

Filed on behalf of: Yangtze Memory Technologies Company, Ltd.

Entered: January 6, 2026

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICRON TECHNOLOGY, INC.,
Petitioner,

v.

YANGTZE MEMORY TECHNOLOGIES COMPANY, LTD.,
Patent Owner.

IPR2025-00117
Patent 10,672,711

PATENT OWNER'S SUR-REPLY

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Exhibit List

Ex.	Description
2001	Micron's Motion to Stay the Case Pending Inter Partes Review and Post Grant Review Proceedings, <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc.</i> , No. 3:23-cv-05792-RFL (N.D. Cal. Jan. 16, 2025), ECF No. 200
2002	Plaintiff/Counterclaim Defendant Yangtze Memory Technologies Company, Ltd.'s and Counterclaim Defendant Yangtze Memory Technologies, Inc.'s Opposition to Micron's Motion to Stay Case Pending Inter Partes Review and Post-Grant Proceedings, <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc.</i> , No. 3:23-cv-05792-RFL (N.D. Cal. Feb. 3, 2025), ECF No. 221
2003	Docket Entry Order (issuing temporary stay), <i>Yangtze Memory Technologies Company, Ltd. v. Micron Technology, Inc.</i> , No. 3:23-cv-05792-RFL (N.D. Cal. Mar. 3, 2025), ECF No. 242
2004	U.S. District Courts—Time Intervals from Filing Date to Beginning Date for Completed Civil Trials, by District, During the 12-Month Period Ending September 30, 2024 (https://www.uscourts.gov/sites/default/files/2025-01/jb_t3_0930.2024.pdf)
2005	RESERVED
2006	Curriculum Vitae of Stephen Campbell, Ph.D.
2007	Declaration of Dr. Stephen Campbell ("Campbell")
2008	Transcript of the deposition of Sanjay Banerjee, Ph.D., taken August 13, 2025
2009	Declaration of Dr. Stephen Campbell, Ph.D. in Support of Patent Owner's Response ("Campbell2")
2010	Declaration of Benjamin Smith in Support of Patent Owner's Unopposed Motion for <i>Pro Hac Vice</i> Under 37 C.F.R. § 42.10(c)

Ex.	Description
2011	Declaration of Robert B. Dunteman in Support of Patent Owner's Unopposed Motion for <i>Pro Hac Vice</i> Under 37 C.F.R. § 42.10(c)

I. Introduction

Patentability of the challenged claims should be confirmed.

First, Petitioner's hindsight-biased arguments for claim 1's gate-stack-on-top design cannot support obviousness. Lacking motivation to combine embodiments or references, Petitioner argues that claim limitations were so "well-known" a POSITA would have decided and known how to implement them. But Petitioner identifies no problem to be solved or benefit motivating its combinations. Petitioner's reliance on "general knowledge" is legally insufficient and ignores the complexity of 3D NAND technology and the claim limitations.

Second, Petitioner abandons the plain meaning of claim 14 for a construction that renders the term "surface" superfluous. Petitioner now reinterprets "surface" to mean "exterior" in claim 14—which is wrong and should have been in its Petition. Petitioner also belatedly relies on "single-etch-stop" embodiments in Kim instead of the two-etch-stop embodiment advanced in the Petition.

Third, Petitioner disregards differences between the prior art and embodiments in the Petition that would have counseled against Petitioner's modifications. Petitioner ignores the impact of materials, etch chemistry, and structure on etch-stop layer thickness. Further, Petitioner modifies Park to achieve coplanarity but in a way that would ruin Park's manufacturing process.

II. Claim Construction

The claims should be afforded their plain meaning, such that “wherein the etch-stop layer is formed on a side surface and a top surface of each step” in claim 14 requires that the etch-stop layer contact these step surfaces.¹ POR 8. In arguing otherwise, Petitioner improperly reads out “surface” and adds a new construction that should have been raised in the Petition.

The Petition conceded that “the ’711 patent’s claims may be afforded their plain and ordinary meaning.” Pet.26. Yet Petitioner argues that the phrase “wherein the etch-stop layer is formed on a side surface and a top surface of each step” means that the etch-stop layer may be formed *not* on the surface but rather anywhere above each step. Untenable as plain meaning, Petitioner relies on a statement in the specification that the standalone term “on” does not always require contact. Claim 14, however, does not say that the etch-stop layer is formed “on a side and a top” of each step (as Petitioner reads it), but instead says that this layer is formed “on a side surface and a top surface” of each step, and it would be improper to render this additional language superfluous. POR 14; *Wasica Fin. GmbH v. Cont’l Auto. Sys., Inc.*, 853 F.3d 1272, 1288 n.10 (Fed. Cir. 2017); *Bicon, Inc. v. Straumann Co.*, 441

¹ The same arguments apply to claim 15, which depends from claim 14 and contains similar additional language.

F.3d 945, 950 (Fed. Cir. 2006). In other words, if the etch-stop layer need not contact these surfaces, the meaning of “formed on a side *surface* and a top *surface* of each step” is no different than “formed on a side and a top of each step.” POR 14.

Petitioner now argues that “surface” specifies only that the layer is on the step’s exterior rather than interior. Reply 3. This new argument is unsupported and non-sensical. Petitioner does not identify what constitutes the “step’s interior” or how the claimed etch-stop layer would be on it. Nor does Petitioner explain why the meaning of “surface” would not also include an *interior* surface. Petitioner cannot now construe “surface” under the guise of rebuttal. *Id.* 12 n.6. Patent Owner’s position *is* the plain meaning. Ex.2009 (“Campbell2”) ¶47; Ex.1027, 146:25-147:6 (“Q. How would an expert in semiconductor fabrication understand the term ‘on the surface?’ A. It means there has to be contact between one layer and the other.”). Petitioner’s argument is wrong and forfeited. *Ralph Lauren Corp. v. Lexos Media IP, LLC*, IPR2018-01755, 2020 WL 1488393, at *5 (P.T.A.B. Mar. 25, 2020) (declining to address new construction first raised by Petitioner in reply), *aff’d sub nom. Ralph Lauren Corp. v. Hirshfeld*, 852 F. App’x 540 (Fed. Cir. 2021).

The required contact between etch-stop layer and step is consistent with the specification’s use of “on the surface.” POR 8-15; *Aortic Innovations LLC v. Edwards Lifesciences Corp.*, 159 F.4th 1, 8-9 (Fed. Cir. 2025) (“[W]hen a patent repeatedly and consistently characterizes a claim term in a particular way, it is proper

to construe the claim term in accordance with that characterization.”).² Petitioner identifies nowhere that the patent uses “on the ... surface” to include intervening layers.

Petitioner's argument that the claims use the term “directly contacts” only to describe embodiments requiring contact presupposes its construction. Reply 2. For example, claim 13 requires “an etch-stop layer disposed on a portion of the gate stack of each step,” which allows for layers between the etch-stop layer and the gate stack. But claim 14 reasonably adds “surface” to indicate the etch-stop layer *contacts* the side and top of each step.

Finally, Petitioner exceeded the scope of its Reply in abandoning plain meaning (Pet.26) for lexicography (Reply 2). *Ralph Lauren*, 2020 WL 1488393, at *5; POR 8 (agreeing that “all claims should be construed according to their plain and ordinary meaning”).

III. Ground I: Petitioner Failed to Demonstrate Kim in View of POSITA's Knowledge Renders Obvious Claims 1-9, 11-16, and 18-19.

A. Claim 1 would not have been obvious.

Petitioner has not shown that claim 1 is unpatentable and its position is fraught with hindsight. Petitioner combines Kim's Figures 17A-22B embodiment with

² Unless noted otherwise, all emphases/alterations are added and internal footnotes, quotation marks, and citations are omitted.

Kim's *separate* Figures 5A-14B embodiment to allegedly render obvious the gate-stack-on-top limitation. Pet.29 (stating the "Petition relies on Kim's 17A-22B embodiment" and "Kim discloses other embodiments, *e.g.*, Figures 5A-14B"); Reply 4. Yet Petitioner provides no motivation for that modification. Petitioner's last-ditch effort to invoke *Intel* falls flat as its Reply fails to explain, or proffer any evidence to show, that the alternative embodiment of Kim is set forth to solve the same problem as the embodiment in Figures 17A-22B. Reply 5 ("[A] 'known way to address [the same problem] is precisely the reason that there's a motivation to combine under *KSR*....'" (original alteration) (quoting *Intel Corp. v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1380 (Fed. Cir. 2023)). Indeed, as in *CommScope, Inc. v. TQ Delta, LLC*, Petitioner has presented no evidence that "identifie[s] a need or problem known in the field of endeavor at the time of invention or explained how" the gate-stack-on-top "helped address that problem." IPR2022-01012, 2023 WL 7491179, at *11 (P.T.A.B. Nov. 13, 2023) (rejecting *Intel*-based argument); POR 18 (quoting Petitioner's expert providing no reason to select gate-stack on top). The lack of evidentiary support is laid bare by Petitioner's mere attorney argument that the "alternative order" of the gate-stack/dielectric pairs solved "the same problem" as gate-stack on bottom of "constructing a staircase structure." See *Icon Health & Fitness, Inc. v. Strava, Inc.*, 849 F.3d 1034, 1043 (Fed. Cir. 2017) ("Attorney argument is not evidence."). This deficiency—including not identifying any problem

with Kim's gate-stack-on-bottom Figures 17A-22B embodiment (or a problem it seeks to solve)—is fatal to, and demonstrates the hindsight in, Petitioner's argument.

Similarly, Petitioner has presented no benefit or improvement in switching the gate-stack order. Petitioner relies on *Boston Scientific Scimed, Inc. v. Cordis Corp.*, to argue that combining different embodiments from a single prior art reference does not require the reference to recognize the resulting benefits. Reply 6 (citing 554 F.3d 982, 991-92 (Fed. Cir. 2009)). Petitioner's reliance is misplaced. First, the law is clear that when “combining multiple embodiments from a single reference ... there must be a motivation to” combine. *In re Stepan Co.*, 868 F.3d 1342, 1346 n.1 (Fed. Cir. 2017). Second, the relevant embodiments in *Boston Scientific* were “adjacent.” But here Petitioner recreated Kim's Figure 22A using an alternative description of yet another embodiment of Kim's Figure 4, which even then would have required other disadvantageous modifications. POR 19-20, 24-25; Ex.2007 ¶¶36, 41-42. Regardless, “[t]he court's analysis in *Boston Scientific* indicates that adjacent placement alone is not sufficient.” *Intel Corp. v. Tela Innovations, Inc.*, IPR2019-01521, 2021 WL 912764, at *9 (P.T.A.B. Mar. 9, 2021). Third, even in *Boston Scientific* the court found a specific motivation to combine the closely-related embodiments insofar as the missing element would have provided the same “benefits” in both embodiments. 554 F.3d at 992; *Tela Innovations*, 2021 WL 912764, at *9 (“The court in *Boston Scientific* articulated a rationale for why a

POSITA would have been motivated to combine two embodiments of a prior art patent in the manner recited in the challenged claims.”). By contrast here, Petitioner does not identify any benefit a POSITA would have recognized in reversing the gate stack orders.

Without any motivation to switch the gate-stack order, Petitioner argues that because Kim's other embodiments and other references, including those not in its proposed combination, disclose a gate stack order different than Kim's Figures 17A-22B embodiment, a POSITA would have made that change. Reply 5-6.³ Petitioner's bare assertion that its proposed modification would have been routine, predictable, and well-known is classic hindsight. But Petitioner “cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.” *In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992).

Patent Owner's evidence, in comparison, demonstrates *why* a POSITA would *not* have been motivated to modify Kim. Switching the gate-stack order is not routine and would require other structural changes; nor would a POSITA have had a

³ Petitioner argues that “citing other references” to establish a motivation under *Intel* is proper. Reply 9 (citing *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1362 (Fed. Cir. 2007)). Regardless of any source, and as explained above, Petitioner failed to meet *Intel*'s standard.

reasonable expectation of success because of the changes to etching processes and structure in Kim's Figures 17A-22B embodiment.⁴ POR 19-20, 24-25; Ex.2007 ¶¶36, 41-42; Kim ¶¶185, 187 (disclosing gate-stack on bottom in Figures 17-22 embodiment).

Petitioner tries distinguishing *Stepan* because there the petitioner did "not offer evidence supporting" a motivation to combine features of different embodiments. Reply 6. But Petitioner does not here either; it merely asserts that because (1) Kim's other embodiments disclose a different order, and (2) other references show the claimed order, switching the gate-stack order in Kim was "suitable." Pet.32-35. In other words, a POSITA could have switched, but had no reason to switch.

Petitioner's other cases are distinguishable. For example, Petitioner cites *Chiron Corp. v. Genentech, Inc.*, arguing that a lack of certain details about changing the gate-stack order in Chen and the '711 patent means that doing so would have

⁴ Dr. Campbell's testimony does not support Petitioner's argument that he "acknowledged that reversing the layer ordering simply involves placing the insulating layers beneath each corresponding sacrificial layers." Reply 9 (citing Ex.1027, 93:12-18, 95:13-25). Dr. Campbell said nothing about simplicity of reversing the order of the sacrificial and insulating layers.

been routine. Reply 7-8 (citing *Chiron*, 363 F.3d 1247, 1253 (Fed. Cir. 2004)). But *Chiron* addresses whether a patent enables a POSITA to practice the claims of the patent without undue experimentation (363 F.3d at 1253), which does not mean a POSITA would have been motivated to do it, a burden Petitioner fails to meet.

Petitioner concedes it is not relying on background references to supply a missing limitation, but nevertheless argues that such general knowledge can do so here because “the gate-stack-on-top implementation was straightforward and simple to a POSITA.” Reply 10. Petitioner is wrong.⁵ To do so, the technology must be “particularly straightforward” and the missing limitation must be “unusually simple.” By contrast here, Petitioner does not dispute that 3D NAND technology is complex and it has provided no evidence that (even within that complex field) switching the gate-stack order would be unusually simple. *DSS Tech. Mgmt., Inc. v. Apple Inc.*, 885 F.3d 1367, 1373-74 (Fed. Cir. 2018) (rejecting reliance on “common knowledge” to “supply a missing claim limitation” because wireless

⁵ Petitioner (Reply 10) also cites *General Electric Co. v. United Technologies Corp.*, IPR2018-01442, Paper 39, 38-40 (P.T.A.B. Feb. 20, 2020). But there, the Board found that “an inlet of a first turbine vane” was disclosed in the prior art as understood by a POSITA, not that it was “unusually simple” and could be supplied by general knowledge. *Gen. Elec.*, IPR2018-01442, Paper 39 at 42.

communications is not “particularly straightforward” technology); POR 21-22. Petitioner fails to carry its burden. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378-79 (Fed. Cir. 2015) (“Failure to prove the matter as required by the applicable standard means that the party with the burden of persuasion,” here Petitioner, “loses.”).

B. Kim does not render claims 14 and 15 obvious.

Claim 14 requires contact between the etch-stop layer and the side and top *surfaces* of the step, or else the claim term “surface” is superfluous. *See supra* §II. Petitioner again relies on forfeited arguments that should have been, but were not raised in the Petition and fails to provide a motivation to combine or reasonable expectation of success.

The Petition relied only on one embodiment disclosed in Figures 17A-22B for allegedly disclosing *two* etch-stop layers. Pet.29, 59-61.⁶ This was a necessary strategic decision because no other embodiments included combinations of other claimed features, such as a high-k dielectric surrounding the conductive layer of each step and *two* etch-stop layers that could map to the etch-stop layer and barrier layer combination of the ’711 patent. *Id.* (mapping Kim’s first and second stop layers 125a and 125b to the “barrier layer” and “etch-stop layer” in Figure 22A). Now for the

⁶ Petitioner relied on the same argument for claim 15.

first time, Petitioner relies on a *different* embodiment of Figures 17-22 that discloses a “single-etch-stop” layer to argue that Kim’s etch-stop layer directly contacts the side and top surfaces of each step, as required by claim 14. Reply 12; Ex.1028 (Banerjee2) ¶40.

Similarly, Petitioner’s expert, also for the first time, states this “one etch-stop alternative” “can be observed through Kim’s Figure 34 embodiment[.]” This figure is absent from the Petition, which relied on the distinct two-etch-stop embodiment from Figures 17-22. Pet.29.

Petitioner’s reliance on these new embodiments amounts to a forfeited theory of *prima facie* obviousness. *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1367 (Fed. Cir. 2015) (affirming Board’s rejection of reply’s reliance “on previously unidentified portions of a prior-art reference to make a meaningfully distinct contention”). Petitioner cannot treat these new arguments as rebuttal (Reply 12 n.6) where it advanced a separate theory in the Petition. Patent Owner’s position is not a “new construction,” but simply a foreseeable disagreement with Petitioner’s understanding of the relevant plain meaning. Campbell2 ¶47; Ex.1027, 146:25-147:6. It is Petitioner that first argued the claims should be given their plain meaning and now *deviates* from that by relying on a theory for claim 14 that depends on a different construction of the standalone term “on.” Pet.60, 89. Petitioner’s

reliance on these new, single-etch-stop embodiments is a *different* theory that should have been included in Petitioner's *prima facie* obviousness case.

Regardless, Petitioner does not establish any motivation to combine these newly-raised embodiments with the two-etch-stop embodiment of Figures 17-22. For example, in addition to disclosing only a single etch-stop layer, Figure 34's "gate conductive layers 101-108" have no surrounding high-k dielectric layer, which is a notable characteristic of the two-etch-stop embodiment of Figures 17-22 and required by the '711 patent.

IV. Ground II: Petitioner Failed to Demonstrate Kim in View of Fang Renders Obvious Claims 10 and 17.

A. Petitioner ignores lack of motivation and reasonable expectation of success and its arguments about criticality are irrelevant.

Petitioner attempts to absolve itself from having to provide a motivation to combine by pointing to the Examiner's statements regarding criticality. Specifically, Petitioner argues that because claim 10's range of 10-to-1000nm thickness of the etch-stop layer "lacks criticality," Patent Owner failed to rebut Petitioner's argument that a POSITA would have been motivated to combine Fang's disclosed range of its etch-stop layer overlapping the claimed thickness of the etch-stop with Kim. Reply 13. Petitioner's argument fails legally and factually.

Criticality is relevant to anticipation, not obviousness. *UCB, Inc. v. Actavis Laboratories UT, Inc.*, 65 F.4th 679, 687, 689-90 (Fed. Cir. 2023) (in a "case of

anticipation, ‘the court must evaluate whether the patentee has established that the claimed range is critical to the operability of the claimed invention’’). Neither the Petition nor Dr. Banerjee argued any challenged claims are anticipated. Ex.2008, 20:1-4. Rather, Petitioner argues that Fang’s disclosed range only renders obvious the claimed range. Pet.62; Reply 14. For obviousness, the correct inquiry (for which Petitioner did not carry its burden of persuasion) is whether the “‘prior art teaches away from the claimed range, ... the claimed range produces new and unexpected results,’ or other evidence demonstrates non-obviousness of the claimed range.” *UCB*, 65 F.4th at 689-90 (original alteration). Thus, Petitioner’s reliance on criticality fails.

Factually, as explained in the POR and below, there are several reasons why a POSITA would not have combined Fang’s disclosed thickness with Kim’s etch-stop layer, i.e., “evidence that demonstrates non-obviousness of the claimed range.” *Id.*; POR 31-42. Similarly, a POSITA would not have had a reasonable expectation of success. POR 30-42. Petitioner assumes, erroneously, that the range of etch-stop thicknesses for Fang’s materials and structure can be used for *Kim*’s unique variety of materials and structure. Reply 18-19. But etch-stop thicknesses are not fungible across different materials, and Petitioner ignores the structural differences in adapting etch-stop thickness from one reference to another. *Id.* 32, 38-42; Campbell ¶¶49, 54-55.

B. Fang is directed to carbon-doped silicon nitride (“CDSN”), and Petitioner fails to adequately address material differences between Kim and Fang.

A POSITA would not have combined Fang's etch-stop layer thickness to Kim. Kim does not use CDSN, and Fang's etch-stop thickness does not apply to the undoped silicon nitride in Kim. Petitioner contends Fang's use of CDSN is merely “exemplary,” ignoring that *every* claim of Fang requires CDSN. CDSN is central to Fang's disclosures, including its etch-stop thicknesses. Campbell² ¶¶48-51.

Petitioner argues that even if Fang's thickness range was specific to CDSN, this is irrelevant because Kim uses a dry etch and, according to Petitioner, “carbon-doping has no impact on the dry-etch rate.” Reply 15-16. These arguments fail.

To start, Petitioner's “dry-etch rate” argument is made for the first time in Reply and depends on new evidence. *Wasica*, 853 F.3d at 1286. Indeed, the term “dry-etch rate” is not in the Petition. The Board should give no weight to Ex.1029 because this evidence could have been provided in the Petition, and Patent Owner is prejudiced by not having an opportunity for its expert to challenge this new evidence in Sur-Reply. *Pioneer Pet Prods., LLC v. Oil-Dri Corp. of Am.*, IPR2022-00691, 2023 WL 5955777, at *12 (P.T.A.B. Sept. 12, 2023) (acknowledging “the prejudice to Patent Owner that would result if we consider the new arguments and evidence in Petitioner's Reply”).

Further, Petitioner's reliance on Ex.1029 is also wrong technically because Petitioner assumes incorrectly that because etch-rates for varying levels of carbon-doping in silicon nitride appear constant for the specific etchant used in Ex.1029, they are constant for *any* etchant. *See* Campbell² ¶¶41, 49-50.

Dr. Banerjee relies on a second piece of new evidence (Ex.1032), that also purports to demonstrate a constant etch-rate for varying levels of carbon-doping in CDSN. But nowhere does Ex.1032 state it is dealing with CDSN or use the term "doped" or "doping," as opposed to silicon carbon nitride, which is excluded in Fang. Ex.1007 (Fang) [0017], [0022]. This evidence should also not be given any weight because it could have been raised in the Petition. *Pioneer*, 2023 WL 5955777, at *12.

Finally, Petitioner fails to address the bulk of Patent Owner's argument that Kim's and Fang's differences undermine any motivation to combine. Instead, Petitioner takes on a strawman. Pet.65. Patent Owner's argument is that Kim's and Fang's purposes are distinct, and a POSITA would not be motivated to combine. Among other things, Kim protects the *top of a device* using a polishing stop layer and an etch-stop layer, whereas Fang prevents punch through *on the staircase steps within* the device.

C. Petitioner ignores the impact of structural differences on etch-stop thickness.

Structural differences would have counseled a POSITA against combining Kim's and Fang's etch-stop layer characteristics, including thickness. Petitioner's Reply ignores these differences simply because the '711 patent discloses a range of etch-stop thicknesses. Petitioner's arguments fail.

First, Petitioner argues Dr. Campbell contradicted Patent Owner's position that the presence of a high-k dielectric layer impacts the necessary thickness of an etch-stop layer. Reply 17. Not so. Petitioner maintains Dr. Campbell testified that where a barrier layer separates the high-k dielectric layer from the etch-stop layer, the high-k dielectric layer does not serve an etch-stop function during the etch of the etch-stop layer. *Id.* Petitioner assumes, erroneously, this means the high-k dielectric layer would not impact the necessary etch-stop layer thickness. But Dr. Campbell confirmed that "the high-k layer *would* serve as an etch-stop during the etching of the barrier layer." Ex.1027, 56:2-9; *see also* Campbell2 ¶55. Even taking Petitioner's assumption as true (which it is not), the presence of the high-k dielectric layer will impact the necessary thickness of the barrier layer, which itself is an etch-stop layer.

Further, Dr. Campbell discussed a scenario that includes a first etch-stop layer, an optional barrier layer (i.e., second etch-stop layer), and a high-k dielectric layer; he was *not* speaking to the myriad other combinations of structure and materials that could present when combining references. For example, Dr.

Campbell's testimony was specific to including a barrier layer; if the optional barrier layer is not included, the high-k dielectric *would* serve an etch-stop function for the etch-stop layer, assuming selectivity between them. Without selectivity, the high-k dielectric layer *still* impacts etch-stop layer thickness by effectively increasing total etch-stop layer width. Ex.1027, 51:24-53:2 (explaining that if the etch-stop is also high-k, the high-k dielectric layer "effectively increases the barrier"). More broadly, Petitioner fails to appreciate the many variables (e.g., chemistries, materials, structure) that influence etch processes, oversimplifying complex technology. POR 23-25.

Second, Petitioner mischaracterizes Patent Owner's position as "admit[ting] ... that 'a range of thickness' ... applies to a device regardless of whether the device includes an extra etch-stop layer." Reply 17. Patent Owner explained the opposite—*different structures*, such as inclusion or omission of another layer, and the materials and etchants used, may necessitate a *different thickness* of the etch-stop layer. POR 40 (explaining the '711 patent provides a range "[that] can accommodate varying thicknesses *based on materials used or structural differences, such as including or excluding the barrier layer*"; see, e.g., Ex.1001 ("'711 patent") 2:5-6, 7:3-9, 7:23-24, 7:35-36, 8:10-14, 10:25-28, 10:47-52, cls. 5, 16. For the same reason, Petitioner is incorrect that "an extra lower etch-stop layer ... [is] irrelevant to the thickness of the overlying etch-stop layer[.]" Reply 18.

Petitioner and its expert contradict this. *Id.* (“the ... barrier layer provides over-etching protection during the intentional ... etching of the etch-stop layer”) (emphasis omitted); Ex.2008, 48:20-49:8 (“[T]he more different materials that you have that the etch has to go through, in general, that provides additional safety margins.”); *see also* ’711 patent 5:54-58, 5:61-63, 7:36-39 (explaining that etch-stop layers, including the barrier layer, protect underlying layers or structures during etching processes).

Finally, Petitioner’s reliance on Chen is misplaced. Chen discusses etch-stop layer characteristics *only* as they relate to reducing tunneling current between the conductive layer and the conductive wordline structures. Chen does not discuss or concern the etch-stop layer’s role in preventing over-etching on staircase steps while etching contact vias. The passages cited by Petitioner hold etch-stop thickness constant because they compare *tunneling length* as a function of the number and material of etch-stop layers, not for purposes of preventing punch-through. Ex.1008 (Chen) [0047]-[0054]. Nor do these passages detail etch-stop thickness for gate-stack-on-top vs. gate-stack-on-bottom configurations or make any reference to Figures 7A-7B where those configurations are shown.

V. Ground III: Petitioner Failed to Demonstrate Park in View of a POSITA's Knowledge Renders Obvious Claims 1-6, 8-9, 11-16, and 18-19.

A. Claim 1 would not have been obvious.

As with Kim, Petitioner errs in arguing Park renders obvious switching layer orders to gate-stack-on-top. Having erred in relying on Park's Figure 9 showing the wrong gate-stack order, and failing to provide motivation to combine disparate embodiments in Park, Petitioner's Reply abandons Park's distinctions between embodiments relied upon in the Petition. Pet.31, 67-69; Reply 19-21. Instead, Petitioner now argues that Figure 9 and related disclosures teach switching the gate-stack order. Pet.69-71 (citing Figure 9i with incorrect order).

Regardless, the portion Petitioner relies on states that "unlike what is shown in FIG.9a" (i.e., a fully etched staircase), the "top surface of each sacrificial layer (140) may be exposed in a plurality of pad regions (P1-P6)." Ex.1006 ("Park") [0102]. This does not disclose any gate-stack order switching or layer deposition. Rather, it describes the process of "etch[ing] to provide a plurality of pad regions (P1-P6)" and what occurs during the processing of the staircase structure. *Id.*

Further, Petitioner commits the same error as in the Petition by modifying Park's Figure 9. Reply 21-22. Petitioner provides no motivation, such as a problem to solve or benefit, to reverse the gate stack order other than that Park's disclosure of various embodiments "may be combined." *Id.* 21; *supra* §III.A. But even in

“combining multiple embodiments from a single reference” the challenger must provide “a motivation to make the combination.” *Stepan*, 868 F.3d at 1346 n.1. The ability to combine does not provide a motivation to do so.

B. Park does not render claims 14 and 15 obvious.

As discussed previously, the claims' plain language requires contact between the etch-stop layer and the side and top **surfaces** of the step, which Park does not disclose. Petitioner's Reply again relies on new theories attempting to render claims 14 and 15 obvious based on Park.

Petitioner argues for the first time in Reply that Park's etch-stop layer 110a is optional in the Figures 5/9 embodiment based on disclosures of the Figures 4/8 embodiment. Reply 23; Pet.31 (relying on the Figures 5/9 embodiment). That argument is forfeited. *Supra* §III.B.

Further, Park's Figures 4/8 embodiment does not make the barrier layer optional in the Figures 5/9 embodiment. Petitioner has not met its burden to establish a motivation to combine them. Even if the barrier layer were optional in the Figures 5/9 embodiment, Petitioner is wrong that “without a barrier layer, the etch-stop layer [of Park] directly contacts the surface of the steps.” Instead, Park's etch-stop layer would contact either the AD2 insulating layer (seen in Figure 9g) or AD insulating layer that covers the surface of the steps (seen in Figure 9b).

Finally, Petitioner assumes that because “each” can mean “each of a subset,” Park’s lack of etch-stop on the sidewall of the bottom step is irrelevant to satisfying claims 14 and 15. But Petitioner identifies no reason the bottom step would not be included in the relevant subset of steps for evaluating Park’s disclosure of these claims.

C. Park does not render claim 15 obvious.

Park does not disclose any specific thickness for its etch-stop layer, much less a “uniform” or “single” thickness on the top and side surfaces of each step. At most, Park discloses a range of comparative thickness of “less than or equal to two times the thickness of the gate insulating film.” Park[0006]; Pet.89-90. Further, Petitioner relies on Park’s figures to argue Park’s reference to “*the* thickness of the etch-stop layer” discloses a uniform thickness. Reply 23-24 (original emphasis). But Park’s figures are not drawn to scale. *See* Park[0017] (“the shapes and sizes of elements in the drawings may be exaggerated”); *Nystrom v. TREX Co.*, 424 F.3d 1136, 1149 (Fed. Cir. 2005) (“[A]rguments based on drawings not explicitly made to scale in issued patents are unavailing.”).

Further, even if the sacrificial etch-stop layers 115a/115b are deposited in uniform layers using ALD (which Park does *not* disclose), that does not ensure uniformity of the etch-stop layers 110a/110b. The sacrificial etch-stop layers 115a/115b are deposited on what is, at that time in the process, the exposed top

surface of the staircase structure. Park Figs.9b-9b. The connection region insulating layer 180 is then deposited on top of sacrificial etch-stop layer 115b and becomes the top of the structure. In contrast, the etch-stop layers 110a/110b are deposited in long, narrow, serpentine cavities (i.e., second side opening T2) created after removing the sacrificial etch-stop material of 115a/115b. Park Fig.9f. Even using ALD, the long, narrow, serpentine shape of the cavities makes holes and gaps more likely and uniformity much more difficult and costly to achieve. POR 54. The Petition merely argues that “it was known that an etch-stop layer of uniform thickness on all steps was desirable.” Pet.90. But Petitioner fails to refute Patent Owner's arguments and merely restates the ALD process would create uniformity. Reply 24-25.

VI. Ground IV: Petitioner Failed to Demonstrate Park in View of Fang Renders Obvious Claims 7, 10, 15, and 17.⁷

Petitioner's arguments for establishing a motivation to apply Fang's coplanarization to Park and a reasonable expectation of success were flawed.

⁷ Petitioner fails to show Park and Fang renders obvious claims 10, 15, and 17 for the same reasons discussed regarding Grounds II and III. *See supra* §§IV, V.C; POR 30-42, 52-55, 65-71. Further, regarding claims 10 and 17, Petitioner relies on a portion of Dr. Campbell's testimony that does not reference Park. Ex.1027, 100:21-101:2.

Petitioner's Reply advances a new theory that, in addition to being forfeited, contains the same flaw.

In the Petition, Petitioner's proposed motivation for combining Fang's coplanarization to Park would remove material necessary for Park's manufacturing process. Petitioner identified Park's planarization step that "occurs *after* forming the channel and *before* depositing the conductive layer 195" and that removes "unnecessary" material. Pet.95. Petitioner argued it would have been obvious to use this specific planarization step in Park to simply remove even *more* material to achieve Fang's coplanarization. *Id.* 94-95. Patent Owner demonstrated this would not work because the material Petitioner proposed removing is *not* unnecessary material and is essential to forming Park's etch-stop layer. POR 61-63. Petitioner does not, and cannot, dispute this. Reply 25-27. Patent Owner also explained that conducting CMP planarization *after* the etch-stop layer is formed would risk damage to the device, including to the conductive layer 195. POR 63-64.

Petitioner's Reply argues, for the first time, a POSITA could planarize *later* in the manufacturing process without damaging the device, identifying a "second planarization" step that occurs *after* formation of the conductive layer 195. Reply 26 (citing Park[0089]); Ex.1028 ¶79. Petitioner's reply argument could have been raised in the Petition and is forfeited. *Supra* §III.B. The same is true for Petitioner's new corresponding reply evidence. *See* Ex.1030. By failing to include this evidence

in the Petition, Patent Owner is prejudiced by not having an opportunity for Dr. Campbell to respond. *Pioneer*, 2023 WL 5955777, at *12.

Regardless, Petitioner's new argument relying on this "second planarization" suffers from the same flaw as Petitioner's original argument. Petitioner suggests it would have been obvious to use this later planarization step that occurs *after* formation of the conductive layer 195 to achieve Fang's coplanarization because "a POSITA would have known how to planarize a top surface without damaging adjacent protruding structures[.]" presumably referring to the conductive layer 195. Reply 25-26; Ex.1028 ¶79 (citing Park[0089]). But the second planarization step still occurs *before* the etch-stop layer has been formed and would still remove the same material necessary to Park's manufacturing process.

VII. Dr. Campbell Is a POSITA.

Petitioner challenges Dr. Campbell's qualifications by selectively quoting its definition and Dr. Campbell's testimony to omit that a POSITA may be qualified by "knowledge" and "training." Reply 27; Pet.27. Petitioner fixates on "design," which is merely an example of "experience" under its definition and not necessary to qualify as a POSITA. Reply 27; Pet.27. Regardless, Dr. Campbell testified that he met the qualifications of a POSITA. Ex.1027, 152:21-153:17.

Dr. Campbell also testified that, as a fabrication and processing expert, he has adequate knowledge of semiconductor design. For example, he testified that the etch

processes, the material selected, the depth and aspect ratio, and the order of the layers “align well with [his] area of expertise.” *Id.* 133:8-24. Dr. Campbell testified that he has sufficient expertise to opine on design aspects that relate to etch processes. *Id.* 134:17-135:3. Dr. Campbell is uniquely qualified to testify regarding the '711 patent's limitations and its technology based on his fabrication and processing expertise and corresponding understanding of semiconductor design. *Id.* 150:20-151:5.

Moreover, Dr. Campbell testified that the '711 patent is a *processing* patent, and a POSITA in design alone would not be able to practice the '711 patent. *Id.* 150:13-151:5. Yet, Petitioner challenges Dr. Campbell's testimony about “design,” and does so without explaining which aspects of the prior art or the limitations purportedly rely on the “design” of semiconductors as opposed to fabrication. Further, the “design” aspects for which Dr. Campbell said he was not an expert relate specifically to *circuit* design. *Id.* (“The design, if you will, where the transistors go and so forth is really modest by comparison.”). To the extent the '711 patent involved aspects of design, Dr. Campbell testified these concepts are sufficiently well-known to a POSITA involved in fabrication of semiconductor devices. *Id.* 130:19-131:3, 133:1-134:8, 134:17-135:3, 150:20-151:5. And Dr. Campbell *is* a processing and fabrication expert regarding “which layers go where and how thick they are and how you're going to etch things.” *Id.* 150:13-151:5.

VIII. Conclusion

For the reasons set forth above and in Patent Owner's Response, the Board should uphold the patentability of the challenged claims.

Respectfully submitted,

Dated: January 6, 2026

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CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. § 42.24

I hereby certify that this Patent Owner's Sur-Reply complies with the word count limitation of 37 C.F.R. § 42.24(c)(4) because the Patent Owner's Sur-Reply contains 5,598 words using Microsoft Word's counting feature, excluding the cover page, signature block, and the parts of the Patent Owner's Sur-Reply exempted by 37 C.F.R. § 42.24(c).

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I certify that on this 6th day of January, 2026, a true and correct copy of the foregoing **Patent Owner's Sur-Reply** was served by electronic mail on Petitioner's lead and backup counsel at the following email addresses:

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