

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CAIHONG DISPLAY DEVICES CO., LTD.,
Petitioner

v.

CORNING INCORPORATED,
Patent Owner

Case IPR2025-01017
U.S. Patent No. 8,642,491

PATENT OWNER PRELIMINARY RESPONSE

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PATENT OWNER'S EXHIBIT LIST

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2001	<i>Certain Glass Substrates for Liquid Crystal Displays, Products Containing the Same, and Methods for Manufacturing the Same II</i> , Inv. No. 337-TA-1441, Order Setting the Procedural Schedule (ITC March 31, 2025)
2002	<i>Certain Glass Substrates for Liquid Crystal Displays, Products Containing the Same, and Methods for Manufacturing the Same</i> , Inv. No. 337-TA-1441, Order 2 (ITC March 7, 2025)
2003	Display of the Year Award Archive, accessed at https://www.sid.org/Awards/Display-Industry-Awards/DIAAwardsArchive (last accessed Apr. 9, 2025)
2004	“Corning wins awards for EAGLE XG(TM),” accessed at: https://www.glassonline.com/corning-wins-awards-for-eagle-xgtm/ (last accessed Apr. 9, 2025) (May 23, 2007)
2005	Bocko, Peter L., “Handbook of Visual Display Technology,” Chapter 5.1.1: Glass Substrates for AMLCD, OLED and Emerging Display Platforms, pp. 599-623 (2012)
2006	<i>Gestures Tech. Partners LLC. v. Apple Inc. et al.</i> , Petition for Writ of Certiorari, Case. No. 24- (filed June 11, 2025)
2007	Declaration of Dr. Richard Brow in Support of Patent Owner’s Preliminary Response
2008	<i>Curriculum Vitae</i> of Dr. Richard Brow
2009	Kim, K.D., “Influence of BaO/(SrO+BaO) on melt properties in R2O-RO-SiO2 glasses for plasma display panel substrates,” <i>Glass Technol.</i> , 41(5):161-164 (2000)
2010	Shannon, R.D. & Prewitt, C.T., “Effective Ionic Radii in Oxides and Fluorides,” <i>Acta Cryst.</i> , B25:925-946 (1969).

Exhibit No.	Description
2011	Mysen, B.O., et al., “The structural role of aluminum in silicate melts: a Raman spectroscopic study at 1 atmosphere,” <i>American Mineralogist</i> , 66:678-701 (1981).
2012	Scarfe, C.M., “Viscosity-temperature relationships at 1 atm in the system diopside-anorthite,” <i>American Mineralogist</i> , 68:1083-1088 (1983).
2013	Wallenberger, F.T., et al., “Design of energy and environmentally friendly fiberglass compositions derived from the quaternary SiO ₂ -Al ₂ O ₃ -CaO-MgO phase diagram - Part I: Structures, properties and crystallization potential of eutectic and selected multi-oxide e-glass compositions,” <i>Melt Chemistry, Relaxation, and Solidification Kinetics of Glasses</i> (2005)
2014	Darwish, H. & Gomaa, M.M., “Effect of compositional changes on the structure and properties of alkali-alumino borosilicate glasses,” <i>Journal of Materials Science: Materials in Electronics</i> , 17:35-42 (2006)
2015	Kaur, N., et al., “Conductivity, dielectric, and structural studies of (30-x) SrO-xBaO-10Al ₂ O ₃ -45SiO ₂ -5B ₂ O ₃ -10Y ₂ O ₃ (5 ≤ x ≤ 25) glasses,” <i>Ionics</i> , 24:2343-2353 (2018)
2016	Zanotto, E.D. & Coutinho, F.A.B, “How many non-crystalline solids can be made from all the elements of the periodic table?,” <i>Journal of Non-Crystalline Solids</i> , 347:285-288 (2004).
2017	Shelby, J.E., “Introduction to Glass Science and Technology,” <i>The Royal Society of Chemistry</i> , 2nd Ed. (2005)
2018	Ellison, A. & Cornejo, I.A., “Glass Substrates for Liquid Crystal Displays,” <i>International Journal of Applied Glass Science</i> , 1(1):87-103 (2010)

Exhibit No.	Description
2019	<i>Certain Glass Substrates for Liquid Crystal Displays, Products Containing the Same, and Methods for Manufacturing the Same</i> , Case No. 337-TA-1441, Ex. 127 – Corning® EAGLE XG® Glass substrates Innovation Timeline
2020	<i>Certain Glass Substrates for Liquid Crystal Displays, Products Containing the Same, and Methods for Manufacturing the Same</i> , Case No. 337-TA-1441, Ex. 132 – Claim Chart for U.S. Patent 8,642,491
2021	Corning Eagle XG Glass Substrates
2022	The Story of Corning® EAGLE XG® Slim Glass Substrates

I. INTRODUCTION

U.S. Patent No. 8,642,491 (“the ’491 patent”) claims innovative, non-obvious improvements to alkali-free boroaluminosilicate glass compositions that are free from toxic fining agents, and yet still achieve the high liquidus viscosity and defect-free quality that is desired for sophisticated glass applications (like LCD screens). The Petition purports to present three invalidity Grounds, all of which suffer from numerous flaws that preclude any reasonable likelihood of showing unpatentability by a preponderance of evidence.

First, the Petition fails to identify its challenges with particularity, mixing concepts of anticipation and obviousness, relying on references that are not part of the Grounds, and omitting essential parts of the *KSR* and *Graham* analyses. The technical arguments are largely conclusory and rely on unsubstantiated expert testimony (from an expert that does not qualify as a POSA) to fill gaps in the prior-art disclosures and in the argumentation. Accordingly, the Petition fails to present properly formulated theories of obviousness and is not supported by competent evidence.

Second, none of the Grounds present prior art (or prior-art combinations) that teaches a glass composition having the claimed liquidus viscosity. This missing limitation alone precludes any reasonable likelihood of success in showing any of the claims unpatentable. The obviousness Grounds also fail to establish a

motivation to combine and a reasonable expectation of success in the proposed combination achieving the claimed compositions. These failures of demonstrating obviousness are corroborated by strong objective indicia of non-obviousness.

Institution should be denied on the merits.

II. FACTUAL BACKGROUND

The '491 patent is directed to alkali-free boroaluminosilicate glasses that can be used for displays such as LCDs. EX1001, Abstract. The '491 patent teaches that “arsenic raises environmental and health issues, and thus there has been a continuing effort in the art to produce glasses with lower arsenic levels and, preferably, glasses which are substantially arsenic free,” and that while efforts have been made to replace arsenic with antimony, “antimony has its own environmental and health issues.” EX1001, 3:26-38. The compositions claimed by the '491 patent allow for the fining (the removal of bubbles) of glass suitable for LCD screens without either of these toxic elements. EX1001, 11:55-12:48. This improvement is made possible through precise control of various metal oxide ratios, which is reflected in the claims.

A. Overview of the Technology

The '491 patent identifies and improves upon a composition of silicate glass to solve a critical problem: the need for nearly defect-free glass without the use of harmful chemicals such as arsenic or antimony. During glass manufacturing,

materials such as SiO_2 , Al_2O_3 , or B_2O_3 are melted to create molten glass, which can produce gas bubbles. If gas bubbles are not removed, they can create defects in the glass product. Removing gas bubbles from glass is called “fining.” Historically, arsenic and antimony were used as “fining agents” to remove gas bubbles from molten glass, but they present environmental and health risks.

Two of the key innovations of the '491 patent glass compositions are (1) the specified MgO mol% and (2) the ratio of the concentration of the divalent metal oxides (MgO, CaO, SrO, and BaO; collectively, RO) to Al_2O_3 ($\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$) of greater than or equal to 1.0. Although MgO had been used in display-glass compositions before the '491 patent, doing so was known to increase the liquidus temperature of the glass, making it more difficult to prevent crystals from forming prematurely during a glass-sheet manufacturing process. The inventor of the '491 patent discovered that this effect could be counteracted by tightly controlling the amount of MgO along with the ratio of RO to Al_2O_3 . Within the claimed range of the RO to Al_2O_3 ratio, adding MgO actually *decreased* the liquidus temperature rather than increasing it, as expected at the time. EX1001, 10:12-64. This also led to the inventor's discovery that the addition of MgO, in combination with the claimed RO to Al_2O_3 ratio, accelerates the digestion of SiO_2 during melting of the glass. The accelerated digestion of SiO_2 reduces the amount of bubbles formed during melting and enables tin (SnO_2)—a fining agent considered to be a much less

effective fining agent than arsenic and antimony—to work effectively in fining the glass. EX1001, 7:23-28, 12:46-48.

These claimed glass compositions are designed to be formed using a fusion downdraw process, which allows for tightly controlled and reproducible glass dimensions and allows for glass sheets that are flat, smooth, defect-free, and thermally and mechanically durable, without further mechanical surface processing such as grinding or polishing. EX1001, 3:55-60, 4:52-5:3, 10:54-64, 12:49-64. The claimed glass compositions, suitable for the fusion downdraw process and lacking arsenic or antimony for fining, represent a substantial improvement over the prior-art glass compositions. EX1001, 3:55-4:2. Commercially, key innovations of the '491 patent led to the launch of Corning® EAGLE XG® glass, a best-selling product for Corning Incorporated (“Patent Owner” or “Corning”).

Beginning in approximately 2001, the inventor, Adam Ellison, began experimenting with ways to manufacture high-quality, defect-free glass without intentional additions of toxic fining agents like arsenic or antimony. After Ellison’s initial attempts to remove arsenic from Corning’s commercial products resulted in glass that was unusable due to bubbles, he started experimenting with glass compositions having an $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.0. EX2018, 97. Unexpectedly, and due to the “stunningly complex” relationship between oxides in the glass, Ellison’s experiments showed that changing the composition of

glass to have a $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.0 resulted in far fewer bubbles. EX2018, 97-98. Ellison's experiments also unexpectedly revealed that the level of MgO in the composition needed to be at least 1.0 in mol%, as compared to about 0.2 mol% in Corning's prior commercial products. EX1001, 10:12-47.

Ellison's discoveries—increasing the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio and increasing the baseline use of MgO—proved to be major breakthroughs that reduced defects within glass panels by an order of magnitude without the intentional use of arsenic or antimony. That breakthrough was embodied in EAGLE XG Glass. It was the first heavy-metal-free TFT LCD glass on the market. The industry immediately appreciated the uniqueness and importance of EAGLE XG Glass. EX2003, 0014; EX2004. Eagle XG Glass has since become the industry standard among the world's leading panel makers.

B. Overview of '491 Patent Claims

The '491 patent, entitled "Finishing of Boroalumino Silicate Glasses," issued on February 4, 2014 to inventor Adam J.G. Ellison. It issued from U.S. Application No. 12/965,032, filed on December 10, 2010, which is a continuation of U.S. Application No. 11/478,493, filed on June 28, 2006 (now U.S. Patent No. 7,851,394), and claims the benefit of U.S. Provisional Application No. 60/694,478, filed on June 28, 2005.

Independent claim 1 of the '491 patent recites an alkali-free glass for a downdraw process comprising, in mole percent (mol%) on an oxide basis, the following: SiO₂: 64.0-71.0, Al₂O₃: 9.0-12.0, B₂O₃: 7.0-12.0, MgO: 1.0-3.0, CaO: 6.0-11.5, SrO: 0-2.0, and BaO: 0-0.1, wherein: (a) the ratio of the concentration of the divalent metal oxides to Al₂O₃ ($[RO]/[Al_2O_3]$) in the glass is greater than or equal to 1.00, (b) the glass has at least 0.01 mol% SnO₂ and at most 0.05 mol% As₂O₃ and Sb₂O₃, respectively, and (c) the glass has a liquidus viscosity greater than or equal to 100,000 poise. EX1001, 19:36-62. Independent claim 13 recites an alkali-free glass sheet produced by a downdraw process comprising a glass that comprises SiO₂, Al₂O₃, B₂O₃, MgO, and CaO, wherein (i) $[RO]/[Al_2O_3]$ is greater than or equal to 1.0, (ii) the MgO content is greater than or equal to 1.0 mol%, (iii) the glass has at least 0.01 mol% SnO₂ and at most 0.005 mol% As₂O₃ and Sb₂O₃, respectively, and (iv) the glass has a liquidus viscosity greater than or equal to 100,000 poise. EX1001, 20:61-21:12.

C. Prosecution History of the '491 Patent

The '491 patent examination applied or at least considered several of the references presented in the Petition. First, the primary reference featured in Ground 1, Japanese Publication No. 2004-189535 (EX1004, "Miwa '535"), was cited by Patent Owner and applied in an obviousness rejection overcome by Patent Owner during prosecution. EX1002, 16-17, 47-48, 63-64. Second, the U.S. equivalent of

the primary reference featured in Ground 2, Japanese Publication No. 2002-308643 (EX1007, “JP ’643”), was cited by Patent Owner and specifically considered by the Examiner. EX1002, 68 (Reference AN). The U.S. equivalent of JP ’643, U.S. Patent No. 6,881,692, shares the same family as JP ’643 and contains substantively identical disclosure. After considering the cited prior art, the Examiner concluded that the “prior art fail to disclose or suggest with sufficient specificity an alkali-free glass” as claimed. EX1002, 17.

III. PERSON OF ORDINARY SKILL IN THE ART (“POSA”)

A POSA is presumed to be aware of all pertinent art. The POSA possesses the “understandings and knowledge reflected in the prior art” and thinks along conventional wisdom. *See Abbott Labs. v. Andrx Pharm., Inc.*, 452 F.3d 1331, 1336 (Fed. Cir. 2006). For the ’491 patent, a POSA at the time of the invention would have had a bachelor’s degree in materials science, geology, chemistry, or a comparable field of study, and at least two to three years of research or industrial experience with the design, manufacturing, characterization, and testing of glasses, including oxide glasses. Alternatively, the POSA would have had a master’s degree or higher in the same fields of study. EX2007, ¶16.

At this stage, Patent Owner submits that the Board does not need to resolve the appropriate level of skill for a POSA for purposes of deciding institution because the Petition fails under either the definition above or Petitioner’s proposed

definition. While Patent Owner does not necessarily agree with Petitioner's proposed definition of a POSA, what is important for purposes of institution is that Petitioner's expert does not satisfy Petitioner's own definition, and therefore cannot competently support the positions in the Petition. EX2007, ¶18.

IV. CLAIM CONSTRUCTION

The Board need not formally construe any term in order to conclude that institution should be denied on the merits. Patent Owner reserves the right to contest Petitioner's implicit or explicit constructions during any further proceedings.

V. REASONS TO DENY INSTITUTION

As a preliminary matter, the Petition is not supported by competent evidence. Petitioner's expert is not qualified as a POSA, he fails to cite evidence in support of most of his purported opinions, and where he does purport to offer evidence, that evidence is unreliable, lacks authentication, and does not support the propositions for which it is cited. Any Final Written Decision that relied on this declaration would not be supported by substantial evidence.

Moreover, each of the Grounds fails to show a likelihood of unpatentability for any of the challenged claims. Ground 1 fails to show the independent claims obvious because there is no motivation to modify and combine the references as proposed and the combinations fail to disclose the claimed liquidus viscosity.

Ground 2 fails to show the independent claims obvious because there is no motivation to modify the references as proposed and the combinations also fail to disclose the claimed liquidus viscosity. Notwithstanding the failure of both these Grounds to make a *prima facie* case of obviousness, a conclusion of obviousness is further undermined by strong objective indicia of non-obviousness, including long-felt need, commercial success, and industry praise for the patented features. Finally, Ground 3 fails to show anticipation of claim 13 because Miwa '377 does not disclose the claimed liquidus viscosity.

A. The Petition fails to present competent supporting evidence.

Petitioner's obviousness and anticipation arguments are largely conclusory and rely heavily on the say-so of Petitioner's supporting expert declaration, which cites unreliable and unauthenticated test data and lacks the requisite expert qualifications. There are significant problems with Petitioner's approach.

First, aside from Petitioner's expert's *ipse dixit*, the Petition has no evidentiary support for a POSA's alleged knowledge and motivation to combine. The Federal Circuit has made clear that the *ipse dixit* of an expert is not sufficient to support obviousness challenges at the PTAB. *See, e.g., TQ Delta, LLC v. Cisco Sys., Inc.*, 942 F.3d 1352, 1362 (Fed. Cir. 2019) (reversing PTAB obviousness finding regarding motivation to combine based only on conclusory expert

testimony as not supported by substantial evidence). The Petition therefore fails to cite evidence sufficient to warrant institution.

Second, Petitioner's expert does not meet Petitioner's own definition of a POSA. Petitioner's expert, Dr. Ernst, is a ceramic engineer and metallurgist. He identifies no significant experience with glass chemistry or material science specifically dealing with the "design, synthesis, and characterization of silicate, borosilicate, aluminosilicate, and boroaluminosilicate glasses." *Compare* Pet., 11-12 (defining level of skill for a POSA), *with* EX1012 (Ernst CV). Indeed, the description of Dr. Ernst's background credentials in his expert report does not describe *any* years of experience with design, synthesis, and characterization of silicate, borosilicate, aluminosilicate, and boroaluminosilicate glasses. *See* EX1003, ¶¶5-7 (describing experience in ceramic engineering, ceramic/metal interfaces, and microscopy).

The Federal Circuit has made clear that "to be qualified to offer expert testimony on issues from the vantage point of an ordinarily skilled artisan in a patent case, an expert must at a minimum possess ordinary skill in the art." *Kyocera Senco Indus. Tools Inc. v. Int'l Trade Comm'n*, 22 F.4th 1369, 1377 (Fed. Cir. 2022). Petitioner's expert does not have, and does not even claim to have, what the Petition has identified as the level of ordinary skill in the relevant art. Without a qualified expert, the Petition has no competent evidentiary support and

the PTAB cannot render a FWD granting the Petition as it would not be supported by substantial evidence. *See id.*

Finally, Dr. Ernst purports to rely on extrinsic test data to support his opinions for Ground 1 of the Petition. *See* EX1003, ¶¶99-108, 197-202. Specifically, Dr. Ernst opines that data presented in Exhibit 1010, a Chinese-language “Test Report,” shows that a composition similar to that of Embodiment 15 of Miwa ’535—as modified per Petitioner’s obviousness theory—has a liquidus viscosity of $10^{6.2}$ dPa. Dr. Ernst concludes that a modified version of Embodiment 15 therefore satisfies claims 1 and 13 of the ’491 patent. There are several problems with this proposition.

First, Dr. Ernst does not purport to know the reliability of the test data or their origins. The foreign-language document appears to have been generated for litigation, but there is no competent sponsoring witness who can authenticate it. The Test Report is not self-authenticating. *See* Fed. R. Evid. 902; 29 C.F.R. § 18.902. It is signed by a Wei Peng, an apparent third party who did not provide a sworn declaration in this proceeding. Assuming Wei Peng is a Chinese national, any declaration would not be subject to penalty of perjury or 18 U.S.C. § 1001, and the PTAB could not compel the declarant to testify at a deposition in the United States. *See* 35 U.S.C. § 24 (deferring the PTAB’s subpoena power to federal courts); Fed. R. Civ. P. 45(c) (limiting the subpoena power of federal courts).

Furthermore, neither the Test Report itself nor Dr. Ernst's declaration explain how the test was performed. There is no materials and methods section, no explanation of testing conditions or assumptions, no account for the source of ingredients, no description of the type of equipment used, and no discussion of the significance of the results. There is no basis for Dr. Ernst or the Board to consider the Test Report reliable. *See* Fed. R. Evid. 702. If review is instituted, Patent Owner will file a motion to strike this evidence and, in the alternative, a motion for additional discovery. *See* 37 C.F.R. § 42.224(a); *Bloomberg Inc. v. Markets-Alert Pty. Ltd.*, CBM2013-00005, Paper 32 (PTAB May 29, 2013).

Finally, even if the test data were admitted over PO's objections, Dr. Ernst's use of the test data is fundamentally flawed. Dr. Ernst acknowledges that the composition tested is only "similar" to the glass described in Miwa '535's Embodiment 15 (modified to replace BaO with SrO). EX1003, ¶198. Setting aside the issues with Dr. Ernst's allegedly obvious substitution of BaO for SrO (discussed below in Section V.B.1), Dr. Ernst does not explain why other differences in the composition would not meaningfully affect the measured liquidus viscosity. For example, Dr. Ernst summarily concludes that the difference in Sb₂O₃ content "has little impact on the liquidus viscosity." EX1003, ¶198. No rationale or evidence is provided to support this statement. Even "little impact" does not mean no material impact. *Id.*

The insufficiency and inconsistency in Dr. Ernst's analysis is further highlighted by Dr. Ernst's conclusion that "glasses with the composition specified in Miwa '535's Embodiment 15 meet the requirement of Limitation 1[m]." EX1003, ¶107. A similar conclusion with respect to claim 13 can be found in paragraph 201 of Dr. Ernst's declaration. In drawing these conclusions, Dr. Ernst appears to have forgotten that the composition specified in Miwa '535's Embodiment 15 is *not* the composition that was tested. It is therefore unclear which composition (the original or modified composition) Dr. Ernst relies on for allegedly having a liquidus viscosity as recited in claims 1 and 13.

These flaws in the evidentiary support for the Petition are fatal. Indeed, "[i]t is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify with particularity the evidence that supports the grounds for the challenge to each claim." *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016) (internal quotes omitted). That is because "the expedited nature of IPRs bring with it an obligation for petitioners to make their case in their petition to institute." *Id.* at 1369-70. The Board should not institute review of a Petition that is so fundamentally flawed and devoid of competent supporting evidence on the merits.

B. All three grounds fail to show unpatentability.

Each of the Grounds is facially and fatally flawed on the merits. Ground 1 fails to articulate a sufficient motivation to modify the primary reference (Miwa '535) or even attempt to establish a reasonable expectation of success in doing so. Petitioner bases its obviousness arguments on the overly simplistic proposition that a POSA would have been motivated to substitute one oxide (BaO) for another (SrO) in isolation of the references' disclosures as a whole.

Ground 2 similarly fails to articulate a sufficient motivation to modify the primary reference (JP '643) or even attempt to establish a reasonable expectation of success in doing so. Petitioner again bases its obviousness arguments on the overly simplistic proposition that a POSA would have been motivated to substitute BaO for SrO with disregard to the cited references' disclosures. Further, in Ground 2, Petitioner fails to establish that a POSA would have been motivated to modify the fining agents of JP '643, as proposed, with a reasonable expectation of success in achieving the claimed compositions. Critically, Petitioner also fails to establish that the twice-modified composition from JP '643 would have a liquidus viscosity as claimed.

With respect to anticipation Ground 3, Petitioner purports to present a theory of anticipation, but fails to identify all of the independent claim elements in Miwa '377—namely the claimed liquidus viscosity.

In an IPR, the burden of proving a proposition of unpatentability is borne by (and remains at all times with) the petitioner. *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1375 (Fed. Cir. 2016). Defects in establishing a ground of unpatentability in a petition are not curable during trial since the petition cannot be corrected or enhanced during trial. *See Sirona Dental Sys. GmbH v. Institut Straumann AG*, 892 F.3d 1349, 1356 (Fed. Cir. 2018). The Board makes its determination regarding institution based on what the petition actually presents and not what it could have reasonably contained had it been drafted differently. *Magnum Oil*, 829 F.3d at 1381 (holding that the Board is not “free to adopt arguments on behalf of petitioners that could have been, but were not, raised by the petitioner during [a post-grant proceeding]”).

For obviousness, a petitioner must “articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness”—“mere conclusory statements” will not suffice. *Magnum Oil*, 829 F.3d at 1380. Indeed, “[i]t is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’” *Intelligent Bio-Sys.*, 821 F.3d at 1369 (quoting 35 U.S.C. § 312(a)(3)). “An obviousness determination requires finding that [a Skilled Artisan] would have been motivated to combine or modify the teachings in the prior art *and* would have had a reasonable expectation

of success in doing so.” *Regents of the Univ. of Cal. v. Broad Inst., Inc.*, 903 F.3d 1286, 1291 (Fed. Cir. 2018); *Intelligent Bio-Sys.*, 821 F.3d at 1367–68. The challenger must explain why a POSA would modify the primary reference to incorporate the teachings of the secondary reference. *See Virtek Vision Int’l ULC v. Assembly Guidance Sys., Inc.*, 97 F.4th 882, 888 (Fed. Cir. 2024) (emphasizing that the mere existence of the claim limitations in the prior art is not enough without a clear motivation to modify and combine).

Here, Petitioner falls short of carrying its burden of establishing a reasonable likelihood of prevailing to show that the claims challenged in Grounds 1-3 are anticipated or obvious for multiple reasons.

1. Ground 1 fails to show obviousness of independent claim 1.

Ground 1 relies on the combination of Miwa ’535 and Peuchert ’469 to show obviousness of independent claim 1. Pet., 21-28. Petitioner cites Miwa ’535’s Embodiment 15 as the basis for its unpatentability ground. Pet., 22. Petitioner acknowledges that the mol% for BaO in Embodiment 15 is 0.21 mol%, which is above the claimed maximum value of 0.1 mol%. Pet., 23-26.

In an attempt to cure this deficiency in Embodiment 15, Petitioner argues that a POSA would have been motivated to reduce the 0.21 mol% for BaO to 0.00 mol%. Pet., 24 (Table 1). To account for the reduction of BaO, Petitioner argues that a POSA would have found it obvious to add 0.31 mol% SrO to the

composition of Embodiment 15, thereby increasing the total mol% of SrO from 0.63 mol% to 0.94 mol%. Pet., 24 (Table 1). Petitioner surmises that only the amount of SrO would be changed, with all the other ten possible oxides listed for Embodiment 15 on page 10 of Exhibit 1004—SiO₂, Al₂O₃, B₂O₃, MgO, CaO, ZnO, ZrO₂, SnO₂, As₂O₃, and Sb₂O₃—remaining essentially unchanged.

Petitioner bases the entirety of this argument on the overly simplistic proposition that a POSA would have been motivated to substitute all 0.21 mol% of the BaO for 0.31 mol% SrO because BaO and SrO have a similar ionic field strength. Pet., 25. According to Petitioner and Dr. Ernst, the similarity in ionic field strength indicates that BaO and SrO “play a *similar* role of network modifiers in the silicate glass structure,” presumably meaning that these two oxides can be freely substituted for each other in all instances. Pet., 20-21, 25 (emphasis in original); EX1003, ¶84. Dr. Ernst cites to only a single table on page 60 of Exhibit 1015, listing ionic field strengths, to support this argument. EX1003, ¶73. Without any meaningful explanation or evidence, Dr. Ernst surmises that the allegedly similar ionic field strengths mean that BaO and SrO can be freely substituted for each other as long as their “combined fraction” within a glass composition remains constant. EX1003, ¶75.

Petitioner further attempts to bolster its argument by citing Peuchert '469. According to Petitioner, Peuchert '469's disclosure of glass compositions with the

“sum of the two heavy alkaline earth metal oxides SrO and BaO [being] preferably limited to a maximum of 4% by weight” would have helped motivate a POSA to change the mol% of BaO in Miwa ’535’s Embodiment 15. Pet., 26. Aside from citing Peuchert ’469 as disclosing a maximum wt% of SrO and BaO, Petitioner provides no actual reason for why Peuchert ’469 would have motivated a POSA to modify Miwa ’535’s Embodiment 15. Indeed, Petitioner could not have provided an actual reason. Peuchert ’469 does not disclose or suggest substituting BaO with SrO, much less does Peuchert ’469 disclose any interplay between these two oxides.

Simply put, Petitioner’s motivation to combine Miwa ’535 and Peuchert ’469 hinges solely on the proposition that, because both references disclose glass compositions comprising BaO and SrO and because these two oxides have a similar ionic field strength, it would have been obvious to modify Miwa ’535 in view of Peuchert ’469. This kind of cursory analysis falls well short of establishing that a POSA would have been motivated to combine Miwa ’535 and Peuchert ’469 to arrive at what is claimed. *See Virtek*, 97 F.4th at 888 (reversing PTAB obviousness decision for lacking articulation of motivation to modify or combine). “It does not suffice to meet the motivation to combine requirement to recognize that two alternative arrangements ... were both known in the art.” *Id.* at 886.

Rather, the patent challenger must show that a skilled artisan would swap the element in one reference for an element in another reference.

Petitioner's arguments in Ground 1 fail to establish that a POSA would have been motivated to modify Miwa '535 as proposed with a reasonable expectation of success for at least the following reasons.

- a. The ionic field strength of Sr^{2+} and Ba^{2+} alone would not have motivated a POSA to explore modifying Miwa '535 as proposed by Petitioner with a reasonable expectation of success.**

A POSA would have understood that substituting even a small percentage of one alkaline earth oxide (for example, MgO, CaO, SrO, or BaO) for another alkaline earth oxide (for example, MgO, CaO, SrO, or BaO) can have profound and unpredictable effects on significant properties of the glass, such as liquidus temperature and CTE. EX2007, ¶¶11, 31, 36, 43-49. Petitioner does not establish a link between ionic field strength and a significant glass property (or any glass characteristic) that would have motivated a POSA to modify Miwa '535. Indeed, there is no clear link. EX2007, ¶¶32-36.

A POSA would have been aware that ionic field strength is a characteristic of metal ions, and that ionic field strength affects the bonding interactions between oxides in the glass. However, ionic field strength alone does not capture the full effects of different cations on glass properties because it does not account for the effects of network anion charge-balancing and the varying bond configurations

with cation valence electrons. EX2007, ¶¶11, 34. As an example, ZnO and MgO have similar ionic sizes ($\text{Mg}^{2+}(\text{VI}) = 0.72 \text{ \AA}$, $\text{Zn}^{2+}(\text{VI}) = 0.745 \text{ \AA}$), EX2010, 928-29, and therefore ionic field strengths that differ less than Sr^{2+} and Ba^{2+} ($0.44 \text{ \AA}^{-2}$ and $0.43 \text{ \AA}^{-2}$, respectively), but display significantly different properties as oxides. EX2007, ¶36. The melting point of MgO is almost 40% greater than ZnO (3125 K vs. 2248 K, respectively), so these oxides can have a significantly different effects on glass properties like high temperature viscosities (e.g., melt viscosity) and liquidus temperature. EX2007, ¶36. A second illustrative example is that of CaO and CdO. Ca^{2+} and Cd^{2+} have similar ionic radii ($\text{Ca}^{2+}(\text{VI}) = 1.00 \text{ \AA}$, $\text{Cd}^{2+}(\text{VI}) = 0.95 \text{ \AA}$, EX2010, 928-29), and therefore have ionic field strengths that differ less than Sr^{2+} and Ba^{2+} ($0.35 \text{ \AA}^{-2}$ and $0.36 \text{ \AA}^{-2}$, respectively), yet their respective oxides have much different properties. EX2007, ¶36. CaO melts at 2845 K whereas CdO melts between 1173 K and 1273 K, so these oxides would have significantly different effects on the properties of a glass. EX2007, ¶36.

A POSA would also have understood that, when the total concentration of alkali or alkaline earth cations is greater than that of Al_2O_3 (as is the case in Miwa '535's Embodiment 15), the amount of alkaline earth oxides equal to the amount of Al_2O_3 will be in charge-compensation roles, not network-modifier roles. EX2007, ¶37. In Miwa '535's Embodiment 15, the ratio of ΣRO (MgO, CaO, SrO, and BaO) to Al_2O_3 , as calculated by Dr. Ernst, is 1.20:1, EX1003, ¶93, meaning that

most of the alkaline earth ions, including most of the Ba^{2+} and Sr^{2+} cations, would be acting as charge-balancing cations rather than as network modifiers. EX2007, ¶37. Network-modifying cations and charge-balancing cations play different roles in a glass composition. EX2007, ¶38; EX2011, 679 (“[T]he activity of a metal cation such as Ca^{2+} may depend on whether it charge-balances aluminum or it simply forms nonbridging oxygens in the melt.”). Dr. Ernst’s discussion of the motivation for substituting BaO with SrO is grounded in an argument that assumes a network modifying regime but, as discussed above, this regime is largely inappropriate given the high relative concentration of Al_2O_3 with respect to ΣRO in Miwa ’535’s Embodiment 15. EX2007, ¶39. Dr. Ernst’s incorrect assumption highlights the insufficiency of Dr. Ernst’s offered motivation that a POSA would have had in modifying Miwa ’535. EX2007, ¶¶39-40.

For at least these reasons, a POSA would not have used ionic field strength as an overriding factor for modifying a glass composition. EX2007, ¶¶32-36. Ionic field strength does not provide enough information to make accurate predictions about resulting glass properties. EX2009, 162 (“[T]he lowering of viscosity by substitution of Ba^{2+} for Sr^{2+} cannot be explained simply in terms of the field strength or polarisability of the modifier.”); EX2007, ¶34. Irrespective of the ionic field-strength values reported in Exhibit 1006, a POSA would have understood that different amounts of Ba^{2+} cations and Sr^{2+} cations behave differently in glasses.

EX2007, ¶¶37-38. Rather than focusing on the field strength of cations, a POSA would have evaluated the possibility of substituting two oxides based on other considerations, including tangible factors such as target glass properties and raw material considerations. EX2007, ¶¶36, 54.

b. The evidence shows that a POSA would not have been motivated to substitute all of the BaO with SrO in Miwa '535's Embodiment 15 as there was no expectation of success for the substitution.

Petitioner gives lip service to a reasonable expectation of success only once in the Petition—on page 21. Petitioner surmises, without evidence, combining Miwa '535 and Peuchert '469, and replacing BaO with SrO, “to be a small set of a finite number of identified means for obtaining the desired non-alkali low-density glass useful as substrates in display technologies.” Pet., 21. This falls well short of establishing a reasonable expectation of success in modifying Miwa '535 as proposed by Petitioner.

Contrary to Petitioner's overly simplistic and unsupported arguments, Miwa '535 itself and extrinsic technical literature show that a POSA would *not* have been motivated to substitute all 0.21 mol% of the BaO with SrO while simultaneously preserving the amount of all the other oxides in Miwa '535's glass. Petitioner cannot assume, without evidence, that the mole percentages for BaO and SrO can be freely adjusted while preserving (i) the amount for eight additional oxides and (ii) the desired glass characteristics touted by Miwa '535. Petitioner does not

consider or address the interplay among a multitude of different oxides and oxide ratios in Miwa '535. This is critical to establishing obviousness in Ground 1 for multiple reasons. First, claim 1 requires specified mole percentages for eight additional oxides: SiO₂, Al₂O₃, B₂O₃, MgO, CaO, As₂O₃, Sb₂O₃, and SnO₂. EX1001, 19:35-60. Second, claim 1 requires that $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ be greater than or equal to 1.00. EX1001, 19:49-51.

Not once does Petitioner provide any reason for *why* a POSA would have expected modifying Miwa '535's Embodiment 15 in view of Peuchert '469 would retain the glass properties touted by Miwa '535, much less offer an improvement a POSA would have been motivated to pursue. This is fatal to Petitioner's ground. The Board in *Juniper Networks* agreed that the petitioner must "direct us with particularity to ... 'specific explanations' of 'expected results.'" *See Juniper Networks, Inc. v. Correct Transmission, LLC*, IPR2021-00682, Paper 26 at 26 (PTAB Oct. 3, 2022). The burden of proof is on Petitioner, not Patent Owner.

In fact, Miwa '535 makes it clear that modifying the mole percentage for BaO and/or SrO results in multiple other changes within the glass composition. Tables 1A and 1B below show all 20 embodiments¹ from Miwa '535 in terms of

¹ Embodiments 21 and 22 are not included here because Miwa describes them as comparative embodiments.

mol% on an oxide basis calculated according to Dr. Ernst's methodology, along with the ratio of $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ("RO/Al"). Embodiment 15 is highlighted orange and the embodiments in which BaO is within the claimed range of 0 to 0.1 mol% are highlighted blue.

Em.	1	2	3	4	5	6	7	8	9	10
SiO ₂	69.45	69.45	69.45	69.45	69.36	69.36	68.77	68.74	68.67	69.38
Al ₂ O ₃	10.39	10.39	10.39	10.39	10.38	10.38	10.29	10.29	10.28	10.22
B ₂ O ₃	10.47	10.46	10.46	10.46	9.50	9.50	11.31	11.30	11.29	10.29
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CaO	8.27	8.27	8.27	8.27	9.44	9.44	9.36	9.35	9.34	9.29
SrO	0.96	0.96	0.96	0.96	0.64	0.64	0.00	0.00	0.00	0.31
BaO	0.22	0.22	0.22	0.22	0.43	0.43	0.00	0.00	0.00	0.04
As ₂ O ₃	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sb ₂ O ₃	0.20	0.20	0.20	0.20	0.20	0.20	0.18	0.20	0.17	0.00
SnO ₂	0.04	0.04	0.04	0.04	0.04	0.04	0.09	0.02	0.07	0.09
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZrO ₂	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.18	0.37
Fe ₂ O ₃	0.0033	0.0041	0.0050	0.0062	0.0083	0.0104	0.0062	0.0062	0.0082	0.0082
RO/Al	0.91	0.91	0.91	0.91	1.01	1.01	0.91	0.91	0.91	0.94

Table 1A

Em.	11	12	13	14	15	16	17	18	19	20
SiO ₂	67.56	68.47	69.05	67.97	67.19	68.70	66.50	67.96	68.64	69.80
Al ₂ O ₃	10.44	9.76	10.33	10.34	10.22	10.28	11.85	10.98	11.59	9.96
B ₂ O ₃	11.47	8.96	11.35	10.41	10.29	8.94	10.13	9.46	9.21	8.47
MgO	0.00	0.82	0.00	0.00	2.10	0.00	0.00	0.49	0.00	1.14
CaO	8.31	8.28	8.22	9.40	9.29	10.52	9.58	9.98	6.62	7.60
SrO	1.22	2.56	0.64	0.32	0.63	0.63	0.00	0.32	2.28	1.26
BaO	0.43	0.02	0.13	0.64	0.21	0.21	1.31	0.64	0.22	0.00
As ₂ O ₃	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sb ₂ O ₃	0.11	0.16	0.11	0.00	0.02	0.06	0.03	0.00	0.21	0.09
SnO ₂	0.04	0.11	0.07	0.07	0.04	0.07	0.07	0.07	0.04	0.04
ZnO	0.41	0.41	0.00	0.40	0.00	0.40	0.41	0.00	0.83	0.81
ZrO ₂	0.00	0.22	0.00	0.08	0.00	0.00	0.11	0.00	0.16	0.27
Cl	0.00	0.19	0.09	0.37	0.00	0.18	0.00	0.09	0.19	0.55
Fe ₂ O ₃	0.0063	0.0062	0.0062	0.0041	0.0041	0.0041	0.0042	0.0041	0.0063	0.0062
RO/Al	0.95	1.20	0.87	1.00	1.20	1.10	0.92	1.04	0.79	1.00

Table 1B

As shown in Tables 1A and 1B, relative to Embodiment 15, Miwa '535 teaches that reducing the mole percentage for BaO results in numerous other changes within the glass compositions. The embodiments make it clear that BaO is not simply replaced with an increased amount of SrO as proposed by Petitioner. For example, in each of Embodiments 7-9 where BaO is set to 0 mol%, both MgO and SrO are also set to 0 mol%, which is a significant *reduction* from the corresponding mole percentages for MgO and SrO in Embodiment 15. In Embodiment 10 where BaO is set to 0.04 mol%, MgO is again reduced to 0 mol% and the mole percentage of SrO is *reduced* to 0.31 mol%. In Embodiment 12 where BaO is set to 0.02 mol%, MgO is reduced to 0.82 mol% and SrO is

increased to 2.56 mol%. And finally, in Embodiment 20 where BaO is set to 0 mol%, the mole percentage of MgO is cut almost in half (2.10 mol% to 1.14 mol%) and the mole percentage of SrO is *doubled* (from 0.63 mol% to 1.26 mol%).

At least these embodiments in Miwa '535 make it clear that there is no simplistic one-to-one correlation between oxides as suggested by Petitioner. Rather, the embodiments show that modifying even one oxide can result in numerous changes to other oxides within the compositions. Changes to MgO and SrO are noted above, but a comparison of all the embodiments shows numerous changes to other oxides relative to Embodiment 15.

Notably, the changes to SrO do not follow a simple, predictable pattern, as suggested by Petitioner. In Embodiments 7-10, a reduction in BaO results in a reduction of SrO, while in Embodiments 12 and 20, a reduction in BaO results in an increase for SrO.

Furthermore, several of Miwa '535's embodiments having reduced BaO relative to Embodiment 15 fall outside the claimed composition. In Embodiments 7-10 and 12, the mole percentage for MgO is 0.82 mol% or less, which falls outside the claimed range of 1.0 to 3.0 mol%. In Embodiments 7-10, $[RO]/[Al_2O_3]$ is less than claimed minimum of 1.00. And in Embodiment 12, the amount of SrO exceeds the claimed maximum value of 2.0 mol%.

Petitioner ignores the variability within Miwa '535's embodiments, and instead focuses on substituting one oxide for another with complete disregard to how substituting oxides would affect the overall glass composition. Indeed, Petitioner does not even attempt to explain how increasing SrO and/or reducing BaO would affect the other ten possible oxides in Miwa '535's embodiments. This is legal error. "Focusing on the obviousness of substitutions and differences, instead of on the invention as a whole, is a legally improper way to simplify the often difficult determination of obviousness." *Gillette Co. v. SC Johnson & Son, Inc.*, 919 F.2d 720, 724 (Fed. Cir. 1990). It is telling that Petitioner and its expert consider only Embodiment 15 in isolation, without a discussion or analysis of the other embodiments in the context of Miwa '535's disclosure as a whole.

Petitioner fails to appreciate (or even consider) that glass compositions are not a system that allows for independent change of one oxide with little or no material effect on other oxides and/or glass properties. Petitioner fails to appreciate this despite the fact that Miwa '535 exemplifies the opposite. What effect Petitioner's BaO/SrO substitution has on Miwa '535's desired glass properties is left entirely unaddressed by Petitioner.

Miwa '535 and Peuchert '469 disclose broad ranges for at least MgO, CaO, BaO, and SrO, and Petitioner does not provide any guidance on how to choose within the disclosed ranges to arrive at claim 1. When there is no provided

guidance on what modifications or steps would motivate a POSA to arrive at a claimed composition, modifying the prior art cannot be based on a simplistic optimization of one variable in insolation of other variables shown to be dependent on that variable. *See Pfizer Inc. v. Mylan Pharm. Inc.*, 71 F. Supp. 3d 458, 468–69 (D. Del. 2014), *aff'd* 628 F. App'x 764 (Fed. Cir. 2016) (“The [prior art] did not indicate that these steps would yield better [results], nor is the court convinced that the one skilled in the art would have found these ‘optimization’ steps obvious without some data to support it.”). “[G]iven the sheer volume of possible combinations and the additional subsequent chemical alterations necessary to arrive at the claimed compound, the court cannot say that one skilled in the art would have had a reason to alter [the prior art]” to arrive at the claim. *Id.*

Indeed, to establish obviousness of claimed ranges, Petitioner must establish that a POSA would have had a reason to attempt to get within the claimed ranges. *See Chemours Co. FC v. Daikin Indus., Ltd.*, 4 F.4th 1370, 1377 (Fed. Cir. 2021) (citing *Procter & Gamble Co. v. Teva Pharm. USA, Inc.*, 566 F.3d 989, 995 (Fed. Cir. 2009)). Petitioner provides no reason for *why* a POSA would attempt to modify the BaO mole percentage in Miwa '535's Embodiment 15 to get within the claimed range of 0 to 0.1 mol%. Petitioner alludes only to the ionic field strength of SrO and BaO. Petitioner does not explain, or offer evidence to explain, why a POSA would have been motivated to (i) isolate Miwa '535's Embodiment 15, (ii)

modify the mole percentage for a single oxide within Embodiment 15, and (iii) retain the mole percentages for all the other oxides within Embodiment 15, much less with any reasonable expectation of success.

In light of Miwa's disclosure, a POSA would not have been motivated to completely remove BaO. EX2007, ¶¶31, 57-58. All but four of Miwa's embodiments (Embodiments 7-9 and 20) contain BaO. Nothing about these four embodiments stands out in terms of glass property performance. EX2007, ¶57. Indeed, Petitioner has not argued that removal of BaO would tend to benefit Miwa's Embodiment 15 in any way.

In fact, reducing the number of oxide components in a glass composition (e.g., completely removing BaO) can make the glass melt more prone to crystallization, making it more difficult to produce a defect-free glass. EX2007, ¶55. This concept is referred to as the "principle of ... confusion," wherein glass melts with greater numbers of oxide components need to undergo more extensive solute redistribution to crystallize. EX2016, 287; EX2007, ¶¶55-56. In other words, additional compositional components "confuse" crystallization, which promotes glass creation. EX2007, ¶¶55-56.

As such, removing all of the BaO in a given glass composition and replacing it completely with SrO, as proposed by Dr. Ernst, would create a less compositionally complex glass. EX2007, ¶56. This less compositionally complex

glass, in turn, could reduce the crystallization “confusion” exhibited by the melt, meaning that the melt could be more likely to crystallize and less likely to form a defect-free glass when cooled below the liquidus temperature. EX2007, ¶56. This increased likelihood of crystallization would have discouraged a POSA from making Dr. Ernst’s proposed modification to Miwa’s Embodiment 15. EX2007, ¶56.

Petitioner’s silence on the evident interplay between different oxides in the hypothetical Miwa ’535-Peuchert ’469 composition is fatal to the alleged motivation to combine. Simply arguing that a combination of art would have been obvious, without some articulated rationale, “is inadequate to support a finding that there would have been a motivation to combine.” *In re Van Os*, 844 F.3d 1359, 1361 (Fed. Cir. 2017).

Extrinsic technical evidence also highlights the non-obviousness of Petitioner’s proposed oxide substitution. A POSA would have understood that a simple substitution of BaO with SrO could at least increase liquidus temperature and increase CTE. EX2007, ¶¶50-54. A POSA would understand both of these things are important considerations for glass sheet forming, and could negatively affect the ability of the glass to form a defect-free sheet. EX2007, ¶50.

As explained by Dr. Brow, “SrO and BaO have distinctly different effects on properties because they have different, not similar, ion properties.” EX2007, ¶47.

These different effects are exemplified by, for example, nonlinear—and often unpredictable—impacts on glass properties. EX2007, ¶¶43-49.

Kim (EX2009) states that “the liquidus temperature show[s] a continuous decrease with increase of BaO [with respect to SrO]” for a plasma display panel glass composition. EX2009, 164. It shows that the ratio of BaO to SrO can have non-linear effects on the liquidus temperature, which do not necessarily follow a predictable pattern. EX2007, ¶45. Kim’s Figure 3 (reproduced below) shows that varying the ratio of BaO to BaO+SrO between 0 and 1 creates a non-linear effect on liquidus temperature (T_l). EX2007, ¶45.

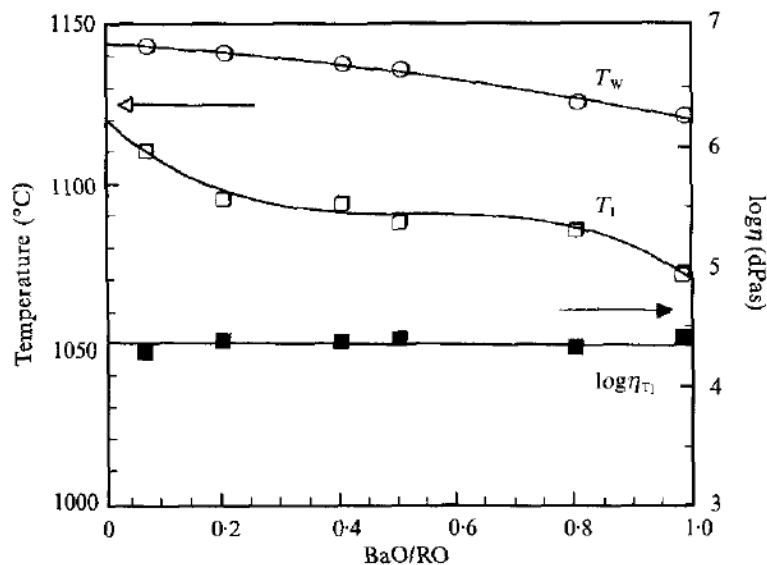


Figure 3. Liquidus temperatures (T_l), working temperature (T_w) and viscosity at liquidus temperature ($\log \eta_{T_l}$) as a function of BaO/RO

EX2009, 162, FIG. 3.

With respect to the alkaline earth oxide MgO, Wallenberger (EX2013) reports data in Figure 1 (reproduced below) that show changing the weight percent

for MgO in a SiO-Al₂O₃-CaO-MgO composition space creates non-linear effects on the liquidus temperature of the glass, with the liquidus temperature exhibiting a parabolic trend that reaches a minimum at about 2.5 weight-% MgO. EX2007, ¶44.

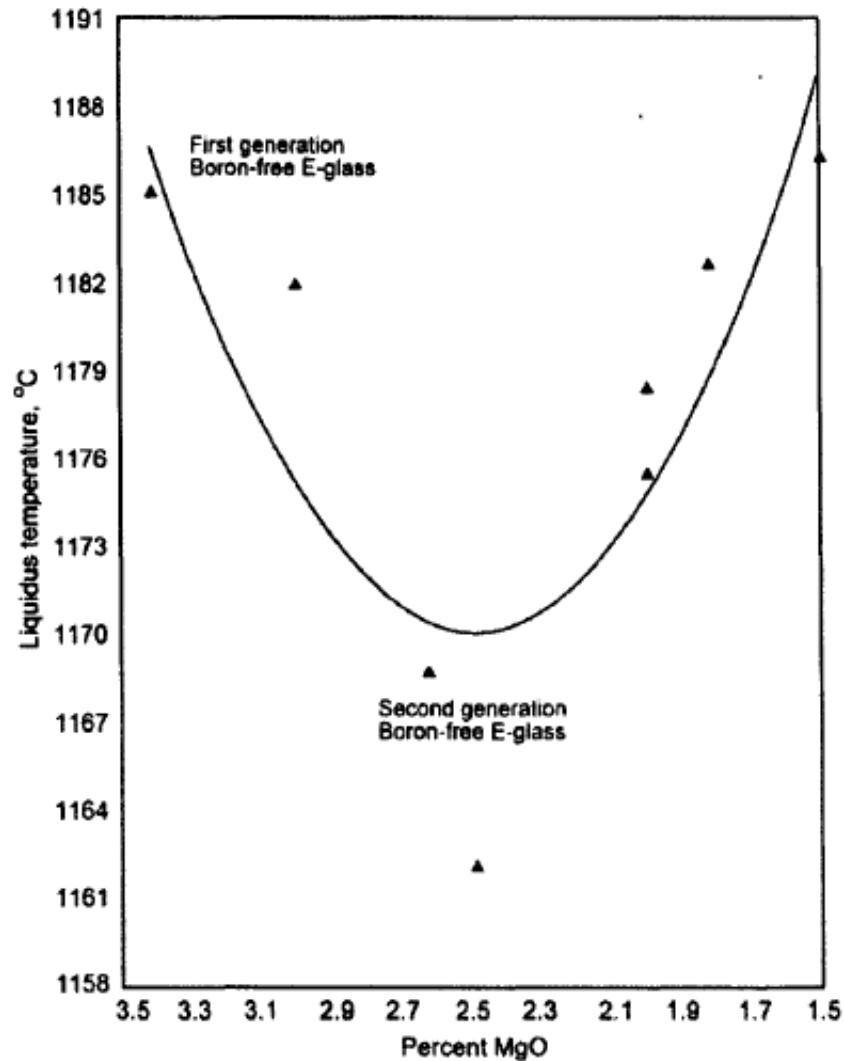
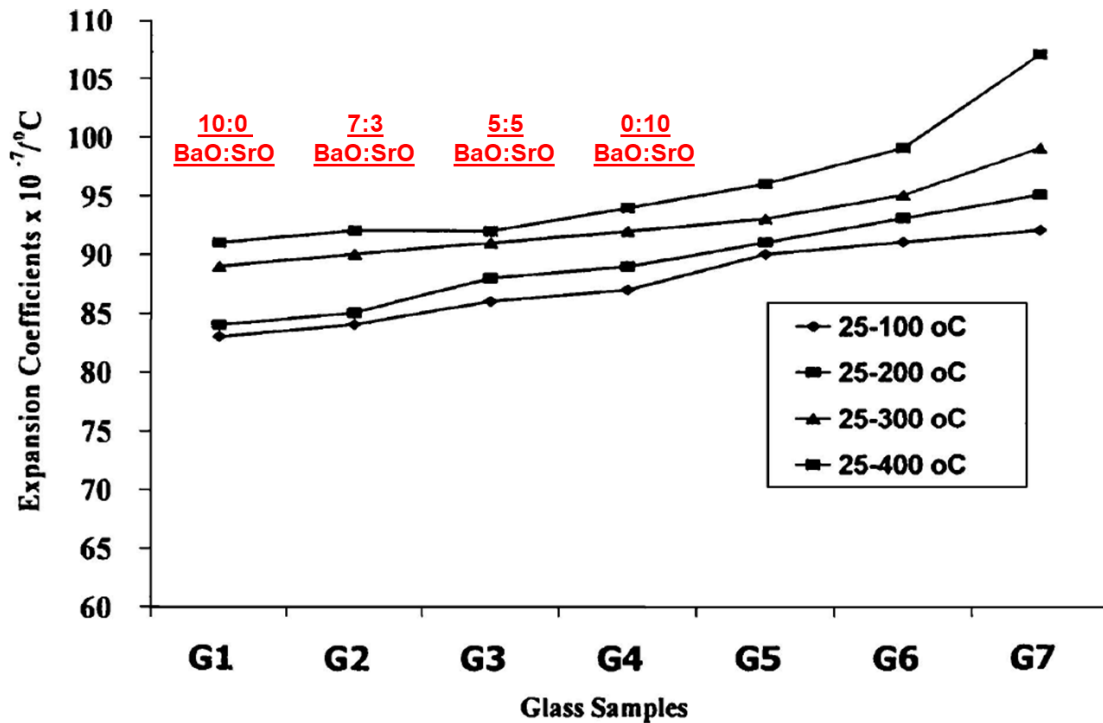


Figure 1. Eutectic with Regard to MgO for Second Generation Boron- and Fluorine-Free E-Glass

EX2013, 184, FIG. 1.

Darwish (EX2014) also states that “the addition of SrO or MgO at the expense of BaO or Al₂O₃, respectively, result[s] in an increase in the thermal

expansion coefficients (i.e., α -values) and a decrease in both the glass transition (T_g) and softening (T_s) temperature values” for an alkali-alumino borosilicate glass composition space. EX2014, 38. Darwish’s Figure 2 (reproduced below) shows that the impact on CTE can be nonlinear in some instances. EX2007, ¶46.



EX2014, 38, FIG. 2 (annotated).

For at least these reasons, a POSA would not have been motivated to simply substitute all of the BaO with SrO in Miwa ’535’s Embodiment 15 as proposed by Petitioner, much less with any reasonable expectation of success. If anything, the evidence would have left a POSA skeptical of making Petitioner’s proposed modification. EX2007, ¶58. Kim specifically teaches that full replacement of SrO by BaO—the opposite of Petitioner’s proposed modification—“is desirable from

the viewpoint of raw material cost and practical glass production.” EX2009, 161; EX2007, ¶54. Further, as explained in more detail below, Kim teaches that increasing the amount of SrO relative to BaO can *increase* liquidus temperature, and Darwish’s data show that increased SrO can *increase* CTE. EX2007, ¶¶50-54. Both of these trends are directly contrary to Miwa ’535’s disclosure that these two properties should be kept low. EX2007, ¶54.

Petitioner submitted no evidence supporting the notion that increasing the amount of SrO relative to BaO would improve or benefit Miwa ’535’s Embodiment 15 in any way. Petitioner has not even considered how the relative amounts of SrO and BaO would affect Miwa ’535’s glass. But, to establish obviousness of claimed ranges, Petitioner must establish that a POSA would have had a reason to attempt to get within the claimed ranges. *See Chemours*, 4 F.4th at 1377. Petitioner does not address the variability of oxides within Miwa ’535’s embodiments, or how substituting oxides would affect Miwa ’535’s overall glass composition and properties.

Nor does Petitioner offer any evidence to show that a POSA would have been guided to modify Miwa ’535 in view of Peuchert ’469 to arrive at the claimed glass composition. This is legal error. “[T]o have a reasonable expectation of success, one must be motivated to do more than merely to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful

result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful.” *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (cleaned up). Petitioner’s reference to ionic field strength, divorced from concrete technical evidence or rationale, would not have motivated a POSA to modify the prior art to arrive at what is claimed, much less with any reasonable expectation of success.

c. Peuchert ’469 would not have motivated a POSA to modify the mol% of BaO in Miwa ’535’s Embodiment 15.

Petitioner does not cite any particular portion of Peuchert ’469’s purported disclosure as providing motivation to modify Miwa ’535. Aside from citing Peuchert ’469 as disclosing a maximum wt% of SrO and BaO, the Petition and Dr. Ernst provide no actual reason for why Peuchert ’469 would have motivated a POSA to modify Miwa ’535’s Embodiment 15 at all, much less with a reasonable expectation of success. EX2007, ¶41.

In fact, no plausible reason could be found in Peuchert ’469. Peuchert ’469 does not disclose or suggest substituting BaO with SrO, much less does Peuchert ’469 disclose any interplay between these two oxides. EX2007, ¶41. Further, the glasses disclosed in Peuchert ’469 are from a significantly different family of glasses—the MgO-Al₂O₃-SiO₂ (MAS) system, diluted by small amounts of B₂O₃

and modified by CaO—than those described in Miwa '535. EX2007, ¶42. The minimum MgO concentration in Peuchert's examples is 8.1 wt% and the maximum B₂O₃ concentration is 6.5 wt%. EX1006, ¶41 (Table). These weight percentages are distinctly different from those described in Miwa '535. EX2007, ¶42. The range of MgO and B₂O₃ in Miwa '535's non-comparative Embodiments 1-20 are 0-1.3 wt% and 9.0-12.0 wt%, respectively. EX1004, ¶¶39-42. In addition, Peuchert '469 and Miwa '535 disclose non-overlapping ranges for glass density. The density of Peuchert '469's example glasses ranges from 2.447 g/cm³ to 2.53 g/cm³. EX1006, ¶41 (Table). The density of Miwa '535's example glasses ranges from 2.35 g/cm³ to 2.44 g/cm³. EX1004, ¶¶39-42.. Because these compositions (and structures and properties) are so different, a POSA would not have considered Peuchert '469 for motivation to modify the BaO and/or SrO mole percentages in Miwa '535, nor would a POSA have had a reasonable expectation of success in doing so. EX2007, ¶42.

d. Petitioner's argument is based on a hindsight selection of Miwa '535's Embodiment 15 and a hindsight reconstruction of the claims divorced from Miwa '535's disclosure.

Petitioner cherry-picks Embodiment 15 from Miwa '535's disclosure and, for some unidentified reason, isolates the SrO and BaO amounts in Embodiment 15 for modification. Petitioner does not explain why a POSA would have selected Miwa '535's Embodiment 15 as a starting point for Ground 1, nor does Petitioner

explain why a POSA would have been motivated to modify only the SrO and BaO amounts in Embodiment 15. This lack of credible rationale and evidence indicates that Petitioner's Ground 1 is based on impermissible hindsight.

The Board has repeatedly rejected an analysis based on nothing but such hindsight. *See, e.g., Kingston Tech. Co., Inc. v. North Star Innovations, Inc.*, IPR2018-01784, Paper 32 at 55 (P.T.A.B. Feb. 26, 2020) (rejecting petitioner's obviousness arguments for "rest[ing] on hindsight" and "us[ing] the challenged patent as a roadmap to reconstruct the claimed invention"); *Solus Advanced Materials Co., Ltd. v. SK nexilis Co., Ltd.*, IPR2025-00005, Paper 14 at 47 (P.T.A.B. May 19, 2025) (explaining "Petitioner provides no convincing argument as to why a skilled artisan would have selected sample 15 for combination with [the secondary references]").

In fact, when looking at Miwa '535's 20 embodiments, there is no readily identifiable reason a POSA would have picked Embodiment 15 for modification absent impermissible hindsight. EX2007, ¶¶59-61. Table 2 below shows measured glass properties reported by Miwa '535 for each embodiment. Values highlighted green mean the glass property is better than Embodiment 15 (according to Miwa '535's teachings). Values highlighted red mean the glass property is worse than Embodiment 15. Values highlighted yellow indicate the value is the same as that reported for Embodiment 15.

Em.	Transmittance (%)				Density (g/cm ³)	CTE (10 ⁻⁷ °C ⁻¹)	Strain Point (°C)	Log 10 ^{2.5} (°C)	Liquidus Temperature (°C)
	300 nm	400 nm	600 nm	800 nm					
1	74	92	92	92	2.38	32	675	1610	1095
2	71	91	91	92	2.38	32	675	1610	1095
3	69	91	91	92	2.38	32	675	1610	1095
4	66	91	91	92	2.38	32	675	1610	1095
5	60	90	90	91	2.4	33	674	1595	1105
6	55	90	91	91	2.4	33	676	1595	1105
7	72	91	92	92	2.35	31	670	1590	1080
8	61	91	91	92	2.35	31	668	1590	1080
9	63	91	91	92	2.35	31	671	1595	1080
10	67	91	92	92	2.37	32	670	1600	1110
11	65	91	92	92	2.4	34	665	1555	1105
12	72	91	92	92	2.44	33	671	1560	1055
13	70	91	92	92	2.35	31	668	1605	1090
14	74	92	92	92	2.4	33	669	1565	1085
15	70	91	92	92	2.39	34	673	1560	1120
16	72	91	92	92	2.42	34	677	1585	1095
17	71	91	92	92	2.43	34	680	1520	1115
18	71	91	92	92	2.4	33	682	1585	1100
19	66	91	91	92	2.43	31	686	1560	1115
20	65	91	91	92	2.41	30	685	1605	1045

Table 2

As shown in Table 2, Embodiment 15 displayed the highest liquidus temperature, performing the worst out of all 20 embodiments. Miwa '535 teaches that “[increased] liquid phase temperature ... mak[es] the glass difficult to mold.” EX1004, ¶25; EX2007, ¶60. Table 2 also shows that Embodiment 15 had a CTE of 34×10^{-7} °C, which was tied for worst out of all 20 embodiments. EX2007, ¶60. Miwa '535 teaches that “coefficient of thermal expansion must be small in order to

improve thermal shock resistance and reduce damage during the heat treatment process.” EX1004, ¶5; EX2007, ¶60.

Petitioner does not even attempt to explain *why* a POSA would have selected the worst-performing embodiment in terms of CTE and liquidus temperature as a starting point for the proposed modification. Nor does Petitioner attempt to explain *why* a POSA would have attempted to improve these properties in Embodiment 15 by substituting BaO with SrO. Petitioner fails to address *how* a POSA would have balanced each of the performance metrics listed for each embodiment or *why* a POSA would have looked past the poor liquidus temperature and CTE when cherry-picking Embodiment 15 from the other 19 embodiments. EX2007, ¶61.

The evidence actually shows that Petitioner’s cherry-picking is a hindsight reconstruction of the claims devoid of technical merit. For example, Miwa ’535 discloses the following preferences for liquidus temperature and CTE:

- “[T]he liquid phase temperature is 1120 °C or *less*, so [the glass] also has excellent fusibility and formability.” EX1004, ¶47 (emphasis added).
- “The coefficient of thermal expansion must be *small* in order to improve thermal shock resistance and reduce damage during the heat treatment process.” EX1004, ¶5 (emphasis added).

Kim and Darwish teach that Petitioner's reconstruction of the claimed compositions by increasing the amount of SrO relative to BaO could directly contradict both of these preferences in Miwa '535. EX2007, ¶¶50-54. Specifically, the data reported in Kim's Figure 3 (reproduced and annotated below) show that, as the amount of SrO increases relative to BaO (i.e., to the left), the liquidus temperature (T_l in Figure 3) tends to *increase*. EX2007, ¶52.

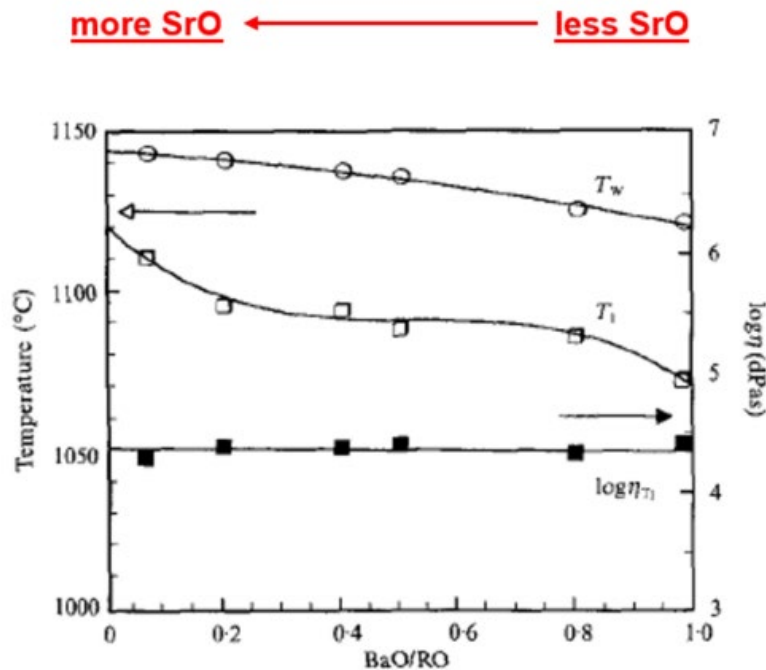
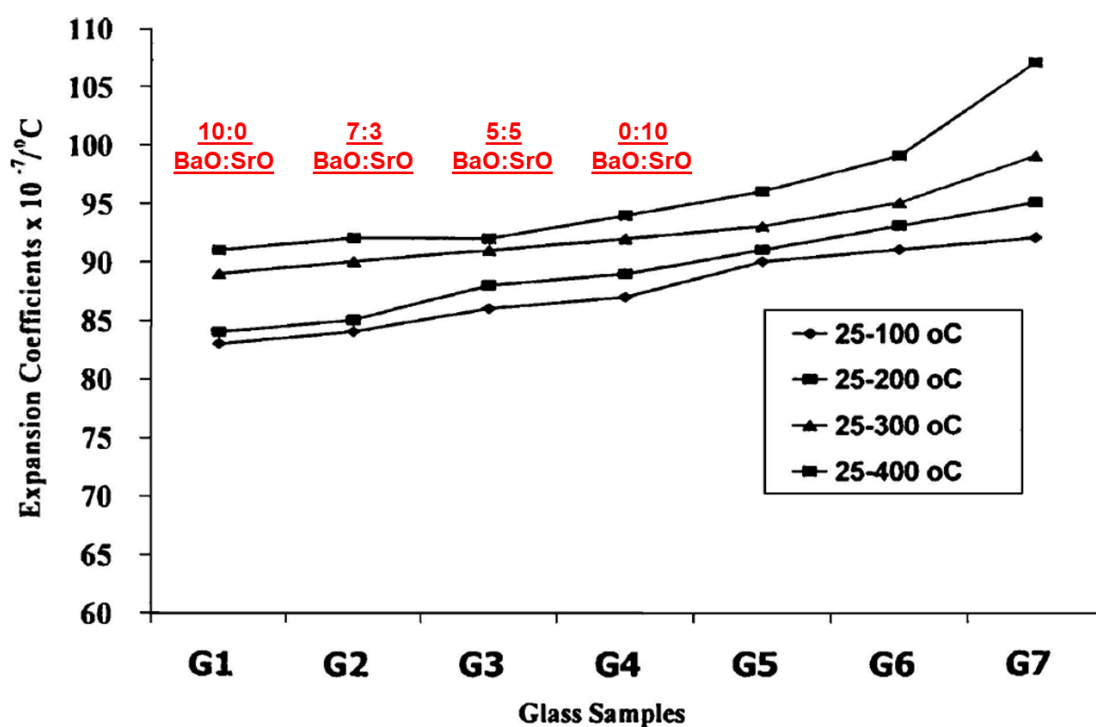


Figure 3. Liquidus temperatures (T_l), working temperature (T_w) and viscosity at liquidus temperature ($\log \eta_l$) as a function of BaO/RO

EX2009, 162, FIG. 3 (annotated).

Similarly, the data reported in Darwish's Figure 2 shows that increased SrO tends to *increase* CTE of an alkali-alumino borosilicate glass. EX2007, ¶53.



EX2014, 38, FIG. 2 (annotated).

2. Ground 1 fails to show obviousness of independent claim 13.

Claim 13 in Ground 1 fares even worse than claim 1. Ground 1 purportedly relies on Miwa '535's Embodiment 15 alone for obviousness of claim 13. Pet., 21 ("Claim[] 13 ... would have been obvious over Miwa '535"), 36 (arguing "*all* of the limitations of Claim 13 are described by Miwa '535" (emphasis added)). However, Petitioner modifies Miwa '535's Embodiment 15 two separate times on page 35 of the Petition. First, Petitioner combines JP '741 with Miwa '535 to address limitations 13[b]-[f]. Pet., 35. Second, Petitioner replaces the BaO in Embodiment 15 with SrO to address limitation 13[g]. Pet., 35.

To the extent Petitioner intended to rely on Miwa '535 alone for obviousness of claim 13, Petitioner's argument flatly contradicts itself by admitting the Miwa '535 alone fails to teach limitations 13[b]-[f] and limitation 13[g]. To the extent Petitioner intended to modify Miwa '535 in view of JP '741 and in view of some other unidentified reference to replace BaO with SrO, Petitioner fails to establish motivation to combine and/or a reasonable expectation of success for such a three-reference combination. Petitioner is entirely silent on both issues for claim 13.

In fact, substituting all the BaO with SrO in Miwa '535's Embodiment 15 would not have been obvious for at least the same reasons discussed above for claim 1. EX2007, ¶63. Further, it would not have been obvious to substitute Sb₂O₃ for SnO₂ in Miwa '535's Embodiment 15 in view of JP '741. EX2007, ¶¶11, 64-66. There is no teaching in either of JP '741 or Peuchert '469 that discusses the replacement of Sb₂O₃ with SnO₂. EX2007, ¶65.

And in any event, Petitioner's ambiguous argument for claim 13 fails to "adhere to the requirement that the initial petition identify 'with particularity' the 'evidence that supports the grounds for the challenge to each claim.'" *Intelligent Bio-Sys.*, 821 F.3d at 1369. For at least these reasons, Petitioner's unpatentability arguments for claim 13 in Ground 1 are facially deficient as well.

3. Ground 2 fails to show obviousness of independent claim 1.

Ground 2 relies on the combination of JP '643, JP '741, and Peuchert '469 for obviousness of independent claim 1. Pet., 41-47. Petitioner cites JP '643's Sample 5 as the basis for its unpatentability ground. Pet., 42-44. Petitioner acknowledges that the mol% for BaO in Sample 5 exceeds the claimed maximum value of 0.1 mol%. Pet., 44-45; EX1003, ¶¶258-262. The table on page 43 of the Petition shows Sample 5 having 0.2 mol% BaO. Petitioner also acknowledges that the mol% for Sb₂O₃ in Sample 5 exceeds the claimed maximum value of 0.05 mol%. Pet., 46; EX1003, ¶¶266-272. The table on page 43 of the Petition shows Sample 5 having 0.2 mol% Sb₂O₃ (four times more than the claimed maximum value).

In an attempt to cure the first deficiency in JP '643, Petitioner argues that it would have been obvious to modify the Sample 5 composition in view of Peuchert '469. Pet., 44-45; EX1003, ¶¶260-263. In attempt to cure the second deficiency in JP '643, Petitioner argues that it would have been obvious to modify the Sample 5 composition in view of JP '741. Pet., 46; EX1003, ¶¶267-273. But Petitioner fails to establish that a POSA would have been motivated to modify JP '643 as proposed with a reasonable expectation of success in achieving the claimed composition for at least the following reasons.

a. A POSA would not have been motivated to completely substitute BaO for SrO in JP '643.

In modifying JP '643 to address limitation 1[g] (BaO: 0-0.1 mol%), Petitioner argues a POSA would have been motivated to reduce the 0.2 mol% for BaO in Sample 5 to 0 mol%. Pet., 45; EX1003, ¶262 (“Then, the mole fractions of SrO and BaO become $X_{\text{SrO}} = 0.64$ mol% and $X_{\text{BaO}} = 0$ mol%, respectively.”). To account for the reduction of BaO, Petitioner argues that a POSA would have found it obvious to add 0.34 mol% SrO to the composition of Sample 5, thereby increasing the total mol% of SrO from 0.3 mol% to 0.64 mol%. EX1003, ¶262. Petitioner surmises that only the amount of SrO would be changed, with all the other eleven possible oxides listed for Sample 5 on page 10 of Exhibit 1007—SiO₂, Al₂O₃, B₂O₃, MgO, CaO, ZnO, P₂O₅, As₂O₃, SnO₂, Sb₂O₃, and ZrO₂—remaining unchanged.

Just like for Ground 1, Petitioner bases the entirety of this argument on the overly simplistic proposition that a POSA would have been motivated to substitute all 0.2 mol% of the BaO for SrO because BaO and SrO have a similar ionic field strength. Pet., 45 (citing EX1003, ¶¶261-263). According to Petitioner and Dr. Ernst, the similarity in ionic field strength indicates that BaO and SrO “play a *similar* role of network modifiers in the silicate glass structure.” Pet., 20-21 (emphasis in original); EX1003, ¶261. Without any meaningful explanation or evidence, Dr. Ernst appears to surmise that the allegedly similar ionic field

strengths mean that BaO and SrO can be freely substituted for each other as long as their “combined fraction” within a glass composition remains constant. EX1003, ¶75.

Additionally, just like for Ground 1, Petitioner attempts to bolster its argument by citing Peuchert '469. But again Petitioner provides no actual reason for why Peuchert '469 would have motivated a POSA to modify JP '643's Sample 5, much less with any reasonable expectation of success. Peuchert '469 does not disclose or suggest substituting BaO with SrO, much less does Peuchert '469 disclose any interplay between these two oxides. EX2007, ¶72.

Simply put, Petitioner's motivation to combine JP '643 and Peuchert '469 hinges solely on the proposition that, because both references disclose glass compositions comprising BaO and SrO, and because these two oxides have a similar ionic field strength, it would have been obvious to modify JP '643 in view of Peuchert '469. This kind of cursory analysis falls well short of establishing that a POSA would have been motivated to combine JP '643 and Peuchert '469 to arrive at what is claimed or would have had a reasonable expectation of success in doing so.

Petitioner does not even attempt to establish that a POSA would have been motivated to modify the BaO mol% in JP '643's Sample 5 in view of Peuchert '469 to achieve any of the glass properties touted by JP '643 or would have had a

reasonable expectation of success in doing so. Indeed, Petitioner does not cite any particular portion of Peuchert '469's disclosure as providing motivation to modify JP '643. Obviousness, however, requires "a reason that would have prompted a person of ordinary skill in the relevant field *to combine the elements in the way the claimed new invention does.*" *KSR Int'l Co v. Teleflex Inc.*, 550 U.S. 398, 418 (emphasis added).

Critically, Petitioner also does not establish that a POSA would have been motivated to modify the BaO and SrO mol% in JP '643's Sample 5 while preserving the disclosed mole percentages for the other eleven possible oxides listed for Sample 5, much less with any reasonable expectation of success. This is critical to establishing obviousness in view of JP '643 and Peuchert '469 for multiple reasons. First, claim 1 requires specified mole percentages for eight additional oxides: SiO₂, Al₂O₃, B₂O₃, MgO, CaO, As₂O₃, Sb₂O₃, and SnO₂. EX1001, 19:35-60. Second, claim 1 requires that $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ be greater than or equal to 1.00. EX1001, 19:49-51. Petitioner cannot assume, without evidence, that the mole percentages for BaO and SrO can be freely adjusted while preserving (i) the amount for eight additional oxides and (ii) the desired glass characteristics touted by JP '643. Petitioner does not consider or address the interplay among a multitude of different oxides and oxide ratios in JP '643.

Petitioner also fails to consider that JP '643 itself contradicts Petitioner's proposal that a POSA would substitute all BaO for SrO. EX2007, ¶¶69-71. Of the **46** non-comparative Samples disclosed by JP '643, ***none of them*** have 0 mol% BaO. EX1007, ¶¶54-69. This makes sense because JP '643 specifically teaches the following:

Particularly when reducing BaO and SrO to achieve lower density, if the contents of these two components become extremely imbalanced, the effect of improving BHF resistance diminishes. Thus, it is desirable to include both components such that the mass ratio (BaO+SrO)/BaO satisfies the range of 1.1–10 (preferably 1.2–5). The preferred BaO content is 0.3% or more (more preferably 0.5% or more) and 2% or less (more preferably 1% or less), and the preferred SrO content is 0.1–2.7%, more preferably 0.3– 1.5%.

EX1007, ¶39. Driving the amount of BaO to “0” renders JP '643's (BaO+SrO)/BaO ratio mathematically undefined. Petitioner's proposed modification flies in the face of JP '643's disclosure, preventing both BaO and SrO from being present in the composition and ignoring the preferred BaO content of at least 0.3%. EX2007, ¶71. Petitioner's proposed modification is the most imbalanced ratio of these two components, with an infinite ratio of strontium oxide to barium oxide. EX2007, ¶71. JP '643 teaches that such an imbalanced ratio of BaO to SrO is detrimental at least because it reduces the buffered hydrofluoric acid (BHF) resistance of a glass composition. EX1007, ¶¶39-40; EX2007, ¶71.

Petitioner ignores JP '643's disclosure, and instead focuses on substituting one oxide for another with complete disregard to how substituting oxides would affect the overall glass composition and its properties. Indeed, Petitioner does not even attempt to explain how increasing SrO and/or reducing BaO would affect the other eleven possible oxides in JP '643 samples. This is legal error. *See Gillette*, 919 F.2d at 724. It is telling that Petitioner and its expert consider only Sample 5 in isolation without a discussion or analysis of the other samples in the context of JP '643's disclosure as a whole.

Petitioner again fails to appreciate (or even consider) that glass compositions are not a system that allows for independent change of one oxide with little or no material effect on other oxides and/or glass properties. JP '643 and Peuchert '469 disclose broad ranges for at least MgO, CaO, BaO, and SrO, and Petitioner does not provide any guidance on how to choose within the disclosed ranges. EX2007, ¶74.

Petitioner also fails to address the fact that the glasses disclosed in Peuchert '469 are from a significantly different family of glasses—the MgO-Al₂O₃-SiO₂ (MAS) system, diluted by small amounts of B₂O₃ and modified by CaO—than those described in JP '643. EX2007, ¶73. For example, the minimum MgO concentration in Peuchert's examples is 8.1 wt% and the maximum B₂O₃ concentration is 6.5 wt%. EX1006, ¶41 (Table). These weight percentages are

distinctly different from those described in JP '643. EX2007, ¶¶73. The range of MgO and B₂O₃ in JP '643's non-comparative samples 1-46 are 0-1.0 wt% and 9.4-12.0 wt%, respectively. EX1007, ¶¶54-69. Because these compositions are so different, a POSA would not have considered Peuchert '469 for motivation to modify the BaO and/or SrO mole percentages in JP '643 or had a reasonable expectation of success in combining these references. EX2007, ¶¶68, 73-74. Instead, Petitioner surmises, without evidence, that combining JP '643 and Peuchert '469, and replacing BaO with SrO, "to be a small set of a finite number of identified means for obtaining the desired non-alkali low-density glass useful as substrates in display technologies." Pet., 21. This falls well short of establishing a reasonable expectation of success for at least the reasons discussed above with respect to Ground 1. EX2007, ¶¶12, 68.

To establish obviousness of claimed ranges, Petitioner must establish that a POSA would have had a reason to attempt to get within the claimed ranges. *See Chemours*, 4 F.4th at 1377. Petitioner provides no reason for *why* a POSA would attempt to modify the BaO mole percentage in JP '643's Sample 5 to get within the claimed range of 0 to 0.1 mol%. Petitioner alludes only to the ionic field strength of SrO and BaO. But a POSA would not have used ionic field strength as an overriding factor for modifying a glass composition. EX2007, ¶¶32-36.

b. JP '741 does not support substituting Sb_2O_3 for SnO_2 in JP '643.

In modifying JP '643 to address limitations 1[i]-[l], Petitioner argues a POSA would have been motivated to reduce the 0.2 mol% for Sb_2O_3 in Sample 5 to 0 mol%. Pet., 46; EX1003, ¶270 (“[r]emove the mass fraction $W_{\text{Sb}_2\text{O}_3} = 1 \text{ ms}\%$ = 0.01 of Sb_2O_3 ”). To account for the reduction of Sb_2O_3 , Petitioner argues that a POSA would have found it obvious to add additional SnO_2 to the composition of Sample 5. Pet., 46; EX1003, ¶271.

Petitioner bases this argument on JP '741's disclosure of glass compositions that use SnO_2 as a fining agent. Pet., 46. But JP '741 is entirely silent on replacing Sb_2O_3 with SnO_2 as a fining agent. EX2007, ¶76. Rather, JP '741 explains that “it is an object of the present invention to provide an alkali-free glass that *does not use As_2O_3* as a clarifying agent and does not contain bubbles that cause display defects.” EX1005, ¶6 (emphasis added). JP '741 does not discuss Sb_2O_3 at all. EX2007, ¶76.

JP '741 does not disclose that SnO_2 is a suitable substitute for Sb_2O_3 in a glass composition like that of JP '643's Sample 5. EX2007, ¶77. And Dr. Ernst provides no evidence to substantiate the idea that SnO_2 could be successfully substituted for Sb_2O_3 in Sample 5. EX2007, ¶77. In place of substantiating the argument, Dr. Ernst suggests that JP '643 and JP '741 can be combined because “the composition of Embodiment No. 5 in JP '643 falls within the compositional

range described in JP '741, making it applicable to use the same types and contents of fining agents.” EX1003, ¶268. But this statement is not actually true at least because Sample 5 in JP '643 contains ZrO₂. EX1007, ¶55; EX2007, ¶78. The compositional ranges in JP '741 do not include a range for ZrO₂ specifically. *See, e.g.*, EX1005, ¶22.

Petitioner also does not even attempt to establish a reasonable expectation of success for modifying JP '643 in view of JP '741. Petitioner surmises, without evidence, that combining JP '643 and JP '741, and replacing Sb₂O₃ with SnO₂, would have been obvious “to avoid the use of toxic fining agents.” Pet., 46. This falls well short of establishing a reasonable expectation of success in modifying JP '643 as proposed by Petitioner.

Petitioner’s conclusory assertions are not supported by any explanation as to why a POSA would have reasonably expected the JP '643-JP '741 combination to succeed. “[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR* 550 U.S. at 418. Here, Petitioner does not provide a single meaningful articulation or rational underpinning to support a finding of a reasonable expectation of success. EX2007, ¶79.

For example, not once does Petitioner provide any reason for *why* a POSA would have expected modifying JP '643's Sample 5 in view of JP '741 would be capable of avoiding the formation of bubbles within the glass compositions of JP '643, much less offer an improvement a POSA would have been motivated to pursue. In fact, a POSA would have understood that SnO₂ was a less effective fining agent than Sb₂O₃, and would not have reasonably expected that as little as 0.02 mol% SnO₂ would replace the loss of 0.2 mol% of Sb₂O₃ fining agent as proposed by Petitioner and Dr. Ernst. *See* EX1003, ¶271; EX2007, ¶¶12, 68, 79.

Petitioner's cursory arguments cannot support a reasonable expectation of success in combining JP '643 and JP '741. Silence and assumptions are insufficient for a *prima facie* case of obviousness. *See Orexo AB v. Actavis Elizabeth LLC*, 903 F.3d 1265, 1273 (Fed. Cir. 2018) (finding that "silence is not a teaching or suggestion," especially where the beneficial results could not be predicted).

c. Petitioner modifies JP '643's Sample 5 twice and assumes, without evidence, that the liquidus viscosity would remain unchanged.

As discussed, Petitioner argues it would have been obvious to modify both the BaO and Sb₂O₃ mole percentages in JP '643's Sample 5 in view of Peuchert '469 and JP '741, respectively. However, when addressing the liquidus viscosity recited in claim 1, Petitioner cites to the *original* composition of JP '643's Sample

5. Pet., 46. Neither Petitioner nor Dr. Ernst allege the *twice-modified* composition of JP '643's Sample 5 has a liquidus viscosity as claimed.

The liquidus viscosity of the twice-modified glass compositions cannot be assumed as proposed by Petitioner, particularly when the modification of JP '643's Sample 5 includes substituting BaO for SrO. EX2007, ¶¶80-82. A POSA would have understood that substituting BaO for SrO could have notable effects on liquidus viscosity, which do not necessarily follow a predictable pattern. For example, Kim (EX2009) states that “the viscosity and the liquidus temperature show a continuous decrease with increase of BaO [with respect to SrO]” for a plasma display panel glass composition. EX2009, 164. And Kim shows that the ratio of BaO to SrO can have non-linear effects on the liquidus temperature, which do not necessarily follow a predictable pattern. Kim's data reported in Figure 3 (reproduced below) shows that varying the ratio of BaO to BaO+SrO between 0 and 1 creates a non-linear effect on liquidus viscosity). EX2009, 162; EX2007, ¶81. Petitioner does not discuss any particular relationship between a glass composition and its liquidus viscosity, much less does Petitioner address the potential changes in this property based on glass composition. Petitioner's assumption that modifying the BaO/SrO ratio of a glass composition would not affect the liquidus viscosity of a glass composition is unfounded. EX2007, ¶81.

Therefore, Petitioner fails to establish the combination of JP '643, Peuchert '469, and JP '741 teaches a glass having the liquidus viscosity recited in claim 1. To the extent Petitioner is relying on a theory of inherency in the obviousness combination, the Petition does not provide sufficient rationale to establish that the glass resulting from the combination of JP '643, Peuchert '469, and JP '741 necessarily has a liquidus viscosity of greater than or equal to 100,000 poise. The Board cannot credit conclusory assertions about highly technical properties of glass without any corroborating evidentiary support. Much less can the Board determine what a POSA would or would not have understood about these properties in the absence of disclosure in the cited art, without some evidentiary basis.

For at least these reasons, Petitioner's unpatentability arguments for claim 1 in Ground 2 are facially deficient. It would be a waste of Board resources to institute trial based on Petitioner's cursory and unsupported arguments.

4. Ground 2 fails to show obviousness of claim 13 for similar reasons as claim 1.

Ground 2 relies on the combination of JP '643 and JP '741 for obviousness of independent claim 13. As with claim 1, Petitioner cites JP '643's Sample 5 as the basis for its unpatentability ground. Pet., 52. Petitioner acknowledges that the mol% for Sb_2O_3 in Sample 5 exceeds the claimed maximum value of 0.005 mol%. Pet., 53; EX1003, ¶¶322-327. The table on page 43 of the Petition shows Sample 5

having 0.2 mol% Sb_2O_3 (*forty* times more than the claimed maximum value). In an attempt to cure this deficiency in JP '643, Petitioner argues that it would have been obvious to reduce the 0.2 mol% for Sb_2O_3 in Sample 5 to 0 mol%. Pet., 53; EX1003, ¶325 (“[r]emove the mass fraction $W_{\text{Sb}_2\text{O}_3} = 1 \text{ ms}\% = 0.01$ of Sb_2O_3 ”). To account for the reduction of Sb_2O_3 , Petitioner argues that a POSA would have found it obvious to add additional SnO_2 to the composition of Sample 5. Pet., 53; EX1003, ¶ 326.

Petitioner fails to establish that a POSA would have been motivated to modify JP '643 with a reasonable expectation of success in achieving the claimed composition for at least two reasons discussed above for claim 1 in Ground 2. First, JP '741 does not support substituting Sb_2O_3 for SnO_2 in JP '643. *See* Section V.B.3.a; EX2007, ¶¶12, 84. Second, Petitioner modifies JP '643's Sample 5, but assumes, without evidence, that the liquidus viscosity would remain unchanged. For at least these reasons, Petitioner's unpatentability arguments for claim 13 in Ground 2 are facially deficient.

5. Ground 3 fails to show that Miwa '377 anticipates, expressly or inherently, the liquidus viscosity in claim 13.

Ground 3 fails to show anticipation of claims 13, 14, and 19-21 (or obviousness of claims 16, 22, and 23) because Miwa '377 does not disclose (or suggest) the claimed liquidus viscosity. Petitioner relies on Miwa '377's Sample 8 as anticipating claim 13. Pet., 59-61. In doing so, Petitioner argues that Miwa

'377's Sample 8 has a liquidus viscosity of greater than or equal to 100,000 poise.

Pet., 61. This argument is based on a false premise and is not supported by a preponderance of evidence.

For anticipation, the petitioner must establish that “every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987). A claim element argued as being inherent must be “necessarily present” in the prior art, and “may not be established by probabilities or possibilities.” *PAR Pharm., Inc. v. TWI Pharm., Inc.*, 773 F.3d 1186, 1195 (Fed. Cir. 2014). “[A] prior art reference may anticipate without disclosing a feature of the claimed invention if that missing characteristic is *necessarily* present, or inherent, in the single anticipating reference.” *Schering Corp. v. Geneva Pharm., Inc.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003) (emphasis added). It is not enough that the allegedly inherent result would occur often, usually, or typically—the allegedly inherent result “must inevitably result from the disclosed steps.” *In re Montgomery*, 677 F.3d 1375, 1380 (Fed. Cir. 2012).

Petitioner does not make clear whether it relies on a theory of express or inherent anticipation to establish that the unspecified liquidus viscosity of Sample 8 is greater than or equal to 100,000 poise. But since Sample 8 has no express disclosure of a liquidus viscosity, it cannot expressly anticipate. Indeed, Miwa '377

is silent with respect to the liquidus viscosity for any of its disclosed embodiments. EX2007, ¶¶13, 85-86.

In purported support for the liquidus viscosity of Sample 8, Petitioner cites a discussion in paragraph 12—which is in the “*prior art*” heading of Miwa ’377—and paragraphs 377-379 of Dr. Ernst’s declaration. Pet., 61. The translation of ’377 provided by Petitioner states, “the liquid phase viscosity is preferably no less than 10^5 dPa·s, and more preferably no less than $10^{5.5}$ dPa·s.” EX1008, ¶12. This citation to Miwa ’377’s discussion of the prior art falls well short of establishing that Miwa ’377’s Sample 8 inherently has a liquidus viscosity of greater than or equal to 100,000 poise for the following reasons.

First, a disclosure of what was “preferable” in the prior art does not imply that Sample 8 has a liquidus viscosity of greater than or equal to 100,000 poise. Miwa ’377 never discloses that Sample 8 has a certain liquidus viscosity, nor does Miwa ’377 specify that Sample 8 has a liquidus viscosity consistent with what was “preferable” in the prior art. EX2007, ¶86 (“Miwa ’377 never explicitly explains that its embodiments have a liquidus viscosity consistent with the prior art ...”).

Second, the citation to paragraphs 377-379 of Dr. Ernst’s declaration on page 61 of the Petition does not cure the deficiencies in Petitioner’s arguments. Paragraph 377 simply quotes paragraph 12 of Miwa ’377 verbatim. And

paragraphs 378-379 are conclusory statements alleging that Miwa '377's Sample 8 has a liquidus viscosity as claimed.

Third, it is unclear whether the quoted portion of Miwa '377 is actually a correct translation. The English translation of Miwa '377 submitted with the Petition in this case says liquid phase viscosity is “preferably *no less than* 10^5 dPa·s, and more preferably *no less than* $10^{5.5}$ dPa·s.” EX1008, ¶12 (emphasis added). However, the translation of Miwa '377 submitted with a related Petition in IPR2025-00937 says the opposite: “the liquid phase viscosity is preferably *less than* 10^5 dPa·s, and more preferably $10^{5.5}$ dPa·s.” See IPR2025-00937, EX1004, ¶12. To the extent the exhibit submitted here may be a mistranslation, that is resolved against Petitioner as the party bearing the burden of proof.

Neither Petitioner nor Dr. Ernst provide technical evidence or rationale to establish that the glass of Miwa '377's Sample 8 necessarily has a liquidus viscosity as claimed. EX2007, ¶¶13, 87. Petitioner has not met its burden of showing inherent anticipation because it has not even purported to demonstrate that the liquidus viscosity of Sample 8 is *necessarily* greater or equal to 100,000 poise.

For at least these reasons, the claimed liquidus viscosity limitation is missing from Miwa '377's Sample 8, and there can be no anticipation. Ground 3 fails.

C. Grounds 1 and 2 fail *Graham* factor four based on substantial objective indicia of non-obviousness.

“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). Indeed, as noted by the court in *WBIP*, “evidence of secondary considerations may often be the most probative and cogent evidence in the record.” *Id.* (citing *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983)).

1. Nexus

To accord substantial weight to secondary considerations, “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*, 944 F. 3d at 1373 (quoting *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1332 (Fed. Cir. 2019)). A patentee is entitled to a presumption of nexus for objective considerations when the patentee shows that the asserted objective evidence is tied to a specific product and that product is the invention disclosed and claimed in the patent. *See WBIP*, 829 F. 3d at 1329.

In the present case, Corning’s EAGLE XG Glass embodies the claimed glass compositions, including the liquidus viscosity recited in claims 1 and 13 of the ’491 patent. EX2020, 1-4. Further, there is a nexus between the claimed glass compositions, the commercial success of EAGLE XG Glass, and the long-felt need

for a defect-free LCD panel glass made without the use of toxic arsenic (As) or antimony (Sb) for glass fining. As discussed above, the claimed compositions eliminated toxic fining agents while providing the high liquidus viscosity needed for fusion downdraw manufacturing to make defect-free glass panels—a result that no one in the industry expected would be viable for LCD applications. This liquidus viscosity lead directly to commercial success and industry praise of EAGLE XG Glass. EX2021; EX2022.

2. Long-felt Need

“Evidence of a long felt but unresolved need tends to show non-obviousness because it is reasonable to infer that the need would have not persisted had the solution been obvious.” *WBIP*, 829 F.3d at 1332. In the present case, the claimed glass compositions embodied by EAGLE XG Glass solved an industry wide decade-plus long search for an LCD panel glass made without arsenic (As) or antimony (Sb). Starting in the early 1990s, with the introduction of Corning’s Code 1737 glass, panel makers were yearning for a defect-free, lightweight glass made without arsenic or antimony. It was only after Corning’s introduction of EAGLE XG Glass in 2006 that this need was meet. EX2021; EX2022. In 2007, “EAGLE XG [was] the first liquid crystal display substrate to contain no added heavy metals such as arsenic, antimony and barium ... making it the most environmentally friendly LCD glass on the market.” EX2004, 1.

3. Commercial Success

“Demonstrating that an invention has commercial value, that it is commercially successful, weighs in favor of its non-obviousness.” *WBIP*, 829 F.3d at 1337. In the present case, the claimed glass compositions embodied by EAGLE XG Glass are wildly commercially successful. Since its introduction in 2006, EAGLE XG Glass has become the industry standard among the world’s leading LCD panel makers. EX2021; EX2022. Corning has produced more than 25 billion square feet of EAGLE XG Glass—enough to pave the Great Wall of China 25 times, or cover nearly 390,000 football fields—to meet the needs of its customers. EX2019.

4. Industry Praise

“Evidence that the industry praised a claimed invention or a product which embodies the patent claims weighs against an assertion that the same claim would have been obvious. Industry participants, especially competitors, are not likely to praise an obvious advance over the known art.” *WBIP*, 829 F.3d at 1334. After its introduction, the industry immediately praised the uniqueness and importance of EAGLE XG Glass. In 2007, Eagle XG Glass won the Display Component of the Year; Gold Award, and the Advanced Display of the Year (ADY) Award. EX2003, 0014; EX2004, 1.

VI. CONCLUSION

The Board should deny institution of *inter partes* review of the '491 patent.

Respectfully submitted,

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CERTIFICATE OF WORD COUNT (37 C.F.R. § 42.24(d))

1. This Patent Owner Preliminary Response complies with the type-volume limitation of 14,000 words, comprising 13,766 words, excluding the parts exempted by 37 C.F.R. § 42.24(a)(1).

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I certify that the above-captioned **PATENT OWNER PRELIMINARY RESPONSE** and associated Exhibits 2007-2022 were served in their entirety on September 16, 2025, upon the following parties via electronic mail:

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