

**UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.**

**Before the Honorable Bryan F. Moore
Administrative Law Judge**

In the Matter of

**CERTAIN GLASS SUBSTRATES FOR
LIQUID CRYSTAL DISPLAYS,
PRODUCTS CONTAINING THE SAME,
AND METHODS FOR MANUFACTURING
THE SAME II**

Investigation No. 337-TA-1441

**DECLARATION OF DR. MICHEL W. BARSOUM
REGARDING CLAIM CONSTRUCTION**

I, Michel W. Barsoum, Ph.D., declare as follows:

I. INTRODUCTION AND QUALIFICATIONS

1. I am being compensated for my work on this matter through Expert Institute Group, Inc. at my standard hourly rate. My compensation is not dependent on the outcome of this case or the content of opinions or analysis. To my knowledge, I do not currently hold any financial interest in any of Respondents Caihong Display Devices Co., Ltd. (“Caihong”), Hisense USA Corporation, HKC Corporation Ltd., HKC Overseas Ltd., LG Electronics U.S.A., Inc., TCL China Star Optoelectronics Technology Co., Ltd., TTE Technology, Inc., VIZIO, Inc., and Xianyang CaiHong Optoelectronics Technology Co., Ltd. (collectively, “Respondents”) or Complainant Corning Incorporated (“Corning”).

2. I have been asked by Respondents to provide my opinions regarding how a person of ordinary skill in the art (“POSA”) would have interpreted certain disputed claim terms in the asserted patents in the above-captioned investigation. I understand that the asserted claims are claims 4 and 16 of U.S. Patent No. 7,851,394 (“394 patent”); claims 2-3, 6, 8, and 12 of U.S.

Patent No. 8,642,491 (“491 patent”); and claims 2-3, 5-6, and 9 of U.S. Patent No. 8,640,498 (“498 patent”) (collectively, the “asserted claims” of the “asserted patents”).

3. I reserve the right to amend or supplement this declaration to address or rebut any evidence, opinion, statement, or position taken by Corning or any expert who submits a declaration in support of Corning’s claim construction positions.

4. In forming the opinions expressed in this declaration, I have considered and relied upon my education, background, and experience. In addition, I have reviewed and relied upon the following materials:

- the asserted patents and their prosecution histories;
- the claim terms and proposed constructions of Defendants and Corning; and
- any other evidence cited or discussed in this declaration, including the evidence listed in Section VII, below.

5. I am a Distinguished Professor in the Department of Materials Science and Engineering at Drexel University. I am internationally recognized as a leader in the area of MAX phases and more recently the 2D solids known as MXenes derived from MAX phases. With over 550 refereed publications and a Google H-index of 149, my work has been cited >130,000 times to date. I have been on the Web of Science’s highly cited researchers list from 2018 to the present. I am a foreign member of the Royal Swedish Society of Engineering Sciences, member of the National Academy of Inventors, and a fellow of the American Ceramic Society and World Academy of Ceramics. In 2020, I was awarded the International Ceramics Prize for basic science by the World Academy of Ceramics. This prize is awarded quadrennially and is one of the highest in my field. The prize was awarded for outstanding contribution in opening new horizons in material research and specifically for pioneering work in MAX phases and their derivatives.

6. I am the author of two books, including *MAX Phases: Properties of Machinable Carbides and Nitrides*. More relevantly to this case, I am the author of *Fundamentals of Ceramics*, the leading global textbook in my field. In the textbook, there is a chapter on glasses, their production, properties, and how to characterize them. My PhD dealt with the making and characterization of Li borosilicate glasses for applications as solid electrolytes in Li ion batteries. I am thus intimately familiar with glasses and their properties.

7. My education, employment history, publications, patents, awards, and other relevant information are further detailed in my curriculum vitae (“CV”), a copy of which is provided as Appendix A to this declaration and which I hereby incorporate by reference.

II. APPLICABLE LEGAL PRINCIPLES

8. I am not a lawyer and am not offering any legal opinions. However, I have been asked by counsel for Respondents to provide opinions in the context of certain legal standards summarized below. I use these legal standards as background for my analysis and to assist in forming my opinions regarding claim construction. Counsel has informed me that claim construction is a question of law for the Administrative Law Judge (“ALJ”) to decide in this investigation, with potential underlying issues of fact. I understand from counsel that the purpose of claim construction is to determine the meaning and scope of the asserted claims from the perspective of a POSA.

9. I have been informed by counsel that a disputed claim term should be read not only in the context of the specific claim in which it appears, but also in the context of the entire patent-in-suit, including the specification. I understand from counsel that the specification has been referred to in some cases as the single best guide to the meaning of a disputed term. As such, I understand from counsel that, for terms without customary meaning in the art, the specification

typically supplies the best context for understanding claim meaning. I have been informed by counsel that ALJs ordinarily interpret claim terms consistently across patents having the same specification. The asserted patents in this case share a substantively identical specification, with the exception of some differences in the summary sections, which merely paraphrase what appears in the asserted claims of each respective patent.

10. I understand from counsel that patents' file histories can additionally inform the meaning of claim language by demonstrating how the inventors understood the alleged inventions and whether the inventors limited the inventions during the course of prosecution, making claim scope narrower than it otherwise would be. I also understand from counsel that the inventor may expressly or implicitly define a term in the specification of a patent and that this is generally known as "lexicography." I have been informed by counsel that, when the meaning of a claim term is not clear from the intrinsic record, the ALJ may also consult extrinsic evidence, such as this declaration, in construing the term.

11. I understand from counsel that claim construction must be understood from the perspective of a POSA at the time of alleged invention. I also understand from counsel that in determining who would have been a POSA, it is proper for me to consider the type of problems encountered in the art, prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the education level of active workers in the field. I have provided my opinion below as to who I would have considered to be a POSA in the field of the asserted patents.

12. Finally, I understand from counsel that a patent claim is invalid as indefinite if the claim, as read in light of the specification delineating the patent, and the prosecution history, fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. I

have been informed by counsel that a claim term does not become reasonably certain simply because a skilled artisan, when pressed, might manage to articulate a definition for it. I understand from counsel that showing that a skilled artisan cannot recognize the scope of a claim term with reasonable certainty requires showing considerably less uncertainty than showing that a skilled artisan could not understand the claim term at all.

III. PERSON OF ORDINARY SKILL IN THE ART

13. As noted above, I understand from counsel that the asserted claims must be construed from the point of view of a POSA as of the earliest claimed priority date of the asserted claims, which I have assumed is June 28, 2005. I understand from counsel that Respondents dispute that the asserted patents are entitled to a priority date of June 28, 2005, and that Respondents' position is that the claims are entitled to, at the earliest, a priority date of June 28, 2006. My opinions herein would not change if it were determined that the asserted claims are only entitled to a priority date of June 28, 2006—I believe the definition of a POSA would not have changed between June 28, 2005, and June 28, 2006.

14. The relevant technical field for the asserted patents covers glass making, glass compositions, and their properties. In my opinion, based on the foregoing legal principles, a POSA in this technical field on June 28, 2005, would have had at least a Bachelor of Science in materials science, materials engineering, glass engineering science, chemical engineering, ceramic engineering or similar majors with 4-8 years of experience related to glass science research, design, synthesis, testing, etc., including experience related (but not limited) to measurement of liquidus temperatures, liquidus viscosities, coefficients of thermal expansion (CTE), strain points, densities, and related properties of silicate, borosilicate, aluminosilicate, and boroaluminosilicate glasses, including publications related to such work in peer-reviewed journals and/or patents. This

definition is approximate. More education may substitute for experience or vice versa. My opinions regarding the level of ordinary skill in the art are based on, among other things, my experience in the relevant field, my understanding of the basic qualifications that would be relevant to an individual tasked with designing, synthesizing, and testing glasses, and my familiarity with the backgrounds of researchers and practitioners in this field, including work colleagues, students, and other individuals, both past and present, who work in these areas.

15. My opinions regarding the level of skill of a POSA and my other opinions set forth below would remain the same if the POSA were determined to have somewhat more or less education and/or experience than I have referenced above. Although my knowledge and skill exceed that of a POSA, my opinions herein reflect and are made from the perspective of a POSA as of June 28, 2005.

16. I understand that Caihong filed petitions for *inter partes* review of the '394 and '498 patents, in which experts have recited similar articulations of the level of ordinary skill in the art. *See* Ex. 1, *Caihong Display Devices Co., Ltd. v. Corning Inc.*, Case No. IPR2025-00439, Ex-1003, Decl. of Dr. Frank Ernst at 10-11; Ex. 2, *Caihong Display Devices Co., Ltd. v. Corning Inc.*, Case No. IPR2025-00937, Ex-1003, Decl. of Dr. Frank Ernst at 12-13. My opinions herein would not change if either of these or a similar articulation of the level of skill of a POSA were adopted in this investigation.

IV. SUMMARY OF THE PATENTS' COMMON SPECIFICATION

17. The alleged inventions relate to certain glasses ('394 and '491 patents) and methods for making glasses ('498 patent). As noted above, the asserted patents in this case share a substantially identical specification. When discussing the specification, I will refer to the '394 patent's specification, which is representative of the specifications of the '491 and '498 patents.

18. The specification describes the alleged inventions as relating to “alkali-free, boroaluminosilicate glasses exhibiting desirable physical and chemical properties for use as substrates in flat panel display devices, such as, active matrix liquid crystal displays (AMLCDs)” and the “fining” of such glasses. ’394 patent, 1:14-20.

19. The patents’ common specification refers to a “fusion process” described in two Corning patents (*see* Ex. 3, U.S. Patent No. 3,338,696; Ex. 4, U.S. Patent No. 3,682,609). ’394 patent, 2:8-14. According to the specification, this fusion downdraw process “is one of the few processes capable of delivering glass sheets which can be used as substrates without requiring costly post forming finishing operations, such as lapping and polishing.” *Id.*, 2:11-14. “Unfortunately, the fusion process places rather severe restrictions on the glass properties, requiring relatively high liquidus viscosities, preferably greater than 100,000 poises, more preferably, greater than 150,000 poises.” *Id.*, 2:14-18.

20. The specification further asserts that, with respect to glass for LCD panels, “it is desirable to use glass substrates whose dimensions are independent of thermal condition (i.e., glasses with lower coefficients of thermal expansion).” *Id.*, 2:26-28. “However, this property needs to be balanced by the generation of stresses between deposited films (e.g., silicon films) and the substrates that arise due to expansion mismatch.” *Id.*, 2:28-31. According to the specification, “[i]t is estimated that an optimal coefficient of thermal expansion (CTE) is in the range of $28-34 \times 10^{-7}/^{\circ}\text{C.}$ ($0-300^{\circ}\text{C.}$), more preferably, $28-33 \times 10^{-7}/^{\circ}\text{C.}$ ($0-300^{\circ}\text{C.}$).” *Id.*, 2:31-34. In addition to thermal stability, the glass should also have “chemical durability” to remain unchanged during manufacturing processes. *Id.*, 2:35-40.

21. The asserted patents state that “[t]hermal stability (also known as thermal compaction or shrinkage) is dependent upon both the inherent viscous nature of a particular glass

composition (as indicated by its strain point) and the thermal history of the glass sheet as determined by the manufacturing process.” *Id.*, 2:41-45. The patents cite U.S. Patents Nos. 5,374,595 (Ex. 5) and 6,319,867 (Ex. 6) as disclosing “glasses with strain points in excess of 650° C. which, when subjected to the thermal history of the fusion process, have acceptable thermal stability[.]” ’394 patent, 2:45-49.

22. The patents also note the demand for increasingly larger sizes of LCD panels, *id.*, 3:1-7, and the related need for glass having a relatively low density (“preferably less than or equal to 2.45 grams/cm³,” *id.*, 3:55-56) but also “a liquidus viscosity greater than or equal to 100,000 poises to allow manufacture by, for example, the fusion process,” *id.*, 3:56-58.

23. In addition, the specification states that LCD substrates “must be essentially completely defect free,” including free from “gaseous inclusions” that are removed via fining agents. *Id.*, 3:21-26. Rather than using toxic fining agents such as arsenic or antimony, the specification discloses using other, non-toxic fining agents, such as tin (either alone or in combination with other fining agents). *See id.*, 3:64-67, 11:63-12:55. For example, the patents suggest the use of SnO₂ in a concentration of “at least 0.01 mole percent.” *Id.*, 12:6. However, the amount of SnO₂ should be “preferably less than or equal to 0.15 mole percent” to avoid formation of “crystalline defects” in the LCD glass. *Id.*, 12:41-45.

24. The specification then goes on to list various oxides suggested for use in making the glass of the alleged inventions, including SiO₂, used as a basic glass former in mole percent concentration “greater than 64 mole percent in order to provide the glass with a density and chemical durability suitable” for LCD glass manufactured using a fusion process. *Id.*, 6:3-9. However, the concentration of SiO₂ should be “less than or equal to 71 mole percent to allow batch materials to be melted using conventional, high volume, melting techniques[.]” *Id.*, 6:25-28.

25. Al_2O_3 is also used as a glass former. *Id.*, 6:39. According to the specification, the mole percent of Al_2O_3 should be “greater than or equal to 9.0 mole percent” to provide the glass with “a low liquidus temperature and a corresponding high liquidus viscosity” and to improve the glass’ strain point. *Id.*, 6:40-42. The concentration of Al_2O_3 should purportedly be kept “below 12.0 mole percent” to achieve an “ $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.00,” where “RO” is the mole percent sum of “MgO, CaO, SrO, and BaO.” *Id.*, 6:44-46, 7:31-32.

26. B_2O_3 is used as a “glass former and a flux that aids melting and lowers the melting temperature” in amounts of at least 7.0 mole percent. *Id.*, 6:49-52. However, according to the specification, too much B_2O_3 (more than 12.0 mole percent) can have undesirable effects on “strain point,” among other things. *Id.*, 6:52-55, 7:3-5. According to the specification, during melting, B_2O_3 “decrease[s] liquidus temperature through simple dilution.” *Id.*, 10:4-8.

27. In addition, the specification discloses: “the glasses of the invention also include at least two alkaline earth oxides, i.e., at least MgO and CaO, and, optionally, SrO and/or BaO.” *Id.*, 7:22-25. “The alkaline earth oxides provide the glass with various properties important to melting, fining, forming, and ultimate use.” *Id.*, 7:25-27. The patents then explain in some detail the alleged significance of the “MgO concentration” and the glass’ “ $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ” ratio, asserting that both are “critical to the glass’ performance and, in particular, are critical with regard to meltability and fining.” *See id.*, 7:28-10:60. The specification concludes that MgO’s concentration “should be greater than or equal to 1.0 mole percent” to achieve the alleged benefits described in the patents. *Id.*, 10:61-63. However: “At concentrations greater than 3.0 mole percent, even with control of the $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio and the SiO_2 concentration, the liquidus temperature rises and liquidus viscosity falls such that forming the glass using a high viscosity forming process (e.g., a fusion process) is compromised.” *Id.*, 10:63-11:1.

28. Regarding CaO, the patents assert that it “is essential to producing low liquidus temperatures (high liquidus viscosities), high strain points and moduli, and CTE’s in the most desired ranges for flat panel applications, specifically, AMLCD applications” and suggests concentrations greater than 6.0 mole percent but less than or equal to 11.5 mole percent to not unduly increase density and CTE. *Id.*, 11:5-17.

29. With respect to SrO and BaO, the specification alleges that they “can both contribute to low liquidus temperatures (high liquidus viscosities) and thus the glasses of the invention will typically contain at least one of these oxides.” *Id.*, 11:19-22. “However, both oxides increase CTE and density and lower modulus and strain point compared to MgO and CaO.” *Id.*, 11:22-24. According to the specification, “[b]etween SrO and BaO, BaO generally has more adverse effects on glass properties than SrO.” *Id.*, 11:24-26. “Accordingly, the BaO concentration in the glasses of the invention is less than or equal to 0.1 mole percent (preferably, less than 0.05 mole percent), while the SrO concentration is allowed to be greater, i.e., less than or equal to 2.0 mole percent, preferably, less than or equal to 1.0 mole percent.” *Id.*, 11:26-30.

30. The patents also refer to various other oxides that could be included in the batch materials used to make the claimed glass. *Id.*, 11:39-41. In addition, the specification refers to “various contaminants associated with batch materials and/or introduced into the glass by the melting, fining, and/or forming equipment[,]” such as Fe₂O₃. *Id.*, 11:43-47.

31. The patents then describe various examples of LCD glasses that are purportedly suitable for manufacture using a fusion downdraw process, listing various properties of the exemplary glasses. *Id.*, 12:56-20:67. For example, the specification notes: “The glasses of Examples 1-43 can also be formed using downdraw techniques, such as the fusion technique.

Thus, they have liquidus temperatures less than or equal to 1170° C. and liquidus viscosities equal to or greater than 100,000, and in most cases, equal to or greater than 150,000.” *Id.*, 14:45-50.

V. SUMMARY OF THE PATENTS’ PROSECUTION HISTORIES

32. Below, I summarize the prosecution histories of the three asserted patents.

A. Prosecution History of the ’394 Patent

33. The application that issued as the ’394 patent was filed on June 28, 2006. On January 23, 2008, the US Patent Office issued a Requirement for Restriction/Election, given that Corning sought claims on both glasses and methods for producing glasses. Appx. A to Complaint at CORNING-ITC2-00000082 – 088. On February 4, 2008, Corning chose to pursue the claims directed to “alkali-free” glasses. *Id.* at CORNING-ITC2-00000089 – 094.

34. On April 1, 2008, the patent examiner rejected the pending claims as obvious over a combination of prior art references. *Id.* at CORNING-ITC2-00000096 – 107. In response, Corning amended the claims on August 4, 2008, and argued that the amended claims would not have been obvious to a POSA in view of the examiner’s cited prior art. *Id.* at CORNING-ITC2-00000120 – 127.

35. The examiner subsequently rejected the pending claims, again, on November 28, 2008, based on a different prior art obviousness combination. *Id.* at CORNING-ITC2-00000214 – 225. Specifically, the examiner determined that the pending claims would have been obvious in view of U.S. Patent No. 6,831,029 (Ex. 7) (“Chacon”) and U.S. Patent No. 6,468,933 (Ex. 8) (“Narita”), relying upon Chacon for ranges of oxides overlapping with the claimed ranges and Narita for its disclosure of using tin oxide and chloride in place of arsenic oxide for fining purposes. *Id.* at CORNING-ITC2-00000219, -221–222.

36. In response, on April 28, 2009, Corning submitted a declaration from the sole named inventor, Adam J. Ellison, Ph.D., in which he asserted that (1) he was a named inventor for the Chacon patent and (2) he performed additional work that “was not recognized when the work underlying the Chacon patent was performed” regarding the criticality of having “a MgO content greater than or equal to 1.0 mole percent” and “a RO/Al₂O₃ ratio greater than or equal to 1.00” for fining purposes. *Id.* at CORNING-ITC2-00000262 – 264 (¶¶ 2-3, 9). In the declaration, Dr. Ellison declares that “a RO/Al₂O₃ ratio of 1.00 is the cutoff for successful tin fining” (assuming MgO greater than or equal to 1.0). *Id.* at CORNING-ITC2-00000263 (¶ 5). Dr. Ellison submitted another declaration on July 24, 2009, in which he noted that non-halide fining is preferable to halide fining at Corning and in which he reiterated his conclusions about the required concentration of MgO and RO/Al₂O₃ ratio, emphasizing that the RO/Al₂O₃ ratio is critical independent of the ratio of MgO to CaO in the glass. *Id.* at CORNING-ITC2-00000272 – 276.

37. On October 13, 2009, the examiner again rejected the claims in view of Chacon and Narita, finding Dr. Ellison’s statements to be “not persuasive” because it was unclear whether “unexpected results” related to improved fining were attributable to the concentration of MgO and RO/Al₂O₃ ratio or, alternatively, the types of halide gasses used for fining. *Id.* at CORNING-ITC2-00000285 – 297. In response, Corning submitted yet another declaration from Dr. Ellison on January 13, 2010, in which he asserted that bromine is “clearly superior to chlorine as a fining agent for LCD glasses” and in which he stated that his tin + bromine testing “was a more stringent test” of his hypothesis regarding the MgO concentration and RO/Al₂O₃ ratio. *Id.* at CORNING-ITC2-00000313 (¶ 7).

38. On April 15, 2010, the examiner withdrew the rejection in view of Chacon and Narita but rejected the claims as being obvious in view of U.S. Patent No. 6,169,047 (Ex. 9)

(“Nishizawa”), among other bases for rejection. *Id.* at CORNING-ITC2-00000318 – 324. In response, Corning amended the claims on July 15, 2010, to recite a limitation related to the glass having “a density that is less than or equal to 2.41 grams/cm³” in claim 1 and to limit the amount of SrO in pending claim 6 to be “at most 1.0 mole percent.” *Id.* at CORNING-ITC2-00000335 – 336. The examiner subsequently issued a Notice of Allowance on August 10, 2010, and the ’394 patent issued on December 14, 2010.

B. Prosecution History of the ’491 Patent

39. The application that issued as the ’491 patent was filed as a continuation of the ’394 patent’s application on December 10, 2010, the same day as the application that issued as the ’498 patent. On May 10, 2013, the examiner rejected the pending claims based on, among other things, Japanese Patent Publication JP 2004-189535 A (Ex. 10) (“Miwa”). Appx. B to Complaint at CORNING-ITC2-00000456 – 463. In response, on August 8, 2013, Corning amended the claims to, among other things, require that the glass have at least 0.01 mole percent SnO₂, no more than 0.05 mole percent As₂O₃, no more than 0.05 mole percent of Sb₂O₃, and a liquidus viscosity “greater than or equal to 100,00 poise.” *Id.* at CORNING-ITC2-00000531, -536. The examiner then issued a Notice of Allowance on January 2, 2014, stating:

The prior art fail[s] to disclose or suggest with sufficient specificity an alkali-free glass comprising in mole percentages the recited components, wherein the glass has the specific recited relationship of the alkaline earth metal oxides to the Al₂O₃ content, the glass has greater than or equal to 1 mole percent MgO, and the glass limits the amounts of As₂O₃ and Sb₂O₃ content present in the glass. Furthermore, the glass has a liquidus viscosity that is greater than or equal to 100,000 poise and is made for the downdraw process.

Id. at CORNING-ITC2-00000560. The ’491 patent issued on February 4, 2014.

C. Prosecution History of the '498 Patent

40. The application that issued as the '498 patent was filed as a divisional application of the '394 patent's application on December 10, 2010. On May 20, 2013, the examiner rejected the pending claims as obvious based on, among other things, Miwa. Appx. C to Complaint at CORNING-ITC2-00000654 – 661. In response, on August 20, 2013, Corning amended the claims to, among other things, recite “producing the glass sheets from the melted and fined batch materials.” *Id.* at CORNING-ITC2-00000686. Corning also argued that Miwa does not disclose or suggest the criticality of having both $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ greater than or equal to 1.0 and a MgO content greater than or equal to 1.0 mole percent. *Id.* at CORNING-ITC2-00000691 – 692. The examiner then issued a Notice of Allowance on October 1, 2013, stating:

The prior art fail[s] to disclose or suggest with sufficient specificity a method of making a glass by the downdraw process comprising an alkali-free glass which comprises the recited components, wherein the glass has the specific recited relationship of the alkaline earth metal oxides to the Al_2O_3 content of greater than or equal to 1, the glass has greater than or equal to 1 mole percent MgO, the glass uses SnO_2 as a fining agent in an amount greater than or equal to 0.01 mole percent, and the glass limits the amounts of As_2O_3 and Sb_2O_3 content present in the glass to at most 0.005 mole percent. Furthermore, the glass has a liquidus viscosity that is greater than or equal to 100,000 poise.

Id. at CORNING-ITC2-00000756. The '498 patent issued on February 4, 2014 (the same day as the '491 patent).

VI. THE ASSERTED CLAIMS

41. As noted above, I have been informed by counsel that Corning is asserting claims 4 and 16 of the '394 patent; claims 2-3, 6, 8, and 12 of the '491 patent; and claims 2-3, 5-6, and 9 of the '498 patent. I list the asserted claims below.

A. Asserted Claims of the '394 Patent

42. Asserted claims 4 and 16 of the '394 patent recite as follows:

1. An alkali-free glass comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-2.0
BaO:	0-0.1

wherein:

(a) $1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.25$,

where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al_2O_3 and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO;

(b) the glass has the compositional characteristic that on an oxide basis, the glass comprises at least 0.01 mole percent SnO_2 ; and

(c) the glass has a density that is less than or equal to 2.41 grams/cm³.

2. The glass of claim 1 wherein the glass has the additional compositional characteristic that on an oxide basis, the glass comprises at most 0.05 mole percent Sb_2O_3 .

...

4. The glass of claim 2 wherein the glass has the further compositional characteristic that on an oxide basis, the glass comprises at most 0.05 mole percent As_2O_3 .

...

8. An alkali-free glass comprising in mole percent on an oxide basis:

SiO ₂ :	64.0-71.0
Al ₂ O ₃ :	9.0-12.0
B ₂ O ₃ :	7.0-12.0
MgO:	1.0-3.0
CaO:	6.0-11.5
SrO:	0-1.0
BaO:	0-0.1

wherein:

$$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \geq 1.00,$$

where [Al₂O₃] is the mole percent of Al₂O₃ and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO.

...

12. The glass of claim 8 wherein the glass has at least one of the following compositional characteristics:

- (a) on an oxide basis, the glass comprises at most 0.05 mole percent As₂O₃;
- (b) on an oxide basis, the glass comprises at most 0.05 mole percent Sb₂O₃;
- (c) on an oxide basis, the glass comprises at least 0.01 mole percent SnO₂.

...

16. The glass of claim 12 wherein the glass has compositional characteristics (a), (b), and (c).

B. Asserted Claims of the '491 Patent

43. Asserted claims 2-3, 6, 8, and 12 of the '491 patent recite as follows:

1. An alkali-free glass for a downdraw process comprising in mole percent on an oxide basis:

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
 BaO: 0-0.1

wherein:

(a) $1.00 \leq \Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$, where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al₂O₃ and $\Sigma[\text{RO}]$ equals the sum of the mole percents of MgO, CaO, SrO, and BaO;

(b) the glass has the following compositional characteristics:

(i) on an oxide basis, the glass comprises at most 0.05 mole percent As₂O₃;

(ii) on an oxide basis, the glass comprises at most 0.05 mole percent Sb₂O₃;
 and

(iii) on an oxide basis, the glass comprises at least 0.01 mole percent SnO₂;
 and

(c) the glass has a liquidus viscosity that is greater than or equal to 100,000 poise.

2. The glass of claim 1 wherein:

$\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3] \leq 1.25$.

3. The glass of claim 1 wherein, on an oxide basis, SrO is at most 1.0 mole percent.

4. The glass of claim 1 wherein the glass has at least one of the following properties:

(a) a density that is less than or equal to 2.41 grams/cm³;

(b) a linear coefficient of thermal expansion (CTE) over the temperature range 0-300° C. which satisfies the relationship:

$$28 \times 10^{-7}/^{\circ}\text{C} \leq \text{CTE} \leq 34 \times 10^{-7}/^{\circ}\text{C};$$

(c) a liquidus temperature less than or equal to 1170° C;

(d) a strain point that is greater than or equal to 650° C.

...

6. The glass of claim 4 wherein the glass has properties (a) through (d).

...

8. The glass of claim 1 wherein, on an oxide basis, the glass comprises at most 0.15 mole percent SnO_2 .

...

12. The glass of claim 1 wherein the downdraw process is a fusion process.

C. Asserted Claims of the '498 Patent

44. Asserted claims 2-3, 5-6, and 9 of the '498 patent recite as follows:

1. A method for producing alkali-free glass sheets by a downdraw process comprising:

(A) selecting, melting, and fining batch materials so that the glass making up the sheets comprises SiO_2 , Al_2O_3 , B_2O_3 , MgO , and CaO , and, on an oxide basis, has:

(i) a $\Sigma[\text{RO}]/[\text{Al}_2\text{O}_3]$ ratio greater than or equal to 1.0, where $[\text{Al}_2\text{O}_3]$ is the mole percent of Al_2O_3 and $\Sigma[\text{RO}]$ is the sum of the mole percents of MgO , CaO , SrO , and BaO ; and

(ii) a MgO content greater than or equal to 1.0 mole percent;

(B) producing the glass sheets from the melted and fined batch materials; wherein:

(a) on an oxide basis, the glass making up the glass sheets comprises at most 0.005 mole percent As_2O_3 ;

(b) on an oxide basis, the glass making up the glass sheets comprises at most 0.005 mole percent Sb_2O_3 ;

(c) SnO_2 is used in the fining and the glass making up the glass sheets has an SnO_2 content which in mole percent on an oxide basis satisfies the relationship:

$$0.01 \leq \text{SnO}_2; \text{ and}$$

(d) the glass making up the glass sheets has a liquidus viscosity that is greater than or equal to 100,000 poise.

2. The method of claim 1 wherein the glass making up the glass sheets has an SnO₂ content which in mole percent on an oxide basis satisfies the relationship:

$$\text{SnO}_2 \leq 0.15.$$

3. The method of claim 1 wherein the MgO content is between 1.2 and 2.8 mole percent.

...

5. The method of claim 1 wherein the glass making up the glass sheets has a density that is less than or equal to 2.41 grams/cm³.

6. The method of claim 1 wherein the glass making up the glass sheets has a linear coefficient of thermal expansion (CTE) over the temperature range 0-300° C. which satisfies the relationship:

$$28 \times 10^{-7}/^{\circ}\text{C.} \leq \text{CTE} \leq 34 \times 10^{-7}/^{\circ}\text{C.}$$

...

9. The method of claim 1 wherein the downdraw process is a fusion process.

VII. MATERIALS CONSIDERED

45. In arriving at my opinions in this declaration, I have considered the asserted patents, their file histories, the parties' proposed claim constructions, and all other information and documents cited or discussed in this declaration, including the exhibits below.

Exhibit No.	Description
N/A	Complaint, <i>Certain Glass Substrates for Liquid Crystal Displays, Products Containing the Same, and Methods for Manufacturing the Same II</i> , Investigation No. 337-TA-1441 ("Complaint")
N/A	Certified copy of U.S. Patent No. 7,851,394 (Exhibit 1 to Complaint) ("394 patent")
N/A	Certified copy of U.S. Patent No. 8,642,491 (Exhibit 2 to Complaint) ("491 patent")
N/A	Certified copy of U.S. Patent No. 8,640,498 (Exhibit 3 to Complaint) ("498 patent")
N/A	Certified copy of Prosecution History of the U.S. Patent No. 7,851,394 (Appendix A to Complaint)
N/A	Certified copy of Prosecution History of the U.S. Patent No. 8,642,491 (Appendix B to Complaint)

N/A	Certified copy of Prosecution History of the U.S. Patent No. 8,640,498 (Appendix C to Complaint)
N/A	Declaration of Professor Steve W. Martin (Exhibit 7 to Complaint)
N/A	Supplemental Declaration of Professor Steve W. Martin (Exhibit 8 to Complaint)
1	Caihong Display Devices Co., Ltd. v. Corning Incorporated, Case No. IPR2025-00439, Ex-1003, Decl. of Dr. Frank Ernst
2	Caihong Display Devices Co., Ltd. v. Corning Incorporated, Case No. IPR2025-00937, Ex-1003, Decl. of Dr. Frank Ernst
3	U.S. Patent No. 3,338,696
4	U.S. Patent No. 3,682,609
5	U.S. Patent No. 5,374,595
6	U.S. Patents No. 6,319,867
7	U.S. Patent No. 6,831,029 (“Chacon”)
8	U.S. Patent No. 6,468,933 (“Narita”)
9	U.S. Patent No. 6,169,047 (“Nishizawa”)
10	Japanese Patent Publication JP 2004-189535 A, with English machine translation (“Miwa”)
11	Alexander B.E. Rocholl et al., Chemical Characterization of NIST Silicate Glass Certified Reference Material SRM 610 by ICP-MS, TIMS, LIMS, SSMS, INAA, AAS and PIXE, 21(1) J. Geostandards & Geoanalysis 101, 112 (1997)
12	Robert H. Doremus, Glass Science (2nd ed. 1994)
13	J. E. Shelby, Introduction to Glass Science and Technology (2nd ed. 2005)
14	U.S. Patent No. 5,326,730 (“Dumbaugh”)
15	ASTM E228-85, Standard Test Method for Linear Thermal Expansion of Solid Materials with a Vitreous Silica Dilatometer (1986)
16	ASTM C336-71, Standard Test Method for Annealing Point and Strain Point of Glass by Fiber Elongation (2004)
17	ASTM C829-81, Standard Practices for Measurement of Liquidus Temperature of Glass by the Gradient Furnace Method (2002)
18	ASTM-C598-93, Standard Test Method for Annealing Point and Strain Point of Glass by Beam Bending (2003)

VIII. CLAIM TERMS AND PROPOSED CONSTRUCTIONS

46. I understand that the parties have proposed the following claim constructions for the following disputed terms:

Disputed Claim Term	Corning's Proposed Construction	Respondents' Proposed Construction
<p>“An alkali-free glass comprising in mole percent on an oxide basis”</p> <p>(‘394 claims 1, 8)</p>	<p>The preamble “an alkali-free glass” is limiting.</p> <p>“alkali-free glass” is defined as below.</p>	<p>Limiting</p> <p>Indefinite</p> <p>Alternatively, if not indefinite:</p> <p>“a glass having a total alkali concentration which is less than or equal to 0.1 mole percent, where the total alkali concentration is the sum of the Na₂O, K₂O, and Li₂O concentrations, comprising in mole percent on an oxide basis:”</p>
<p>“An alkali-free glass for a downdraw process comprising in mole percent on an oxide basis:”</p> <p>(‘491 claim 1)</p>	<p>The preamble “[a]n alkali-free glass for a downdraw process” is limiting.</p> <p>“alkali-free glass” is defined as below.</p>	<p>Limiting</p> <p>Indefinite</p> <p>Alternatively, if not indefinite: “a glass having a total alkali concentration which is less than or equal to 0.1 mole percent, where the total alkali concentration is the sum of the Na₂O, K₂O, and Li₂O concentrations, for a downdraw process comprising in mole percent on an oxide basis:”</p> <p>In addition, if not indefinite:</p> <p>“glass for a downdraw process” should be construed as glass in a liquid phase suitable for use in a downdraw process and does not encompass a “glass sheet produced by [the] downdraw process”</p>

“[mole percent] on an oxide basis” (All asserted claims)	Plain and ordinary meaning, i.e., “mole percent calculated using elements in their oxide form”	Indefinite
“liquidus viscosity” (All asserted claims of the '491 and '498 patents)	Plain and ordinary meaning, i.e., “the viscosity of a glass composition at its liquidus temperature”	Indefinite
“linear coefficient of thermal expansion” ('491 claim 4; '498 claim 6)	Plain and ordinary meaning, i.e., “the relative change in the length of a glass composition when the temperature of the glass composition changes over a specified range”	Under Corning’s proposed construction: indefinite Otherwise: plain and ordinary meaning
“strain point” ('491 claim 4)	Plain and ordinary meaning, i.e., “the temperature at which the internal stresses in a glass are substantially relieved”	Under Corning’s proposed construction: indefinite Otherwise: plain and ordinary meaning
“liquidus temperature” ('491 claim 4)	Plain and ordinary meaning, i.e., “the lowest temperature above which crystals cannot form in a glass”	Indefinite

47. I also understand that the parties have agreed upon the following constructions for the following claim terms:

Undisputed Claim Term	Agreed Upon Construction
“alkali-free glass” (All asserted claims)	“A glass having a total alkali concentration which is less than or equal to 0.1 mole percent, where the total alkali concentration is the sum of the Na ₂ O, K ₂ O, and Li ₂ O concentrations”
“A method for producing alkali-free glass sheets by a downdraw process comprising:” ('498 claim 1)	“A method for producing sheets of glass having a total alkali concentration which is less than or equal to 0.1 mole percent, where the total alkali concentration is the sum of the Na ₂ O, K ₂ O, and Li ₂ O concentrations by a downdraw process comprising:” “downdraw process” is defined as below.
“oxide” (All asserted claims)	Plain and ordinary meaning, i.e., “binary compound in which oxygen is chemically bonded to one other element”

“downdraw process” (All asserted claims of the '491 and '498 patents)	Plain and ordinary meaning, i.e., “a process in which molten glass is drawn vertically downward and forms a glass ribbon”
“fusion process” ('491 claim 12; '498 claim 9)	Plain and ordinary meaning, i.e., “a downdraw process in which separate streams of molten glass flow downward and combine into a single stream of molten glass that is drawn vertically downward and forms a glass ribbon,” where “downdraw process” means “a process in which molten glass is drawn vertically downward and forms a glass ribbon”
“fining” (All asserted claims of the '498 patent)	“Removing gaseous inclusions from melted batch materials”
“batch materials” (All asserted claims of the '498 patent)	Plain and ordinary meaning, i.e., “the materials that are mixed and melted to produce glass”

48. I further understand that, at this time, the parties agree that no construction is necessary for any other claim term in the asserted patents.

49. Below, I provide opinions about certain of the parties’ proposed constructions for the disputed claim terms, not all of them.

IX. CLAIM CONSTRUCTION

A. “[mole percent] on an oxide basis”

Disputed Claim Term	Corning’s Proposed Construction	Respondents’ Proposed Construction
“[mole percent] on an oxide basis” (All asserted claims)	Plain and ordinary meaning, i.e., “mole percent calculated using elements in their oxide form”	Indefinite

50. One of the most important, if not the most important, aspects of a materials-related patent claim is the composition of the final product (in this case, the final glass composition). In the following paragraphs, I make the case that all allegedly measured compositions listed in Table 1 of the specification were most probably not measured.

51. Table 1 lists two sets of values concerning the glass compositions made by Corning. The majority list the batch compositions used (e.g., runs 1-6). Crucially, a subset were compositions (from continuous melter) that “were obtained from the ribbon via standard chemical methods[.]” ’394 patent, 14:7-10. In particular, Table 1 lists examples of glasses of the alleged inventions in terms of “mole percents which are *either* calculated on an oxide basis from the glass batches in the case of the crucible melts *or* determined from *measurements on the finished glass* for the compositions prepared using the continuous melter (see below).” *Id.*, 13:9-13 (emphasis added).

52. A POSA would quickly realize that the values reported in Table 1, “obtained from the ribbon via standard chemical methods,” are *highly improbable, if not impossible*. *Id.*, 14:8-9. Melting a glass composition at 1590 °C to 1610 °C as described in the specification (*id.*, 13:53-14:5) would inevitably result in (1) changes in glass compositions due to the loss, by vaporization, of the various oxides at *different* rates and (2) important changes due to impurities in the raw materials. The fact that the values in Table 1 for these glasses are almost identical to the starting compositions to *three* significant figures—even if one were to assume no intended changes to the batches from run to run—is, again, highly improbable. For example, the compositions derived from batch materials in mole % for run 6 of SiO₂, Al₂O₃, B₂O₃, MgO, CaO, SrO, and SnO₂ are listed as: 68.98, 10.45, 9.90, 2.00, 8.10, 0.50, and 0.07, respectively. *Id.*, Table 1. The corresponding compositions for run 7, purportedly measured on glass ribbons *after* melting, are 69.41, 10.19, 9.96, 1.87, 7.98, 0.52 and 0.07, respectively. *Id.* Based on my experience, such agreement between starting and final chemistries, especially for a glass molten at 1590 °C to 1610 °C, is highly improbable, even if one were using the same measurements of the respective batch materials for both runs. In my experience two *identical* starting batches molten under the same

conditions would yield different compositions whose discrepancies, possibly of the order of 1 atomic % or higher, would be significantly higher than those reflected in Table 1, especially for the trace elements like SnO₂.

53. This can be easily ascertained by measuring the compositions of any two batches of commercial glasses of the same composition produced by Corning or any other glass manufacturer. If such measurements were to be carried out, then with a reasonable degree of scientific certainty, the differences in values between the two measured values of the *same* starting compositions and the same melt would be significantly more different than the compositions listed in Table 1. Said otherwise, if a POSA were to try to reproduce the results of, say, run 7 (*measured* composition values), the first question they would have to answer is: what is the starting composition? A careful perusal of the values listed in Table 1 would indicate that this question is not as important as it could have otherwise been because, *according to Table 1*, the initial and final compositions appear to be quite close indeed. It follows that, if a POSA were to make a glass using the oxide fractions listed for run 7 (that were allegedly measured) as the starting batch and then measure the final glass composition, they would, with a reasonable degree of scientific certainty, differ (at least in the 1 atomic % range) from those listed for run 7 in Table 1. In which case, the questions of (1) what the claims cover in terms of glass compositions and (2) how such glass compositions could be used to make glasses that have such *small variances* in their measured concentration values of their respective oxides lack reasonably certain answers.

54. The specification states that the glasses of Examples 1-6, 9-11, 29-31, 33-34, 36-42, and 46-52 “were prepared by melting 3,000 gram batches of each glass composition at a temperature and time to result in a relatively homogeneous glass composition, e.g., at a temperature of about 1600° C. for a period of about 16 hours in platinum crucibles[,]” after which

they were annealed and cooled. *Id.*, 13:39-52. Given that all compositions in Table 1 add up to exactly 100 %, these compositions therefore implicitly assume that the oxides used were 100% pure, which is impossible, especially for a mineral that is front loaded by heavy machinery from a geologic formation. A POSA would recognize this impossibility, which contributes to the indefinite nature of the asserted claims from the POSA's perspective.

55. The other examples from Table 1 are more egregious. For Examples (or runs) 7-8, 12-28, 32, 35, and 43-45 in Table 1, the specification alleges the use of a "laboratory scale, continuous, Joule-heated melter," comprising various components, including the use of "tin oxide electrodes," to create "a ribbon approximately 5 mm thick and 30 mm wide." *Id.*, 13:53-14:5. The specification then vaguely states: "Compositions were obtained from the ribbon ***via standard chemical methods***" that are not specified. *Id.*, 14:7-9 (emphasis added). However, as discussed above, the mole percents for the various oxides would vary more significantly than those shown in Table 1 for these examples if, for no other reason, than inhomogeneities in the final glasses. Specifically, and for example, it is extremely improbable that the compositions measured from the finished glass ribbons (e.g., runs 7 and 8 in Table 1) would have such low variance from the values estimated from the batch ingredients, based on the methods described in the specification for making the glass ribbons, which would almost certainly result in significantly more variance in the reported mole percents. *See, e.g.*, Ex. 11, Alexander B.E. Rocholl et al., *Chemical Characterization of NIST Silicate Glass Certified Reference Material SRM 610 by ICP-MS, TIMS, LIMS, SSMS, INAA, AAS and PIXE*, 21(1) J. Geostandards & Geoanalysis 101, 112 (1997) (noting "assumed uncertainty of the proposed values" of elemental analysis using "ICP-MS, SSMS, LIMS, TIMS, INAA, AAS, and PIXE" were "between 2 and 10%"). For example, at least some of the

oxides recited in the specification that may be included in the claimed glasses may become gases and escape the glass during melting, including tin oxides.

56. More importantly, returning to oxide impurities found in the various starting materials, according to the measured values in Table 1, there are ***no*** impurities present. From a POSA's point of view that would be nonsensical. Impurity oxides would undoubtedly have been introduced in the glass, either unintentionally from impurities in the raw materials or from the equipment used to make the glass. It is important to note here that it is not only the reproducibility of the results that is problematic but the very likely outcome that some impurity oxides (e.g., Fe_2O_3) in the finished glass are present at ***higher*** concentrations than some of the minority oxides listed in Table 1 that were intentionally added and allegedly measured. For example, all of the examples in Table 1 include the composition of, notably, SnO_2 at exactly 0.07 % (700 ppm). A POSA would consider that concentration as trace and, even if measured, it would pale in comparison to unintentional impurities found in the raw materials (e.g., Fe_2O_3). Said otherwise, the concentration of unwanted impurities would dwarf the SnO_2 concentration allegedly measured at 0.07 %. Along the same lines to a POSA, quantifying any elements present at < 1 atomic % poses measurement and reproducibility problems, if for no other reason than such trace elements would not necessarily be uniformly distributed in the glass.

57. Moreover, it is highly unlikely that ***all*** the ***measured*** glass compositions would include ***exactly*** 0.07 % as reflected in Table 1. The only scientific method to quantify such trace elements is statistically. One would need to measure the concentrations on several/many glass samples and report not only the average, but all the pertinent standard deviations. Table 1 does not include standard deviations. A POSA would have no idea how to make glass using the method disclosed for Examples 7-8, 12-28, 32, 35, and 43-45 to achieve such consistency. *Id.*, 13:60

(noting the use of, e.g., “tin oxide electrodes” that could contaminate the melt with Sn at higher concentration than what was initially batched).

58. Along these lines, it is important to note again that all the measured compositions add up to exactly 100% and thus imply that all the initial oxides were 100% pure, which, again, is impossible. Therefore, I conclude, with a reasonable degree of scientific certainty, that the compositions listed in Table 1 that were purportedly *measured* (e.g., runs 7, 8, 12-28, 32, 35, and 43-45) were in fact *not* measured. This renders the glass compositions listed in the patent of no use to a POSA.

59. In claim 1, reference is made to, “alkali-free glass comprising in mole percent on an oxide basis.” Considering the aforementioned uncertainties in Table 1, and because the claims do not specify, it is unclear whether the asserted claims cover raw batch materials or finished glasses. If the former, then the final compositions, especially vis-à-vis impurity elements, would be unknown/unknowable. Recall that all compositions listed in Table 1 add up to *exactly* 100%. If the latter, then the starting compositions would be unknown. According to Table 1, that distinction is apparently not particularly important since the various glasses have very comparable compositions. This would mislead or confuse a POSA into thinking they were doing something wrong if they actually made glasses having compositions that fall just outside the scope of the asserted claims and measured significantly higher variances between the measured compositions of the glasses and/or relatively large concentrations of impurities, resulting in some glasses unpredictably and inadvertently infringing even though they were specifically designed *not* to infringe.

60. Another important factor has to do with the absolute values of the very low concentrations purportedly measured in Table 1. Given the importance of SnO₂, I consider a

hypothetical value of 0.05% or a 0.0005 mole fraction (500 ppm). Such values are beyond the detectability limits of most spectroscopic characterization tools and most chemical methods. It is far from trivial to even come close to such values. From my experience, such low values, if they can be measured at all, would fluctuate substantially when measured even on the same glass. Crucially, in all runs, batch or measured, the SnO₂ concentrations are *exactly* 0.07, which is so improbable as to be close to impossible. Said otherwise, the fact that there is no range given for “measured” concentration (e.g., runs, 7, 8, 12-28, 32, 35, and 43-45) of SnO₂ in Table 1 is so highly improbable that it leads me to again conclude, with a reasonable degree of scientific certainty, that the compositions for these runs were *not* measured. And if these compositions were not measured, a POSA would lack confidence in any of the other disclosures in the patent.

61. In Corning’s Complaint, Corning references declarations submitted by Professor Steve Martin, in which he refers to glass testing he performed using “a Quanta FEG 250 SEM from FEI (now Thermo-Fisher) equipped with an Oxford Instruments Aztec™ energy-dispersive x-ray spectrometer (EDS) with an X-Max 80 detector.” *See, e.g.*, Complaint, ¶¶ 79-80; Ex. 7 to Complaint, ¶ 11. These testing methods are surface-sensitive and have low detection sensitivity for light elements and are different from chemical testing methods used to measure bulk glass samples. Given that the claims recite highly specific mole percents of less than 0.1 for BaO, for example (in the case of the ’394 and ’491 patents) or less than 0.005 mole percent for As₂O₃ and Sb₂O₃ (for the ’498 patent), a particular glass could infringe based on measurements using one tool but not infringe using another tool. In fact, Dr. Martin appears to concede that his equipment used to test the accused glass was incapable of measuring these low mole percents. *See* Complaint, Ex. 8, ¶ 1.

62. In summary, Table 1 implies that there were little differences between the starting batch compositions and those measured chemically on the finished glass. It is my opinion that, with a reasonable degree of scientific certainty, such *small* differences, i.e., lack of variance, especially of the low concentration elements, are not possible for the compositions listed in Table 1. I also claim, with a reasonable degree of scientific certainty, that the compositions listed in Table 1 for runs 7, 8, 12-28, 32, 35, and 43-45, were *not* measured, contrary to the representations in the specification. The chemical composition of a glass as estimated from its batch materials in many cases can differ from the chemical composition of the glass as measured from its final form. This is especially true when the glass is processed at temperatures of the order of 1600 °C for 16 hours. '394 patent, 13:39-52. Furthermore, these differences are greatly magnified when dealing with elements added in the ppm range.

63. In view of the foregoing, a POSA would not know how to make a non-infringing glass near one or more of the mole percent ranges recited in the asserted claims with reasonable certainty.

B. “liquidus temperature”

Disputed Claim Term	Corning’s Proposed Construction	Respondents’ Proposed Construction
“liquidus temperature” (’491 claim 4)	Plain and ordinary meaning, i.e., “the lowest temperature above which crystals cannot form in a glass”	Indefinite

64. In my opinion, the asserted claims that include the phrase “liquidus temperature” are indefinite because they fail to inform a POSA about the scope of the alleged inventions with reasonable certainty, when read in light of the patents’ specifications and prosecution histories.

65. One of Corning’s own patents (Ex. 14, U.S. Patent No. 5,326,730 (“Dumbaugh”)) related to glasses for fusion downdraw processes states, regarding experiments described in Dumbaugh’s specification:

The liquidus temperatures of the glasses were measured via two different methods. The standard liquidus method (Liq.) involves placing crushed glass particles in a platinum boat, placing the boat in a furnace having a region of gradient temperatures, heating the boat in an appropriate temperature region for 24 hours to melt the glass in at least a section of the boat length, withdrawing the boat from the furnace, allowing the melt to cool in the boat to a length of glass, removing said length of glass from the boat, and determining by means of microscopic examination the highest temperature at which crystals appear in the interior of the glass. A second method termed the “meltback liquidus” (M.Liq.) contemplates placing a glass sample which has been precrystallized by holding at a temperature of 1,000 °C. for 24 hours in a platinum boat, heating the boat in an appropriate temperature region in a gradient furnace for 24 hours, withdrawing the boat from the furnace, removing the glass sample from the boat, and then determining by microscopic examination the lowest temperature at which crystals are not observed in the interior of the glass. Generally, the Liquidus temperatures measured by these two techniques do not differ by more than 50° C., ***with the “meltback liquidus” typically being higher than the standard liquidus temperature.***

Ex. 14, 6:30-54. (emphasis added). The data in Table I of Dumbaugh shows differences between the two measures of liquidus temperature ranging from 5-55 °C.

66. A 55 °C discrepancy in the measured liquidus temperature would be significant in

the context of the asserted patents. For example, the specification characterizes the liquidus temperature of 1200 °C of the glass in Example 45 in Table 1 as too high, with a resultant liquidus viscosity that is too low. '394 patent, 14:66-15:2, Table 1. But in another part of the specification, the inventor describes glasses that purportedly meet the limitations of one or more of the asserted claims as having liquidus temperatures of “less than or equal to 1170°C,” which is the claimed range in claim 4 of the '491 patent. The liquidus temperatures in the asserted patents were measured using what Dumbaugh refers to as the “standard liquidus method.” Ex. 14, 6:30-54. If a POSA instead measured the liquidus temperatures using the alternative “meltback liquidus” method discussed in Dumbaugh, the resultant measurements may be too high relative to glasses deemed acceptable for a fusion downdraw process in the asserted patents’ specification and would take the liquidus temperature out of the range claimed in claim 4. For example, in Dumbaugh, the meltback liquidus method results in a liquidus temperature measurement for the Code 1733 glass that is 55° C higher than the measurement obtained from using the alternative method. Similarly, the measurements for Code 1735 glass show a measurement 35° C. higher than that obtained by the alternative method. If either of these 35° or 55° C higher measurements were applied to the glasses in Table 1 of the '394 patent, many of the glasses for Examples 1-43 deemed acceptable for a fusion downdraw process would have liquidus temperatures outside of the claimed range (including those in Examples 1-7, 10-12, 16, 18, 23, 29-31, 33-34, 36-42).

67. Moreover, as discussed below, liquidus viscosity may be determined based upon the measured liquidus temperature. A variation of 55° C in the measured liquidus temperature could take the estimated liquidus viscosity of the glass out of the acceptable range for a fusion draw application, based on the inventor’s own methodology for measuring liquidus viscosity. *See* '394 patent, 14:32-36.

C. “liquidus viscosity”

Disputed Claim Term	Corning’s Proposed Construction	Respondents’ Proposed Construction
“liquidus viscosity” (All asserted claims of the ’491 and ’498 patents)	Plain and ordinary meaning, i.e., “the viscosity of a glass composition at its liquidus temperature”	Indefinite

68. In my opinion, the asserted claims that include the phrase “liquidus viscosity” are indefinite because they fail to inform a POSA about the scope of the alleged inventions with reasonable certainty, when read in light of the patents’ specifications and prosecution histories.

69. The asserted claims of the ’491 and ’498 patents do not include any specific way to measure the liquidus viscosity. The specification of the asserted patents states, for one embodiment of the invention: “The liquidus viscosity in poises was determined from the liquidus temperature and the coefficients of the Fulcher equation.” ’394 patent, 14:32-34. Said otherwise, the liquidus viscosity was not measured, but calculated from the liquidus temperature using the Tammann-Vogel-Fulcher type equation. To calculate the liquidus viscosity, a POSA would need to know the coefficients used in the Fulcher equation. The latter are empirical constants obtained by fitting viscosity vs. temperature plots and are different for every glass composition. Absent these coefficients, it is *impossible* to estimate liquidus viscosity. Even if a POSA would have chosen the Fulcher equation and would have known how to calculate the “coefficients of the Fulcher equation,” a POSA still would not be able to determine the “liquidus viscosity” with reasonable certainty. This is at least because the specification is completely silent on the method used for measuring the viscosity values of a glass melt that serve as the basis for the Fulcher equation and hence for determining the “liquidus viscosity.” And because viscosity measurement results of liquid glass are known to vary substantially depending on the measurement method and

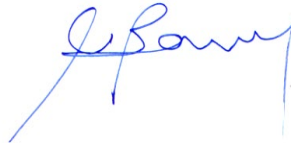
conditions—including shear rate and the type of viscometer used—a POSA would not be able to determine “liquidus viscosity” with reasonable certainty in the absence of this critical measurement information. In other words, this term is indefinite.

70. As noted in *Glass Science*, by Robert H. Doremus, “viscosity equations of the Tammann-Vogel-Fulcher type that predict infinite viscosity” at some temperatures “are unlikely to be correct.” Ex. 12 at 115-116. Another well-known book, *Introduction to Glass Science and Technology* (2nd Ed.) by J. E. Shelby, notes that the Fulcher equation is only useful over “limited temperature ranges.” Ex. 13 at 120. In addition, the specification and the claims provide no guidance as to how to measure the “coefficients of the Fulcher equation.”

71. I reserve the right to supplement this declaration with new information and/or documents that may be discovered or produced in this case, or to address any new claim constructions offered by Complainant.

I swear under penalty of perjury under the laws of the United States that any facts recited herein are true and correct to the best of my knowledge.

Date: May 13, 2025



Michel W. Barsoum, Ph.D.