). Petitioner contends that Patent Owner forfeited its opportunity to submit these exhibits by not filing them with its Response, when it was already aware that Figure 11 of Parkin was at issue because Patent Owner itself had addressed Figure 11 issues in its Preliminary Response and the Board had invited the parties to address issues related to Figure 11. *Id*. at 3 (citing Prelim. Resp. 44–47; Dec. 28–29). Petitioner alleges that it is "highly prejudiced" and has been "sandbagged" by the untimely submission of the exhibits because it could not meaningfully address Patent Owner's late filings. *Id*. at 4. Petitioner also contends that the late admission of exhibits violates the Administrative Procedure Act (APA) by denying Petitioner notice and fair opportunity to address the exhibits. *Id*. at 4–5 (citing, *inter alia*, 5 U.S.C. §§ 554(b)-(c), 556(d)).

Patent Owner asserts that Petitioner's Reply presented new allegations and it used the exhibits at issue to attempt to impeach Petitioner's expert, Dr. Bokor, at deposition and Dr. Bokor testified that he had reviewed the exhibits prior to the deposition. PO Opp. 1–3. Patent Owner argues that it is not belatedly presenting new evidence because the exhibits are incorporated as part of the Parkin patent (Ex. 1062), and Petitioner should have filed these exhibits with its Petition. PO Opp. 3. Patent Owner contends that the Board did not prohibit the submission of the exhibits with its motion to strike, and the exhibits are not new because they were cited in Patent Owner's motion papers. *Id*. at 4–5. Patent Owner also asserts that, even if the Board were to

find that Patent Owner should not have submitted the exhibits, the argument should not be struck because it is properly presented in response to new arguments in Petitioner's Reply. *Id*. at 5–7.

Rule 42.23(b) states that "[a] sur-reply may only respond to arguments raised in the corresponding reply and *may not be accompanied by new evidence* other than deposition *transcripts* of the cross-examination of any reply witness." 37 C.F.R. § 42.23(b) (emphasis added). The CTPG mirrors the language of the Rule and further states that "[s]ur-replies should only respond to arguments made in reply briefs, comment on reply declaration testimony, or point to cross-examination testimony." CTPG § II.I.

It would have been prudent for Patent Owner to seek the Board's authorization to file the exhibits with its motion to strike papers and with its Sur-reply. Instead, Patent Owner used a route where the exhibits were first presented at a deposition of Petitioner's expert, then filed along with a motion to strike and then referred to in Patent Owner's Sur-reply.[9] A concern is lack of notice and prejudice to Petitioner. As previously stated in a Board decision, which addressed filing deposition exhibits with the sur-reply, permitting the filing of deposition exhibits "would give parties the incentive to raise completely new evidence during a deposition, and then introduce that evidence into the record with a sur-reply, depriving the opposing party the opportunity to fully address that evidence." *Ascend*

[9] The Board did not grant leave to file new evidence with Patent Owner's Motion to Strike (*see* Paper 30, 3–4), but we need not need address that issue to decide the motion.

*Performance Materials Operations LLC v. Samsung SDI Co.*, IPR2020-00349, Paper 53 at 11–13 (PTAB July 15, 2021) (Final Written Decision).

Nevertheless, under these specific circumstances, we decline to strike Exhibits 2080 and 2081 and associated arguments from the record. The exhibits are cited in Parkin's discussion of Figure 11 and, specifically, are included in a discussion of Figure 11's tunnel barrier. *See* Ex. 1062, 23:6–11.[10] As discussed *supra* Section II.D.ii.2, Petitioner relies upon the teachings relating to Figure 11 as part of its showing as to the obviousness of the claims, and Dr. Bokor presented opinions on teachings relating to Figure 11. *See*, *e.g.*, Ex. 1024 ¶¶ 129, 144–150; Ex. 2018, 134:9–139:22; Ex. 2085, 48:18–66:8, 107:16–115:20. Given the relevance of the exhibits to Dr. Bokor's opinions, we determine that it is permissible that Patent Owner filed the exhibits to allow the Board to consider the context of the testimony. We note that we limit this determination to the specific facts of this case.

Accordingly, Petitioner's Motion to Strike is *denied*.

## IV. PATENT OWNER'S MOTION TO STRIKE

Patent Owner filed a Motion to Strike portions of Petitioner's Reply, Exhibits 1097–1099, and portions of Exhibits 1105 and 2018. PO Mot. Strike 1. Patent Owner alleges that the motion should be granted because the Reply relies upon a new theory that was not in previous briefing and advances new arguments based on new evidence. *Id*. at 1–8. Patent Owner contends that it would be prejudiced by having to address Petitioner's new arguments at oral hearing. *Id*. at 8–10. We have addressed whether

[10] Ex. 2080 is Application No. 10/824,835 and Ex. 2081 is Application No. 10/646,246.

Petitioner's arguments in the Reply are permissible, *supra* Section II.D.ii.1, and determined that Petitioner's arguments and evidence in the Reply properly respond to arguments made on contested issues. Further, Patent Owner had the opportunity to address the arguments and evidence in its Sur-reply and at oral hearing, thus addressing any potential prejudice.

Accordingly, Patent Owner's Motion to Strike is *denied*.

## V. PATENT OWNER'S MOTION TO EXCLUDE

Patent Owner filed a Motion to Exclude portions of Dr. Bokor's alleged new testimony on whether a person of ordinary skill in the art would have reasonably expected MgO(001) to form on amorphous surfaces including CoFeB. PO Mot. Excl. 1. Specifically, Patent Owner seeks to exclude portions of Dr. Bokor's Reply Declaration (Ex. 1105 ¶¶ 6–30), which are relied on in Petitioner's Reply (pages 5–9). *Id*. Patent Owner contends that Dr. Bokor's testimony does not meet the requirements of Federal Rule of Evidence 702 because it is not based on sufficient facts or data and does not meet reliability requirements. *See id*. at 1–2. Patent Owner, in part, asserts that Dr. Bokor is not qualified to opine on MgO thin film crystal formation because he admitted that he was "no expert. I'm no crystal grower." *Id*. at 2, 12 (citing Ex. 2018, 77:9–78:3). Patent Owner contends that Dr. Bokor did not rely on sufficient supporting facts because no reference taught forming MgO(001) on CoFeB; there was no consideration of how amorphous CoFeB would affect crystal formation because, as admitted, substrate material was crucial; and the relied-upon references did not provide a sufficient basis or support the testimony. *Id*. at 3–10. Patent Owner further argues that the testimony is not the product of any scientific principle or method. *Id*. at 10–12. And Patent Owner asserts

that Dr. Bokor has no specialized knowledge helpful to understand MgO formation on amorphous CoFeB. *Id*. at 12–15. Patent Owner also argues that Dr. Bokor's testimony is not admissible under Federal Rule of Evidence 701 as lay opinion. *Id*. at 15.

As discussed, *supra* Section II.D.ii.1, we have determined that Petitioner's arguments and evidence in the Reply properly respond to arguments made on contested issues. Patent Owner has not disputed that Dr. Bokor is qualified as a person of ordinary skill in the art under the qualifications adopted for the purposes of this proceeding. *See* Tr. 90:9–15. Patent Owner instead objects to Dr. Bokor's testimony to the extent he testifies on crystal growth. *See id*.

The Board acts as both the gatekeeper of evidence and the weigher of evidence. "The policy considerations for excluding expert testimony, such as those implemented by the gatekeeping framework established by the Supreme Court in *Daubert v. Merrell Dow Pharm., Inc*., 509 U.S. 579 (1993), are less compelling in bench proceedings such as *inter partes* reviews than in jury trials." *See Nestle Healthcare Nutrition, Inc. v. Steuben Foods, Inc*., IPR2015-00249, Paper 76 at 23 (PTAB June 2, 2016). We take into account the qualifications of an expert witness—and any shortcomings—when evaluating the weight to be given that witness's testimony. Additionally, we weigh the testimony regarding each particular issue on which Dr. Bokor opines considering factual corroboration based on the underlying facts of record, as well as the cohesiveness of the articulated reasoning. *See In re Acad. of Sci. Tech Ctr*., 367 F.3d 1359, 1368 (Fed. Cir. 2004) ("[T]he Board is entitled to weigh the declarations and conclude that the lack of factual corroboration warrants discounting the opinions expressed

in the declarations."); *see also* 37 C.F.R. § 42.65(a) ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight."); *cf. In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016) (Petitioner's burden of proving obviousness cannot be satisfied by mere conclusory statements).

Accordingly, Patent Owner's Motion to Exclude is *denied*.

## VI. CONCLUSION

The outcome for the challenged claims of this Final Written Decision follows.[11] In summary:

| Claim(s) | 35 U.S.C § | Reference(s)/Basis | Claim(s) Shown Unpatentable | Claim(s) Not Shown Unpatentable |
|---|---|---|---|---|
| 1–4 | 103(a) | Bowen, Sunai | 1, 2 | 3, 4 |
| 1–4 | 103(a) | Bowen, Parkin | 1, 2 | 3, 4 |
| 1–4 | 103(a) | Nagahama, Sunai | | 1–4 |
| 1–4 | 103(a) | Nagahama, Parkin | | 1–4 |
| **Overall Outcome** | | | 1, 2 | 3, 4 |

[11] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

## VII. ORDER

It is, therefore,

ORDERED that Petitioner has demonstrated by a preponderance of the evidence that claims 1 and 2 of the '134 patent are unpatentable and Petitioner has not demonstrated by a preponderance of the evidence that claims 3 and 4 of the '134 patent are unpatentable;

FURTHER ORDERED that Petitioner's Motion to Strike is *denied*;

FURTHER ORDERED that Patent Owner's Motion to Strike is *denied*;

FURTHER ORDERED that Patent Owner's Motion to Exclude is *denied*; and

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

PETITIONER:

Michelle Armond
Douglas Wilson
Josepher Li
Monica Arnold
Yue Han
ARMOND WILSON LLP
michelle.armond@armondwilson.com
doug.wilson@armondwilson.com
josepher.li@armondwilson.com
monica.arnold@armondwilson.com
amy.han@armondwilson.com

PATENT OWNER:

Gerald Hrycyszyn
Jie Xiang
Richard F. Giunta
Adam R. Wichman
Thomas A. Franklin
WOLF GREENFIELD & SACKS, P.C.
ghrycyszyn-ptab@wolfgreenfield.com
jxiang-ptab@wolfgreenfield.com
RGiunta-PTAB@wolfgreenfield.com
AWichman-PTAB@wolfgreenfield.com
TFranklin-PTAB@wolfgreenfield.com

# EXHIBIT 2

Director_PTABDecision_Review@uspto.gov
571.272.7822

Paper 56
Date: July 21, 2026

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE OFFICE OF THE UNDER SECRETARY OF COMMERCE FOR INTELLECTUAL PROPERTY AND DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

---

WESTERN DIGITAL TECHNOLOGIES, INC.,
Petitioner,

v.

GODO KAISHA IP BRIDGE 1,
Patent Owner.

---

IPR2024-01447 (Patent 8,405,134 B2)
IPR2024-01493 (Patent 10,680,167 B2)[1]

---

Before JOHN A. SQUIRES, *Under Secretary of Commerce for Intellectual Property and Director of the United States Patent and Trademark Office*.

# ORDER

[1] This order applies to each of the above-listed proceedings.

The Office received a request for Director Review of the Final Written Decision in each of the above-captioned cases and an authorized response to each request. *See* Papers 54, 55.[2]

Having considered the requests and responses, it is:

ORDERED that the requests for Director Review are denied.

[2] Citations are to the record in IPR2024-01447. The parties filed similar papers in IPR2024-01493.

FOR PETITIONER:

Michelle E. Armond
Douglas R. Wilson
Josepher Li
Monica Arnold
Yue Han
ARMOND WILSON LLP
michelle.armond@armondwilson.com
doug.wilson@armondwilson.com
josepher.li@armondwilson.com
monica.arnold@armondwilson.com
amy.han@armondwilson.com

PATENT OWNER:

Adam R. Wichman
Gerald B. Hrycyszyn
Jie Xiang
Thomas A. Franklin
Richard F. Giunta
Scott A. McKeown
WOLF GREENFIELD & SACKS, P.C.
AWichman-PTAB@wolfgreenfield.com
GHrycyszyn-PTAB @wolfgreenfield.com
JXiang-PTAB @wolfgreenfield.com
TFranklin-PTAB @wolfgreenfield.com
RGiunta-PTAB@wolfgreenfield.com
SMcKeown-PTAB@wolfgreenfield.com