

Paper No. ____

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. IPR2024-01493
U.S. Patent No. 10,680,167

PATENT OWNER'S SUR-REPLY TO PETITIONER'S REPLY

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35 U.S.C. §312(a)(3)	6, 11
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REGULATIONS

37 C.F.R. §42.6(a)(3)	16
37 C.F.R. §42.22	6, 11

EXHIBIT LIST

Exhibit	Description
2001	Kittel, C., <i>Introduction to Solid State Physics</i> , 6th Edition, 1986, pgs. 13-15, 18, 23 (“Kittel”)
2002	Duke, C.B., <i>Tunneling in Solids</i> , Solid State Physics: Advances in Research and Applications, 1969, pgs. 1, 6-7, 34-35, 78-79 (“Duke”)
2003	Definition of “ferromagnetism,” Oxford English Reference Dictionary, Second Edition, pg. 513 (“Oxford English Reference Dictionary”)
2004	“Ferromagnetism,” The New Encyclopedia Britannica: Volume 4, 15th Edition, 2003, pgs. 748-749 (“Britannica”)
2005	J-G Zhu and C. Park. “Review Feature: Magnetic tunnel junctions,” <i>Materials Today</i> , vol. 9, no. 11, 2006, pp. 36-45 (“Zhu”)
2006	Djayaprawira, D. et al. “230% room-temperature magnetoresistance in CoFeB/MgO/CoFeB magnetic tunnel junctions,” <i>Applied Physics Letters</i> , vol. 86, no. 9, 2005, pp. 092502-1 to -3
2007	Yuasa, S., et al. “High Tunnel Magnetoresistance at Room Temperature in Fully Epitaxial Fe/MgO/Fe Tunnel Junctions due to Coherent Spin-Polarized Tunneling,” <i>Japanese Journal of Applied Physics</i> , vol. 43, no. 4B, 2004, p. L588
2008	Yuasa, S., et al. “Giant room-temperature magnetoresistance in single crystal Fe/MgO/Fe magnetic tunnel junctions,” <i>Nature Materials</i> , vol. 3, no. 12, 2004, pp. 868-871
2009	Callister, W.D., <i>Fundamentals of Materials Science and Engineering, An Integrated Approach</i> , Department of Metallurgical Engineering, The University of Utah, Second Edition, 2005, pgs. 36-37, G1 (“Callister”)
2010	U.S. Patent No. 6,590,803 to Saito et al. (“the ’803 Patent”)
2011	U.S. Patent Application Publication No. 2002/0036877 to Sakakima et al. (“Sakakima”)

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2012	U.S. Patent No. 6,917,492 to Matsukawa et al. (“the ’492 Patent”)
2013	S. Yuasa et al. “Characterization of growth and crystallization processes in CoFeB / MgO / CoFeB magnetic tunnel junction structure by reflective high-energy electron diffraction,” <i>Applied Physics Letters</i> , vol. 87, no. 24, p. 242503, 2005.
2014	Definitions of “crystalline” and “crystallize,” Webster’s Encyclopedic Unabridged Dictionary of the English Language (1989)
2015	Definitions of “anneal,” “crystalline” and “crystallized,” Webster’s Ninth New Collegiate Dictionary (1984)
2016	Gleiter, H. “Nanostructured Materials: Basic Concepts and Microstructure,” <i>Acta Materialia</i> , vol. 48, no. 1, pp. 1-29 (2000)
2017	Deposition of Jeffrey Bokor, Ph.D. (June 24, 2025)
2018	Deposition of Jeffrey Bokor, Ph.D. (June 25, 2025)
2019	Marrows, C.H. “Spin-polarised currents and magnetic domain walls,” <i>Advances in Physics</i> , vol. 52, no. 8, 2005, pp. 585-713
2020	Tsymbal, E., et al., <i>Handbook of Spin Transport and Magnetism</i> , 2012
2021	RESERVED
2022	Nakatani, T., et al. “Read sensor technology for ultrahigh density magnetic recording,” <i>MRS Bulletin, Materials Research Society</i> , vol. 43, no. 2, 2018, pp. 106-111
2023	Jiang, B., et al. “Tunneling magnetoresistive devices as read heads in hard disk drives,” <i>Journal of Magnetism and Magnetic Materials</i> , vol. 571, 2023, p. 170546
2024	The 23rd (FY2022) Japan Society of Applied Physics Achievement Award Recipients (with English translation), The Japan Society of Applied Physics, <i>available at</i> https://www.jsap.or.jp/outstanding-achievementaward/recipients/recipients23

Exhibit	Description
2025	RESERVED
2026	2021 New Fellows, IEEE Japan Council, <i>available at</i> https://ieeelp.org/en/kaiin/fellow/fellow21.html
2027	JST owned patent wins Future Creative Invention Prize at the National Invention Award 2021, Japan Science and Technology Agency, <i>available at</i> https://www.jst.go.jp/report/2021/210525_e.html
2028	Dr. Shinji Yuasa profile, <i>available at</i> https://www.jst.go.jp/impact/sahashi/en/system/index.html
2029	AIST wins three Science and Technology Awards in the 2016 Minister of Education, Culture, Sports, Science and Technology Commendation for Science and Technology, <i>available at</i> https://www.aist.go.jp/aist_j/news/prize/pr20160412_3.html
2030	Yuasa, S., “IEEE Magnetics Society Distinguished Lecturers for 2012: Magnetoresistance and Spin-Transfer Torque in Magnetic Tunnel Junctions,” <i>IEEE Transactions on Magnetics</i> , vol. 48, no. 1, 2012, p.3
2031	Shinji Yuasa – IEEE Magnetics Society, <i>available at</i> https://ieemagnetics.org/contact/shinji-yuasa#biography
2032	AIST, “Winner of the 20th Tsukuba Award,” <i>available at</i> https://www.aist.go.jp/aist_j/news/prize/itemid025-000077.html
2033	Announcing the winners for “Tsukuba Prize,” “Esaki Leona Prize,” and “Tsukuba Encouragement Prize”: Ibaraki Prefectural Science and Technology Promotion Foundation (with English translation), <i>available at</i> https://www.tsukuba-sci.com/cms/?p=9853
2034	AIST: 34th Inoue Harunari Prize, <i>available at</i> https://www.aist.go.jp/aist_j/news/prize/itemid025-000082.html
2035	Technological seeds that overcome the valley of death (Shinji Yuasa/Head of the Spintronics Group, National Institute of Advanced Industrial Science and Technology), <i>available at</i> https://scienceportal.jst.go.jp/explore/highlight/20090717_01/

Exhibit	Description
2036-2037	RESERVED
2038	Maat, S., et al. “Physics and Design of Hard Disk Drive Magnetic Recording Read Heads,” <i>Handbook of Spintronics</i> , 2014
2039	Butler, et al. “Magnetic Memory: A signal boost is in order,” <i>Nature Materials</i> , vol. 3, no. 12, 2004, pp. 845-847
2040-2047	RESERVED
2048	M. Ohring, <i>The Materials Science of Thin Films</i> , Academic Press (1992).
2049-2051	RESERVED
2052	Google Scholar data page for Djayaprawira, D. et al. “230% room-temperature magnetoresistance in CoFeB/MgO/CoFeB magnetic tunnel junctions,” <i>Applied Physics Letters</i> , vol. 86, no. 9, 2005, pp. 092502-1 to -3
2053	Declaration of Caroline Ross, Ph.D.
2054	CV of Dr. Caroline Ross, Ph.D.
2055	Japanese Patent No. JP 5120680 B2 with certified English translation
2056	File History of U.S. Patent Application No. 10/824835 (EX1092 in <i>Western Digital v. IP Bridge</i> , IPR2025-00701)
2057	Google Scholar data page for Yuasa, S., et al. “Giant room-temperature magnetoresistance in single crystal Fe/MgO/Fe magnetic tunnel junctions,” <i>Nature Materials</i> , vol. 3, no. 12, 2004, pp. 868-871
2058	Saito, Y., et al. “Correlation between Barrier Width, Barrier Height, and DC Bias Voltage Dependences on the Magnetoresistance Ratio in Ir–Mn Exchange Biased Single and Double Tunnel Junctions,” <i>Jpn. J. Appl. Phys.</i> , vol. 39 (2000), pp. L 1035–L 1038.

Exhibit	Description
2059	Powder diffraction file for Au, from Joint Committee of Powder Diffraction Standards (JCPDS), The International Centre for Diffraction Data, icdd.com
2060	I. Petrov et al. “Microstructural evolution during film growth,” <i>Journal of Vacuum Science & Technology A: Vacuum, Surfaces, and Films</i> , vol. 21, no.5, 2003, pp. S117-S128 (“Petrov”)
2061	E. Krikorian and R.J. Sneed. “Nucleation, Growth and Transformation of Amorphous and Crystalline Solids Condensing From the Gas Phase,” <i>Astrophysics and Space Science</i> , vol. 65, 1979, pp. 129-154 (“Krikorian”)
2062	M.O. Aboelfotoh. “Crystal Structure of Evaporated MgO Films on Amorphous and Polycrystalline Substrates,” <i>Journal of Vacuum Science and Technology</i> , vol. 10, no. 5, 1973, pp. 621-625
2063	Errata to EX2017 - Deposition of Jeffrey Bokor, Ph.D. (June 24, 2025)
2064	Errata to EX2018 - Deposition of Jeffrey Bokor, Ph.D. (June 25, 2025)
2065-2071	RESERVED
2072	EX2024 - The 23rd (FY2022) Japan Society of Applied Physics Achievement Award Recipients (with English translation), The Japan Society of Applied Physics, https://www.jsap.or.jp/outstanding-achievementaward/recipients/recipients23 with Amended Certification of Translation [SUPPLEMENTAL EVIDENCE - NOT FILED]
2073	Certified English Translation of EX2029 - AIST wins three Science and Technology Awards in the 2016 Minister of Education, Culture, Sports, Science and Technology Commendation for Science and Technology, <i>available at</i> https://www.aist.go.jp/aist_j/news/prize/pr20160412_3.html [SUPPLEMENTAL EVIDENCE - NOT FILED]

Exhibit	Description
2074	Certified English Translation of EX2032 - AIST, “Winner of the 20th Tsukuba Award,” <i>available at</i> https://www.aist.go.jp/aist_j/news/prize/itemid025-000077.html [SUPPLEMENTAL EVIDENCE - NOT FILED]
2075	Certified English Translation of EX2034 - AIST: 34th Inoue Harunari Prize, <i>available at</i> https://www.aist.go.jp/aist_j/news/prize/itemid025-000082.html [SUPPLEMENTAL EVIDENCE - NOT FILED]
2076	Certified English Translation of EX2035 - Technological seeds that overcome the valley of death (Shinji Yuasa/Head of the Spintronics Group, National Institute of Advanced Industrial Science and Technology), <i>available at</i> https://scienceportal.jst.go.jp/explore/highlight/20090717_01/ [SUPPLEMENTAL EVIDENCE - NOT FILED]
2077	Declaration of Caroline Ross, Ph.D. [SUPPLEMENTAL EVIDENCE - NOT FILED]
2078	Declaration of Dara Del Rosario [SUPPLEMENTAL EVIDENCE - NOT FILED]
2079	Transcript of October 29, 2025 Board Conference Call
2080	U.S. Patent Application Ser. No. 10/824,835 [cited as deposition EX2079 in EX2085, Deposition of Jeffrey Bokor, Ph.D. (Oct. 30, 2025)]
2081	U.S. Patent Application Ser. No. 10/646,246
2082-2084	RESERVED
2085	Transcript of Deposition of Jeffrey Bokor, Ph.D. (Oct. 30, 2025)
2086	Transcript of Deposition of Jeffrey Bokor, Ph.D. (Oct. 31, 2025)
2087	RESERVED

Exhibit	Description
2088	Errata to EX2085 - Deposition of Jeffrey Bokor, Ph.D. (Oct. 30, 2025)
2089	Errata to EX2086 - Deposition of Jeffrey Bokor, Ph.D. (Oct. 31, 2025)

I. Introduction

The '167 Patent claims Yuasa's award-winning method for manufacturing an MTJ with an MgO(001) barrier on amorphous CoFeB. Before Yuasa's invention, manufacturing MgO(001) MTJs required painstaking processes. A crystalline(001) underlayer templated the formation of a lower electrode as crystalline(001) thereon, the lower electrode templated MgO(001) barrier formation thereon, and the MgO(001) barrier templated crystalline(001) upper electrode formation thereon. That was too complicated for mass production.

Yuasa's invention eliminated the complexity. Yuasa formed a *non-crystalline* amorphous CoFeB layer, formed an MgO layer on that amorphous CoFeB, formed another amorphous CoFeB layer on the MgO, then annealed the entire structure. This yielded crystallized CoFeB layers and an MgO(001) barrier, which objective evidence shows was surprising. *Infra* §VII. Yuasa's invention was praised for simplifying MgO MTJ manufacture, making them mass-produceable and unleashing commercial applications. *Id.* This is *undisputed*. Petitioner's expert Bokor admitted it. *Id.*

Petitioner found no prior art reference describing a manufacturing method remotely like Yuasa's claimed method. POR, 26-27. Petitioner's primary references (Bowen and Nagahama) used the conventional crystalline(001)-templating approach that bore no resemblance to Yuasa's method.

The Petition relied on Bowen/Nagahama's manufacturing methods to meet the claimed method and only alleged POSAs would have modified the material (from iron to CoFeB) used to form the lower electrode. POR, 5-13. But Petitioner's expert Bokor admitted Bowen/Nagahama's manufacturing methods would not have worked with amorphous CoFeB and that POSAs would not have annealed the lower electrode—as Bowen/Nagahama did—before forming an MgO barrier thereon if the lower electrode was CoFeB. POR, 5-8, 11-13. The Reply's assertion that Petitioner's combinations eliminated that annealing step is baseless. The Petition relied on Bowen/Nagahama's step of annealing the lower electrode before forming MgO on it (*id.*, 8-11), as the Board recognized for the Bowen ground. Paper 9 ("DI"), 15-16; *id.*, 22 (Nagahama ground not addressed). Petitioner should be held to the manufacturing methods the ***Petition*** identified. That is fatal to the Petition because it is undisputed that POSAs would not have adopted such methods because they would not have worked.

Even if the Board accepts Petitioner's belated disavowal of Bowen/Nagahama's electrode annealing step, the grounds fail because Petitioner's combinations violate everything Bowen/Nagahama taught about how to make an MTJ with an MgO(001) barrier. Bowen/Nagahama used the conventional approach that relied on a crystalline(001) structure of each layer to template crystalline(001) formation of the layer above it. The combinations indisputably abandon this

operative templating principle.

Finally, Petitioner fails to refute the *Petition*'s failure to establish a reasonable expectation of success in forming an MgO(001) barrier layer on amorphous CoFeB. POR, 12-29. The Reply does not meaningfully defend the Petition's failed showing. Instead, it advances new arguments, based on new evidence, in a belated attempt to establish *prima facie* obviousness. Those arguments—that (1) Parkin formed MgO(001) on amorphous CoFeB and (2) POSAs reasonably expected success in forming MgO(001) on amorphous CoFeB because newly-cited prior art allegedly disclosed MgO(001) forming on *different* amorphous surfaces—are subject to a Motion to Strike (Paper 30) and should not be considered. If considered, they fail.

Petitioner bases its assertion that Parkin discloses forming MgO(001) on amorphous CoFeB on a mischaracterization of “Figure 3A’s ‘inverted embodiment’” shown in Fig. 11. Reply, 7. Parkin forms Fig. 11’s MgO barrier 540 on crystalline(001) layer 520 (Parkin, 22:67-68) using “methods” in incorporated applications (*id.*, 23:6-11, 19:1-6) that Parkin explains form MgO(001) on a *crystalline(001) layer*—not on amorphous CoFeB (*id.*, 3:24-41). Petitioner and Bokor ignored this disclosure and are wrong about Parkin Fig. 11. *No prior art reference taught forming an MgO(001) barrier on amorphous CoFeB.*

The Reply’s reliance on new evidence purportedly showing MgO(001) formation on *different* amorphous surfaces fails. Reply, 7-10. No prior art reference supports Petitioner’s assertion that POSAs would have considered this informative of how an MgO barrier would form on amorphous **CoFeB**. All Petitioner has is the naked say-so of Bokor. But Bokor’s testimony is not credible. He is “*no expert*” in crystal growth. EX2018, 77:19, 77:9-78:3.¹ Bokor admitted crystal growth is very complicated and that he did not consider, or even understand, many relevant considerations. *Infra* §§VI.A, VI.D. Patent Owner (“IPB”)’s expert Ross *is* an expert in crystal formation. She explained that given the complexities of crystal formation on CoFeB, POSAs would not have considered teachings for different amorphous surfaces to be informative. *Infra* §VI.D.1. Extensive evidence—including objective evidence praising Yuasa’s surprising results—corroborates her testimony. *Infra* §§VI.D.3, VII.

II. Bokor Admits the Combinations Are Unworkable

Bowen’s/Nagahama’s manufacturing methods—which anneal a lower Fe electrode before forming MgO on it—would not work with amorphous CoFeB electrodes, and POSAs would not have used them. POR, 5-13. Bokor admitted this. EX2018, 169:16-171:19, 173:2-5. That the claims do not require annealing the

¹ All emphasis added.

lower electrode before forming the MgO barrier (Reply, 2) is irrelevant obfuscation because Petitioner's **grounds** do and it is undisputed that they must describe a workable process to establish obviousness. POR, 4-13.

The Petition contradicts the Reply's contention that the grounds eliminated Bowen's/Nagahama's step of annealing the lower electrode before forming MgO on it. Reply, 2-3. The grounds relied on the manufacturing methods in Bowen/Nagahama. Petition, 21 ("Bowen taught... a method of manufacturing a [MTJ] device as claimed"), 49 (same for Nagahama). Petitioner's **only** modification concerning the lower electrode was changing its **material** from Fe to CoFeB. POR, 9-11; Petition, 23-29 (Bowen), 50-55 (Nagahama). "[S]ubstitut[ing]" the **material** (Reply, 2) does not eliminate Bowen's/Nagahama's step of annealing the lower electrode before forming MgO on it. POR, 8-9; EX1026, 1655; EX1027, [0062] (step (7)).

Ground 1 relied on Bowen's annealing step. Petition, 30 ("Bowen taught... annealing... its bottom electrode"). The Board saw this. DI, 15 ("***we agree with Petitioner*** and find that ***Bowen teaches annealing its Fe bottom layer***"). And Bokor admitted he did not modify Bowen's annealing step. EX2018, 172:18-24, 180:24-181:8; *generally id.*, 172:18-182:11.

Ground 2 relied on Nagahama's step of annealing the lower electrode before forming MgO on it. Petition, 50 (*citing EX1027, [0062]* for Nagahama's "method

of manufacturing”); EX1027, [0062] (*annealing* step (7)); DI, 22 (not addressing Ground 2).

If the Petition “substituted... out” annealing the lower electrode in Bowen/Nagahama (Reply, 2-3), Petitioner should have been able to provide a pinpoint citation. It cites *nothing* because the Petition never made that argument. EX2018, 172:18-24 (Bokor admitted he never said this for Bowen). The Petition must state its grounds with “particularity” and provide a “detailed explanation” clearly explaining its combinations. 35 U.S.C. §312(a)(3); 37 C.F.R. §42.22; POR, 4, 6, 19-21 (*citing Personal Web*). Those requirements prevent Petitioner from leveraging alleged ambiguity in the Petition to change course and offer a different theory after the grounds are proven deficient. *Wasica Finance v. Cont'l Auto. Sys.*, 853 F.3d 1272, 1286–1287 (Fed. Cir. 2017). The Board should not allow it.

III. Petitioner Never Refutes That Its Combinations Destroy the Principle of Operation of Bowen’s/Nagahama’s Manufacturing Methods

The Reply fails to refute that Petitioner’s combinations fail because they alter Bowen’s/Nagahama’s *manufacturing processes* contrary to their principle of operation. POR, 39-40 (*citing caselaw*).

Petitioner never disputes the operative *manufacturing* principle in Bowen/Nagahama is templating—each forms a crystalline(001) underlayer to template formation of a crystalline(001) lower electrode, which templates formation of an MgO(001) barrier. The combinations eviscerate this templating

principle by **replacing** Bowen’s/Nagahama’s **crystalline(001)** electrode with **non-crystalline amorphous** CoFeB. POR, 30-39; *Netflix v. DivX*, No. 2021-1931, 2022 WL 2298983, at *3, 5-7 (Fed. Cir. June 22, 2021) (affirming Board finding that **method** claims were not proven unpatentable because POSAs were not motivated to make a combination that changed the primary reference’s “basic principle of... operation”).

The Reply obfuscates. IPB did not allege that a CoFeB electrode would “subvert the operation of Bowen’s/Nagahama’s MTJ” **device**. Reply 15 (citing *Mouttet* to allegedly refute this strawman); *see also id.* (“**MTJ’s** Principle of Operation” does not change). The claims recite **methods of manufacture**—not a device. Petitioner never refutes IPB’s argument that Petitioner’s combinations change the “principle of operation” of Bowen’s/Nagahama’s **manufacturing processes**. Reply, 15; POR, 39-40.

Petitioner’s remaining argument that Parkin “already” formed MgO(001) barriers on CoFeB electrodes fails. Reply, 15.

First, the combinations modify **Bowen’s/Nagahama’s** manufacturing methods—not Parkin’s. POR, 30-39.

Second, touting performance of Parkin’s **device** says nothing about Parkin’s **manufacturing process**. Reply, 15.

Third, Petitioner cites Parkin’s disclosure that Fig. 3A’s device can be

“inverted” (*id.*) as in Fig. 11 (*id.*, 5-7) but ignores Parkin’s *process* for forming Fig. 11’s device. Parkin formed Fig. 11’s MgO(001) barrier 540 using a templating crystalline(001) layer 520. EX1062, 23:5-10, 3:24-41; *infra* §VI.B. Parkin provides no support for discarding Bowen’s/Nagahama’s operative templating principle – forming an MgO(001) barrier on a crystalline(001) layer—because Parkin used it too. POR, 39-40; *Netflix*, 2022 WL 2298983, at *3, 5-7; *Plas-Pak Indus. v. Sulzer Mixpac*, 600 F. App’x 755, 759 (Fed. Cir. 2015) (affirming Board’s non-obviousness finding and explaining “[A] change in a reference’s ‘principle of operation’ is unlikely to motivate [POSAs] to pursue a combination with that reference.”).

Petitioner’s combinations abandon Bowen’s/Nagahama’s operative manufacturing principle by eliminating the templating that achieves an MgO(001) barrier in favor of an approach nowhere taught in the prior art. That fails to establish obviousness.

IV. The ’167 Patent Describes Forming MgO(001) on CoFeB

Petitioner’s contention the ’167 Patent “provides nothing on how to fabricate MgO(001) on an amorphous layer” is false. Reply, 12. The ’167 Patent explains forming amorphous CoFeB, forming MgO on it, and annealing the device to achieve MgO(001). EX1013, 8:43-9:27 (modifying embodiment without epitaxial MgO to use CoFeB electrodes and “an anneal process after preparation of the MTJ

device,” yielding the ’167 Patent Fig. 11’s MTJ with MgO(001) and crystallized CoFeB), Fig. 11; EX2023, 2 (praising Yuasa’s “novel idea[]” forming MgO on “CoFeB amorphous... electrodes” wherein “[u]pon annealing CoFeB and MgO can be crystallized to BCC structures.”).

V. Petitioner Never Refutes the Petition’s Failure to Establish a Reasonable Expectation of Success in Achieving MgO(001) On Amorphous CoFeB

Every claim requires forming an MgO(001) barrier on amorphous CoFeB. *See* Limitations 1[b]/1[e] and 11[b] (“MgO(001) limitations”). The Petition never established *prima facie* obviousness for either ground because it never alleged, and cited no *evidence* establishing, that POSAs would have reasonably expected either ground’s process to achieve MgO(001) on the amorphous CoFeB that replaces Bowen’s/Nagahama’s crystalline(001) lower electrode. POR, 19-21; *id.*, 12-29.

It is undisputed that the Petition mapped the MgO(001) limitations to *unmodified* Bowen/Nagahama and never addressed how or why its *combinations*’ manufacturing methods—that remove the crystalline(001) layer on which MgO(001) formed in Bowen/Nagahama—allegedly would have yielded MgO(001). Petition, 33 (1[e]: “**Bowen taught**... this limitation”), 57 (1[e]: “**Nagahama taught**... this limitation”); POR, 12-29. It also is undisputed that Ground 1’s assertion that POSAs had reason to replace Bowen’s single-crystal MgO(001) with polycrystalline MgO(001) (Petition, 33) says nothing about why

polycrystalline MgO(001) allegedly would have formed in Ground 1's combination. POR, 12-29. As Petitioner admits, polycrystalline MgO(001) formed in Nagahama on a **crystalline(001)** electrode. Petition, 57 (*citing* EX1027, [0073]).

Even if the Petition is read as having alleged POSAs would have reasonably expected MgO(001) to form on amorphous CoFeB in its combinations (it did not), it is undisputed that **no evidence** the Petition cited to meet the MgO(001) limitations establishes that. POR, 12-29.

A. Petitioner Misapplies the Law

Petitioner concedes "blind adherence to Bowen's/Nagahama's fabrication steps" would not achieve MgO(001). Reply, 4. Petitioner was required to explain each combination's contemplated workings as a "prerequisite to adequately explaining and supporting a conclusion that a [POSA] would have... reasonably expect[ed] success" in achieving the claim. POR, 19 (*citing Personal Web*). That a "brief explanation" may suffice (Reply, 12) is **irrelevant** because the Petition has **no** explanation of how either ground allegedly achieves an MgO(001) barrier. Moreover, Petitioner omits *Personal Web*'s statement that a brief explanation may suffice **if** "the **technology is simple and familiar** and the prior art is clear." Reply, 12. The technology is indisputably not "simple." EX2085, 178:13-179:3, 201:12-202:5 (Bokor admitting crystal growth is "very complicated"); 156:23-157:8,

185:8-186:15 (Bokor admitting he did not understand parameters impacting crystal formation).

That the expectation of success showing need not be “absolute” (Reply, 4) is immaterial because the Petition made *no* showing that POSAs would have reasonably expected either ground’s process to yield an MgO(001) barrier on amorphous CoFeB.

B. Petitioner Should Be Held to the Petition’s Failed Arguments

Petitioner must make its case “with particularity” *in the Petition*. 35 U.S.C. §312(a)(3); 37 C.F.R. §42.22. The Petition never addressed the impact eliminating Bowen’s/Nagahama’s crystalline(001) Fe layer would have had on a POSA’s expectation of whether an MgO(001) barrier would form in its combinations. That is stunning given the evidence that POSAs would *not* have expected MgO(001) to form on CoFeB. POR, 12-29; *infra* §§VI.C-VI.D. The Board should hold Petitioner to the *Petition’s* arguments and find that the Petition failed to establish a reasonable expectation of success in meeting the MgO(001) limitations with either ground’s process.

VI. New Reply Arguments Fail If Considered

The Reply argues: (1) Parkin discloses forming MgO(100) on amorphous CoFeB (Reply, 2-5) and (2) forming MgO(001) on *different* amorphous materials gave POSAs a reasonable expectation of success in achieving MgO(001) on

amorphous CoFeB (*id.*, 7-10). The Petition never made these arguments so they should not be considered. If considered, they fail.

A. Petitioner’s New Arguments Hinge on Untrustworthy Bokor Testimony

Bokor admitted evaluating whether MgO(001) would have been expected to form on amorphous CoFeB involves “very complicated” crystal growth dynamics. EX2085, 178:5-179:3, 201:12-202:7. Bokor admitted “*I’m no expert. I’m no crystal grower.*” EX2018, 77:9-78:3. Bokor is unqualified to offer testimony on MgO crystal formation. Petitioner cannot carry its burden because it lacks credible expert testimony in this “very complicated” area. EX2085, 178:13-179:3, 201:12-202:7; *Wyers v. Master Lock*, 616 F.3d 1231, 1240 n.5 (Fed. Cir. 2010) (“expert testimony... is sometimes essential... in cases involving complex technology”).

As detailed below, Bokor’s testimony also warrants no weight because it is conclusory, and refuted by the documentary evidence and Ross who is indisputably a world-leading expert on crystal growth and material science. EX2053, ¶¶2-10.

B. Parkin Does Not Form MgO(001) on Amorphous CoFeB

The Reply cites *different* Parkin disclosure (*e.g.*, Fig. 11) uncited in the Petition to advance the *different* argument that Parkin teaches “forming a polycrystalline MgO(001) tunnel barrier over an *amorphous CoFeB* layer.” Reply, 5-7. That is improper. *Ariosa Diagnostics v. Verinata Health*, 805 F.3d 1359, 1367 (Fed. Cir. 2015) (affirming Board’s refusal to consider Reply arguments relying

“on previously unidentified portions of a prior-art reference to make a meaningfully distinct contention”).

Petitioner obfuscates by alleging Parkin discloses MgO(100) “atop” or “over” amorphous CoFeB. Reply, 5-7. The combinations indisputably form the MgO barrier *on* amorphous CoFeB (Petition, 28-29, 54-55) which Parkin does *not* disclose; Parkin forms its MgO(001) barrier *on* a crystalline(001) layer.

1. Fig. 3A Device

Petitioner never disputes Parkin achieved **MgO(001) barrier 120'** in Fig. 3A (annotated below) by forming it on **crystalline CoFe(001) layer 119**. EX1062, 9:58-10:2, 13:10-25, 17:11-39; POR, 14-16; EX2053 ¶¶84-94 (forming MgO on a crystalline(001) layer promotes MgO(001)).

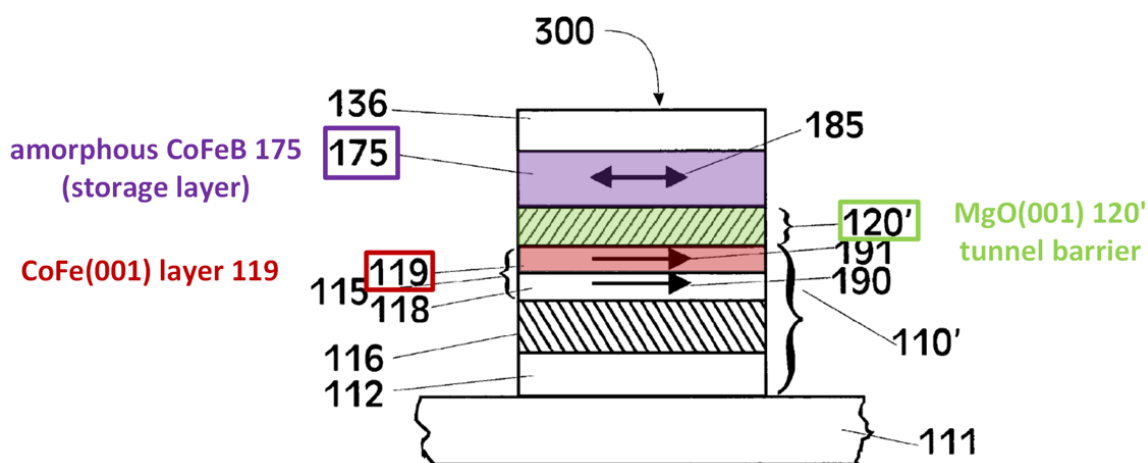


FIG. 3A

Parkin forms “**MgO tunnel barrier 120'**” on “electrode 110' using the method [in] application [] 10/824,835” (“‘835-Application”) (Parkin, 17:21-28) that Parkin incorporates by reference and characterizes as forming an **MgO**

barrier on an electrode “comprised of a **Co—Fe alloy**, which is **bcc and (100) textured**” (*id.*, 3:24-37). EX2053, ¶¶90-91. That is what the ’835-Application describes. EX2080, 26:5-19, 58:1-5, 25:8-10, 24:21-25:1, 27:10-18, 35:10-18, 45:19-46:12.² Bokor admitted this. EX2085, 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.

2. “Inverted” Fig. 3A Does Not Disclose MgO(001) on Amorphous CoFeB

Both experts—and *Parkin*—refute Petitioner’s suggestion that “inverted” Fig. 3A (EX1062, 17:7-10) discloses forming MgO(001) on amorphous CoFeB (Reply, 5-7). Petitioner’s “predictable results” argument fails because it depends on that false premise. Reply, 13; POR, 27-29.

Fig. 3A’s MTJ has “reference” electrode 115 (fixed polarization) beneath, and “storage” electrode 175 (variable polarization) above, MgO barrier 120’. EX1062, 16:47-17:7. “Inverted” means inverting the reference/storage electrode positions so the storage electrode is beneath the MgO barrier. *Id.*, 17:7-10; EX1101, 157:5-9. Petitioner’s suggestion that Parkin says Fig. 3A’s storage electrode remains entirely CoFeB when moved beneath the MgO is wrong.

Parkin’s Fig. 11 (annotated below) shows Fig. 3A’s device “*inverted* so that the storage... electrode is formed beneath” MgO barrier 540. Parkin, 22:29-33.

² EX2080 is cited as EX2079 in EX2085.

Fig. 11 **adds crystalline CoFe(001) layer 520** to “**storage electrode 510**” (Parkin, 22:56-23:11) to provide a template for forming **MgO(001) barrier 540** using the ’835-Application’s method. *Id.*, 22:66-23:11.

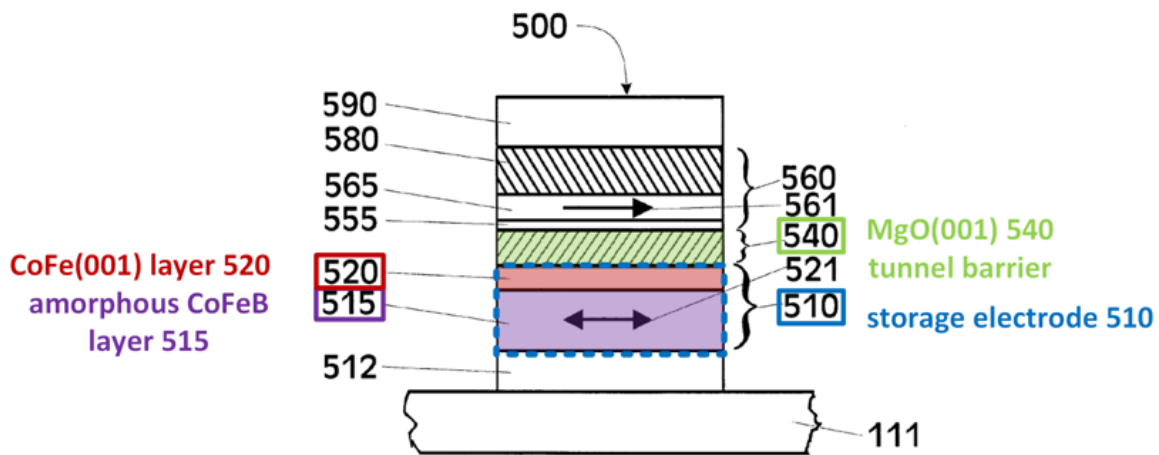


FIG. 11

Both experts refute Petitioner’s (mis)reading of Parkin’s “inverted” Fig. 3A. EX2085, 43:24-44:10 (**Bokor** admitted: in EX1062, 17:7-10, “[Parkin] is not describing the composition of the layers”), 42:8-43:9, 44:15-45:24; EX1101, 159:4-9 (Ross: Parkin “merely says the device may be inverted. It doesn’t give any further details”), 160:18-161:5 (“we don’t know which of the layers are actually flipped”). **Bokor** conceded he found no disclosure in Parkin of forming MgO(001) on amorphous CoFeB other than his *different* contention (discussed *infra* §VI.B.3) that Parkin allegedly says Fig. 11’s **interface layer 520** is “optional.” EX2085, 117:15-120:4.

Parkin never says MgO(001) would form on amorphous CoFeB.³

3. Petitioner Mischaracterizes Fig. 11

The Petition never cited Parkin Fig. 11 or argued that crystalline(001) CoFe **interface layer 520** is optional. *Supra* §V (Petition's arguments). *The Reply also never argues* that **layer 520** is optional but cites new Bokor evidence alleging this. Reply, 7 (*citing* EX2018, 134:1-138:11). That argument cannot be incorporated by reference into the Reply. 37 C.F.R. §42.6(a)(3). This impermissible new argument should not be considered. Paper 30. If considered, it fails.

Despite the Reply's color annotation *misrepresenting CoFe(001) layer 520* as "CoFeB" (Reply, 7), bottom electrode 510 in Fig. 11 (annotated below) has **amorphous CoFeB layer 515** and **crystalline(001) Co₇₀Fe₃₀ interface layer 520**. EX1062, 22:56-23:1, 3:24-37. **MgO tunnel barrier 540** is "formed according to the methods described in" EX2080 ('835-Application) and EX2081("246-Application") which form MgO(001) on a crystalline(001) layer like **interface layer 520**. EX1062, 23:6-11, 3:24-37; EX2080, 35:12-18; EX2081, 91:5-21.

³ POSAs would not expect MgO to be crystalline(001) if formed on amorphous CoFeB. EX1101, 157:15-161:20

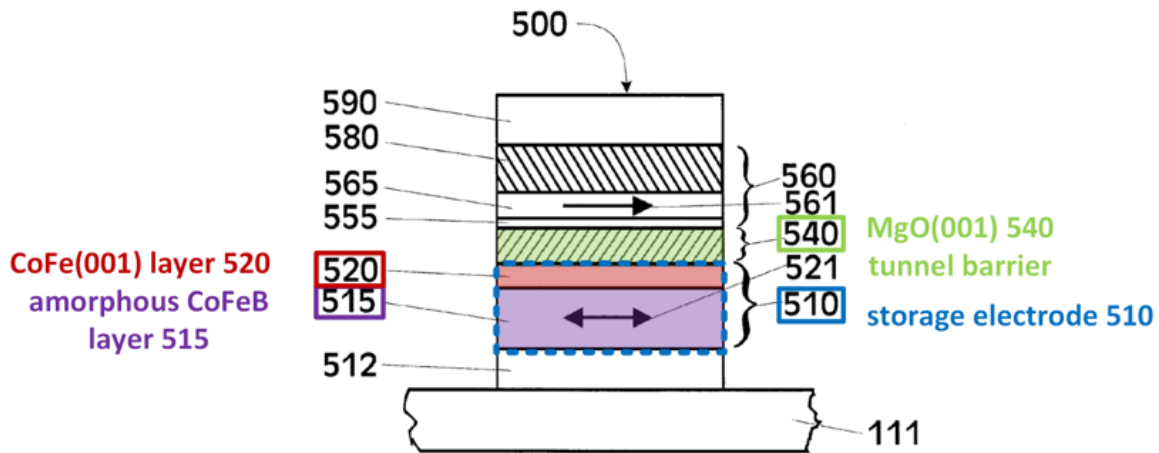


FIG. 11

At deposition, Bokor newly-argued that Parkin forms MgO(001) on amorphous CoFeB based solely on his assertion that **interface layer 520** is “optional.” EX2018, 134:24-135:6, 135:15-20; EX2085, 117:15-120:4. If considered, this argument fails.

First, 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. It says **interface layer 520** “may be” *CoFe*. That comports with Parkin’s disclosure that another crystalline(001) layer 119 “may be formed from *Co₇₀Fe₃₀*” (*id.*, 13:10-13). Parkin’s teaching that the crystalline(001) layer templating the MgO barrier can be “formed from” different crystalline(001) materials never says **layer 520** is optional. EX2085, 52:3-20 (Bokor conceded POSAs could read Parkin as saying “an interface layer of something else may also be used”); 53:3-14 (similar).

Second, Petitioner’s (mis)reading is inconsistent with Parkin’s teaching to form Fig. 11’s **MgO(001) barrier 540** using the methods in EX2080-EX2081 (Parkin, 23:6-11) which, as **Parkin** itself says (Parkin, 3:24-41), form MgO on a crystalline(001) layer. *Supra* §VI.B.1 (EX2080 citations); EX2081, 91:5-21. Bokor admitted Parkin says Fig. 11’s MgO is made using the ’835-Application’s method employing a crystalline(001) layer (EX2085, 107:8-108:4) and could identify no ’835-Application disclosure of forming an MgO(001) barrier on amorphous CoFeB (EX2085, 55:1-75:21, 100:21-108:4). The ’835- and ’246-Applications—which Petitioner and Bokor ignored—directly refute Petitioner’s assertion that Parkin formed Fig. 11’s MgO(001) on amorphous CoFeB.

Third, objective evidence acknowledged Parkin’s well-known work yet attributed discovery of MgO(001) formation on amorphous CoFeB to Yuasa. *Infra* §VII. No one has ever interpreted Parkin the way Petitioner does despite Parkin’s work having been cited over 4,000 times. *Id.*

C. No Prior Art Reference Formed MgO(001) on CoFeB

Bokor found no other prior art allegedly teaching MgO(001) formed on amorphous CoFeB (EX2085, 95:7-97:1) and admitted the **sole basis** for his opinion that this was known was his contention that Parkin’s Fig. 11 **interface layer 520** was “optional” (EX2085, 114:17-23, 117:15-120:4). Because Parkin’s Fig. 11 MgO(001) barrier was formed on a crystalline(001) layer (*supra* §VI.B.3),

Petitioner failed to identify *any* prior art reference that formed MgO(001) on amorphous CoFeB.

D. Petitioner's New Argument that MgO Formation on Other Amorphous Surfaces Provided a Reasonable Expectation of Success Fails

The Reply's argument that MgO(001) formation on other amorphous materials provided an expectation of success in forming MgO(001) on amorphous CoFeB (Reply, 7-10) was not in the Petition (*supra* §V) and should not be considered. Paper 30. If considered, this argument fails.

1. Petitioner's Argument Rests on Unreliable Bokor Testimony

It is undisputed that no *prior art* teaches that MgO(001) formation on another amorphous substrate was predictive of forming an MgO(001) barrier on amorphous CoFeB. The only evidence Petitioner cites to purportedly link its new evidence to a reasonable expectation of success in forming an MgO(001) barrier on amorphous CoFeB is Bokor's naked say-so. Bokor is unqualified to offer that opinion. Bokor admitted MgO crystal formation "is very complicated" (*supra* §§V.A, VI.A) and he is *not a crystal growth expert* (*supra* §VI.A).

Petitioner never disputed that Ross is expert in materials science, thin film growth and crystal growth. EX2053, ¶¶2-10. Ross is unequivocal that POSAs would *not* have expected MgO to crystallize on amorphous CoFeB before Yuasa unexpectedly showed it could be done and her testimony extensively cites

corroborating evidence. EX2053, ¶¶149-173, 287-326; POR, 1-2, 6-7, 21-27, 56-68.

Ross explained why Petitioner's art disclosing forming MgO on SiO₂ was not predictive of MgO(001) barrier formation on CoFeB. EX2053 ¶¶149-167.

"MgO nucleation and grain growth *depended crucially* on multiple factors including" the substrate material. *Id.*, ¶164; POR, 24-25.

Bokor admitted crystal growth depends "*crucially on the material of the substrate*" (EX2085, 154:13-155:2), on the "*surface energy of the substrate*" (*id.*, 158:8-18), and other parameters (*id.*, 152:17-158:18). Bokor has a "*limited understanding*" of these parameters. EX2085, 154:1-157:11. In opining that POSAs would have reasonably expected MgO(001) to form on amorphous CoFeB, he did "not undertake[] a detailed analysis of the mechanism involved and all the different parameters" (*id.*, 152:17-153:15) and admitted he did not even *understand* many of the factors (*id.*, 185:10-186:3). Bokor conceded he did not consider the impact that *a different material (amorphous CoFeB)* would have had on MgO crystallization. *Id.*, 179:7-22, 176:10-178:4, 172:7-176:23.

Bokor said it would take a "rather *extensive independent study* [to] answer questions about the precise mechanisms for the *formation of the highly oriented MgO on any particular surface*" like amorphous CoFeB. *Id.*, 153:2-15. Bokor did not do that "independent study." Instead, his "analysis" was limited to citing

“references that said that results obtained [] in that particular study indicated that [MgO(001)] would grow on *any* amorphous surface. And [CoFeB] falls within the category of any amorphous surface.” EX2085:180:22-181:7; 176:25-177:19 (similar).

No prior art reference says MgO(001) “would grow on *any* amorphous surface.” *Infra* §VI.D.2. Bokor *assumed* MgO(001) would form on CoFeB if it formed on other amorphous surfaces. He lacked the expertise to offer that opinion and Petitioner’s own evidence refutes it.

2. No Evidence Teaches that MgO(001) Forms on All Amorphous Substrates

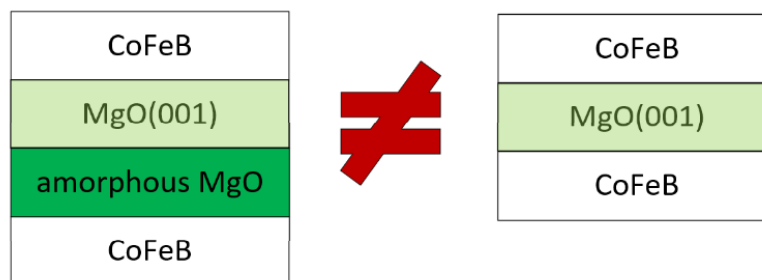
Petitioner says Nagahama, APL (EX2006), Nature (EX2008), Wulff (EX1036), and Tonouchi (EX1099), teach that MgO(001) forms on *any amorphous substrate* and thereby implicitly teach MgO(001) would form on amorphous CoFeB. Reply, 7-10. These references *refute* Petitioner’s argument.

a. MgO Seed Layers Are Not MgO(001) Barriers

Nagahama: Petitioner cites Nagahama Fig. 12’s MgO “*seed* layers” (double underlayers 202-203) on which Nagahama builds its MTJ (205) that Ground 2 relies on. Reply, 8; EX2053, ¶¶208-211; POR, 38-39. *Seed* layers 202-203 are not Nagahama’s MgO *barrier* Petitioner mapped to the MgO(001) limitations. Petition, 54-55; EX1105, ¶13 (Bokor admitted an “MgO(001) *seed* layer is not a tunnel *barrier*”).

Petitioner concedes MgO layer 202 in Nagahama's Fig. 12 is *amorphous* at its interface with substrate 201 and only MgO layer 203 crystallizes. Reply, 8; EX1027, [0056]-[0059]. This corroborates Ross's explanation that MgO is expected to have a non-crystalline orientation at its interface with an amorphous substrate and crystallizes only at thicknesses away from the substrate. EX2053, ¶¶159-167.

An MTJ's MgO *barrier* must be crystallized at its interface with each electrode. EX2085, 123:18-124:5 (*Bokor* admitted); EX1046, 4. The Petition alleged Butler's/Nagahama's barriers, with MgO(001) at the electrode interfaces, met the MgO(001) limitations. Petition, 28-29, 54-55. If MgO formed on a CoFeB electrode the way Nagahama's seed layers formed (with an *amorphous* MgO layer 202 on the amorphous undersurface), that would not yield the structure Petitioner mapped to the MgO(001) limitations. Thus, Nagahama's *seed layer* teachings *refute* Petitioner's assertion that POSAs would have reasonably expected success in forming an MgO(001) *barrier* on amorphous CoFeB in Petitioner's combinations.



Yuasa Nature Materials (EX2008)/Inaba (EX1098): EX2008

characterizes Inaba as teaching that Fe(001)/MgO(001)/Fe(001) MTJs can be prepared on any substrate using an “***MgO(001) seed layer.***” EX2008, 870; Reply, 9-10. Inaba says MgO has no crystal structure at its interface with a substrate and only crystalizes at thicknesses away from the interface. EX1098, 2373 (“MgO initial layer shows ***no clear crystallographic structure*** up to around a few nm from the Si substrate”). Petitioner’s reliance on Inaba’s seed layer fails for the same reasons as its reliance on Nagahama’s seed layers.

b. Wulff (EX1036)/Tonouchi (EX1099)

Petitioner’s suggestion that Wulff taught forming MgO(100) on substrates beyond the alumina, sapphire, and float glass he studied (EX1036, 150), is baseless. Reply, 10. Wulff’s reference to MgO growth “regardless of the substrate selection” summarizes Tonouchi (reference [8])’s below-discussed results. EX1036, 148.

Petitioner falsely alleges Tonouchi “confirmed MgO(100) grew ‘regardless of the substrate’” and saw “no material difference between 1- and 100-nm MgO layers.”⁴ Reply, 8. Tonouchi acknowledged the well-known understanding (EX2053, ¶¶153-167) that sufficiently-thick MgO layers can form crystalline(100)

⁴ IPB’s request to have Ross address Tonouchi was denied. Paper 29.

and investigated whether this “maintains at one monolayer of MgO deposition.” EX1099, 962.

Tonouchi deposited MgO on multiple substrates. *Id.*, 962-964. Petitioner seizes on Tonouchi’s teaching that MgO(001) formed at the surface with one (SiO₂) which Tonouchi attributed to “structural surface deformation” which would be absent in a *flat* MTJ electrode. Reply, 10; EX1099, 964; EX2085, 201:4-22 (Bokor admitted Tonouchi did not understand why crystalline MgO formed in a thin layer on SiO₂), 192:19-23 (MTJ electrode must “be very flat”). Petitioner ignores Tonouchi’s teaching that MgO did not form at the interface for *other substrate* materials (InP, GaAs). EX1099, 964. Tonouchi refutes that MgO(001) would form “regardless of the substrate.” Reply, 10.

c. Wang-1997 (EX1097)

Wang-1997 formed MgO(001) on Si₃N₄. Reply, 7; EX1097, 2955. Wang-1997 says nothing about crystallizing MgO on any other substrate. It is undisputed that MgO crystal formation depends on many factors including the substrate material. POR, 39-42; EX2053 ¶¶153-167. Tonouchi’s findings corroborate this. *Supra* §VI.D.2.b.

Bokor never considered, and *did not even understand* many of, the factors impacting MgO crystal formation. *Supra* §§VI.A, VI.D.1. Petitioner cites no credible evidence that POSAs would have expected Wang-1997’s teaching for

Si₃N₄ (not a metal) to be predictive of forming MgO(001) on CoFeB (a metal).

Moreover, Wang-1997's process is incompatible with MTJs. EX2085, 188:12-190:14, 192:19-194:8 (Bokor could not explain how Wang-1997's ion-beam-assisted deposition could form an MTJ without damaging the ferromagnetic layer, which must "be very flat" (*id.*, 192:19-23)).

d. APL (EX2006)

Petitioner's contention that Yuasa's APL paper "refutes" that MgO(001) forming on CoFeB was surprising, because APL cites Wang-1997's MgO(001) growth on amorphous Si₃N₄, is extraordinary. Reply, 9. In the *same paragraph* that cites Wang-1997, APL says: "***Surprisingly***, the MgO layer, grown on the amorphous CoFeB layer, showed a good crystalline structure with a (001) fiber texture." EX2006, 2. APL ***confirms*** Yuasa's discovery was surprising. *Infra* §VII (Petitioner never disputes this article in a ***prestigious peer-reviewed journal*** has been cited over a thousand times).

3. Ross's Testimony is Corroborated and Credible

Petitioner's allegation that Ross is "unreliable" because she allegedly said "MgO forms ***only*** 'random grain orientation' on amorphous surfaces" (Reply, 8-9) misrepresents her testimony. Ross testified that POSAs knew MgO "would ***most likely*** have resulted in random grain orientation." EX2053, ¶164. Extensive objective evidence (*supra* §VI.D.2.a) and Petitioner's references Nagahama and

Inaba—which taught that MgO was amorphous/non-crystalline at its interface with many substrates—corroborate her testimony. *Supra* §VI.D.2.a- VI.D.2.b.

Petitioner’s assertion that **Ross’s** crystal formation testimony is “unreliable” is extraordinary. Reply, 8-9. Petitioner cites Bokor’s (unqualified) testimony criticizing Ross’s citation to Petrov’s teaching that initial crystal formation (“nucleation”) on amorphous substrates is random—not (001)—and that MgO forms as (001) only at thicknesses away from the substrate, because Petrov is not specific to MgO (POR, 23-24; EX2053, ¶¶153-167; EX2065, S118, S126). Reply, 8-9 (citing EX1105, ¶25). Despite bearing the burden, Petitioner cites no evidence suggesting that POSAs expected these fundamental crystal growth dynamics to **not** apply to MgO.

Indeed, Aboelfotoh (EX2062)’s findings mirror Petrov’s for MgO: MgO formed randomly on amorphous substrates and as (001) only at thicknesses away from the substrate. POR, 23; EX2053, ¶¶162-164; EX2062, 621-625.

Aboelfotoh explains **why** the substrate material matters: when factors suggest a strong bond between MgO and the amorphous material surface on which it forms POSAs expected random MgO grain orientation, whereas when those factors suggest a weak bond, MgO(001) may form at the surface. EX2062, 625. Bokor never considered Aboelfotoh’s explanation, could not explain Aboelfotoh’s factors, and refused to answer whether applying Aboelfotoh’s factors to CoFeB

would lead POSAs to expect random grain formation at the surface rather than (001). EX2085, 173:13-180:4, 183:24-187:22.

Petitioner cites Bokor’s (unqualified) testimony that EX1104 refuted Aboelfotoh. Reply, 9 (*citing* EX1105, ¶¶28-30). But EX1104 **confirmed** Aboelfotoh’s results because MgO layers thinner than **150 nm** were “amorphous” and only thicker films had a (111) or (001)/(200)-orientation. EX1104, 3733. It is undisputed that MTJ MgO barriers were on the order of **10 nm**. EX2053, ¶164. Aboelfotoh and EX1104 show that MgO was amorphous/non-crystalline at the thicknesses required for an MTJ. Bokor’s discussion of MgO crystallizing at greater thickness is irrelevant obfuscation.

VII. Secondary Considerations

A. Praise

Petitioner **never disputes** Yuasa’s industry-praised APL paper (EX2006) describes a CoFeB/MgO/CoFeB MTJ manufacturing method meeting claim 1.⁵ POR, 59-60; EX2053, ¶¶290-296; Reply, 23-24; *Volvo v. Brunswick*, 81 F.4th 1202, 1212 (Fed. Cir. 2023) (nexus provided by claimed combination as a whole).

Park (EX2005) - Petitioner **never disputes** its employee praised Yuasa’s

⁵ Ross admitting no nexus for claims requiring “entirely crystallized” ferromagnetic layers is irrelevant to claim 1.

invention as a “practical solution to overcome” the difficulty in forming MgO(001) MTJs on “a single crystal substrate” by showing MgO(001) formation on amorphous CoFeB. POR, 62; EX2005, 36, 39-40; EX2085, 15:2-16:21, 32:3-25 (admitting same); *see also id.*, 28:23-31:11 (admitting Park describes claim 1), 20:10-15 (admitting Park describes and praises APL’s manufacturing technique as providing a practical solution to the problems EX2005 described), 12:20-13:6, 14:6-17:1, 138:22-139:15.

Gao (EX2022) - Petitioner never disputes another employee—after discussing Parkin’s work—praised the “significance” of *Yuasa’s* CoFeB/MgO/CoFeB MTJ manufacturing method that formed “strong (001) MgO texture” on amorphous CoFeB instead of on a crystalline(001) layer. POR, 62; EX2022, 106-107, 111; EX2085, 125:7-129:11 (admitting same).

TDK (EX2023) – Petitioner never disputes TDK—after discussing Parkin’s work—praised *Yuasa’s* “novel idea[]” that formed “simple CoFeB amorphous magnetic electrodes” and showed that “[u]pon annealing CoFeB and MgO can be crystallized.” POR, 62-63; EX2023, 2; EX2085, 129:13-137:15, 138:22-139:15, 136:25-137:15 (conceding Yuasa’s method made manufacturing MgO barriers “much easier” for reasons EX2023 explains).

Petitioner’s *only* response alleges Parkin “already disclosed” CoFeB/MgO/CoFeB “*MTJs*” —not MTJ *manufacturing methods*—“rendering

Park/Gao/TDK incapable of showing non-obviousness.” Reply, 26. Petitioner provides no analysis and cites no evidence supporting its assertion that Parkin teaches claim 1.⁶ Reply, 23-28. The Examiner disagreed. EX1013, 2 (code(56), considering EX1062).

Parkin does not teach forming MgO(001) on amorphous CoFeB (*supra* §VI.B). Park, Gao and TDK praised *Yuasa* for this. Gao and TDK acknowledged Parkin’s work (EX2022, 107 (ref. 9); EX2023, 2 (ref. 19)) but credited *Yuasa*, not Parkin, with forming MgO(001) on amorphous CoFeB. Whether Parkin discloses individual claim *limitations*—rather than the claimed method as a whole—fails to refute nexus. *Chemours v. Daikin*, 4 F.4th 1370, 1378 (Fed. Cir. 2021).

“Concluding otherwise would mean that nexus could never exist where the claimed invention is a unique combination of known elements from the prior art.” *Id.*

B. Awards

Petitioner never disputes Yuasa received an award for “an original method of growing a crystalline layer [MgO] on an amorphous layer [CoFeB].” POR, 64-65 (*citing* EX2034, 1 and EX2035).

Bokor admitted Yuasa’s invention eliminated need for a crystalline(001) underlayer and enabled mass production “on arbitrary underlying layers” which

⁶ Petitioner presented no Parkin anticipation ground.

unleashed industrial applications for MgO MTJs. EX2085, 139:18-141:14, 143:1-9. EX2029 and EX2024 praised Yuasa for this contribution. POR, 63-64, 67.

Petitioner's assertion that Yuasa's awards (EX2024, EX2026, EX2029-EX2035) "lack nexus because Parkin previously disclosed MgO-CoFeB MTJs" (Reply, 27) fails as explained *supra* §VI.B.

C. Yuasa's Surprising Results

Petitioner never disputes EX2006 describes claim 1's method, says "[s]urprisingly, the MgO layer, grown on amorphous CoFeB layer, showed a good crystalline structure with a (001) fiber texture,"⁷ nor that this paper appears in a *prominent peer-reviewed* journal and has been cited over 1,200 times. POR, 5, 26-27, 59-60; EX2017, 191:20-25 (Bokor: "prominent journal"). APL's *editors* and *peer reviewers* endorsed Yuasa's result as surprising and Petitioner cites no evidence of anyone disputing that despite this paper being widely-cited.

VIII. Petitioner's Challenges Fail for All Claims

Petitioner's challenges to all claims fail for the above reasons, and its challenges to claims 2, 4, 6, and 12-13 also fail because they are unsupported by expert testimony. POR, 55-56.

⁷ APL does not "refute[]" any "surprise" (Reply, 9). *Supra* §VI.D.2.d.

Respectfully submitted,
GODO KAISHA IP BRIDGE I

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Pursuant to 37 C.F.R. § 42.24, the undersigned certifies that the foregoing **PATENT OWNER'S SUR-REPLY TO PETITIONER'S REPLY** contains 5,595 words excluding; a table of contents, a table of authorities, a certificate of service or word count, or appendix of exhibits or claim listing. Patent Owner has relied on the word count feature of the word processing system used to create this paper in making this certification.

Date: November 19, 2025

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CERTIFICATE OF SERVICE UNDER 37 C.F.R. § 42.6 (E)(4)

I certify that on November 19, 2025, a copy of the foregoing document, including any exhibits filed therewith, is being served via electronic mail, as previously consented to by Petitioner, upon the following:

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