

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

THE BOEING COMPANY
Petitioner,

v.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
Patent Owner.

Case No. IPR2024-00761
U.S. Patent No. 7,487,684

PETITION'S REPLY TO PATENT OWNER'S RESPONSE

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1001	U.S. Patent 7,487,684 (“’684 Patent”)	X
1002	Prosecution History of U.S. Patent 7,487,684 (“’684 File History”)	X
1003	Declaration of Junlan Wang, Ph.D. (“Wang Declaration”)	X
1004	Curriculum Vitae of Junlan Wang, Ph.D.	X
1005	Junlan Wang, 2002 Ph.D. Dissertation at University of Illinois at Urbana-Champaign, “Thin-film Adhesion Measurements by Laser-Induced Stress Wave” (“Wang-Dissertation” or “Wang”)	X
1006	Declaration of Ingrid Hseih-Yee (“Hseih-Yee Declaration”)	X
1007	Anderholm, N., 1970, “Laser-Generated Stress Waves,” Appl. Phys. Lett., 16(3), pp. 113-115	X
1008	Fox, J.A., and Barr, D.N., 1973, “Laser-Induced Shock Effects in Plexiglas and 6061-T6 Aluminum,” Appl. Phys. Lett., 22(11), pp. 594-596	X
1009	Yang, L., 1974, “Stress Waves Generated in Thin Metallic Films by a Q-Switched Ruby Laser,” J. Appl. Phys., 45(6), pp. 2601-2608	X
1010	Stephens, A.W., and Vossen, J.L., 1976, “Abstract: Measurement of Interfacial Bond Strength by Laser Spallation,” J. Vac. Sci. Technol., 13(1), pp. 38-39	X
1011	Gupta, V., Argon, A., Parks, D., and Cornie, J., 1992, “Measurement of Interface Strength by a Laser Spallation Technique,” J. Mech. Phys. Solids, 40(1), pp. 141-180 (“Gupta-1992”)	X
1012	J. Yuan and V. Gupta, “Measurement of interface strength by the modified laser spallation experiment. I-II,” Journal of Applied Physics, vol. 74, no. 4, pp. 2388-2404, 1993	X
1013	J. Yuan, V. Gupta, A. Pronin, “Measurement of interface strength by the modified laser spallation	X

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	experiment. III,” Journal of Applied Physics, vol. 74, no. 4, pp. 2405-2410, 1993 (“Gupta-1993”)	
1014	Wang, J. , Sottos, N. R. , and Weaver, R. L., 2000, “Laser Induced Thin Film Spallation,” TAM Technical Reports, University of Illinois Urbana-Champaign	X
1015	Wang, J., Weaver, R.L., 2001, “Abstract: Laser-induced weak shock in fused silica for destructive testing of thin films” J. Acoust. Soc. Am. 109, 2308 (2001)	X
1016	Wang, J., Weaver, R. L., and Sottos, N. R., 2002, “A Parametric Study of Laser Induced Thin Film Spallation,” Exp. Mech., 42(1), pp. 74-83 (“Wang-2002”)	X
1017	Wang, J., Sottos, N. R., and Weaver, R.L., 2003, “Thin Film Adhesion Measurement by Laser Induced Stress Waves,” J. Mech. Phys. Solids	X
1018	Wang, J., Weaver, R. L., and Sottos, N. R., 2003, “Laser-Induced Decompression Shock Development in Fused Silica,” J. Appl. Phys., 93(12), pp. 9529–9536	X
1019	Gupta V, Kireev V, Tian J, Yoshida H, Akahoshi H, 2003, “Glass-modified stress waves for adhesion measurement of ultra-thin films for device applications,” J. Mech. Phys. Solids 51(8):1395-1412	X
1020	Fairand, B.P., Clauer, A.H., 1977, “Use of Laser Generated Shocks to Improve the Properties of Metals and Alloys,” Indus. App. Of High Power Laser Tech., Vol. 86,	X
1021	Barker, L.M., Hollenbach, R.E, 1970, “Shock wave studies of PMMA, fused silica and sapphire,” J. Appl. Phys, 41, pp. 4208-4226	X
1022	December 13, 2023 Defendant’s Motion to Dismiss Plaintiff’s Second Amended Complaint Under Federal Rules of Civil Procedure 12(b)(2), 12(b)(3), and 12(b)(2), Dkt. 78, <i>Laser Spallation Technologies, LLC</i>	X

Exhibit No.	Description	Previously Submitted
	<i>v. The Boeing Company</i> , Case No. 2:23-cv-02294 (C.D. Cal.)	
1023	February 1, 2024 Order Denying Defendants’ Motion to Dismiss, Dkt. 86, <i>Laser Spallation Technologies, LLC v. The Boeing Company</i> , Case No. 2:23-cv-02294 (C.D. Cal.)	X
1024	February 7, 2024 Order Setting Deadlines Re Jurisdictional Discovery, Dkt. 90, <i>Laser Spallation Technologies, LLC v. The Boeing Company</i> , Case No. 2:23-cv-02294 (C.D. Cal.)	X
1025	February 27, 2024 Order Conditionally Granting Motion to Compel Gupta Deposition [ECF 91] and Denying Application to Expedite Hearing on Motion to Compel [ECF 92], Dkt, 93, <i>Laser Spallation Technologies, LLC v. The Boeing Company</i> , Case No. 2:23-cv-02294 (C.D. Cal.)	X
1026	February 1, 2024 Order Re: Civil Jury/Court Trial, Dkt. 89, <i>Laser Spallation Technologies, LLC v. The Boeing Company</i> , Case No. 2:23-cv-02294 (C.D. Cal.)	X
1027	Provisional Application No. 60/550,803	X
1028	Alexander Pronin, 1995 Ph.D. Dissertation at Dartmouth College, “Applications of Laser Generated Stress Pulses for Materials Characterization”	X
1029	Gupta, V., & Argon, A. S., 1991, “Measurement of strength of thin film interfaces by laser spallation experiment,” <i>Inelastic Deformation of Composite Materials: IUTAM Symposium, Troy, New York, May 29–June 1, 1990</i> (pp. 51-74). New York, NY: Springer New York	X
1030	Conference Program Book, ASME International Mechanical Engineering Congress and Exposition, November 17-22, 2002, New Orleans, Louisiana	X
1031	Uerara, K., Sakurai, M., 2002, “Bonding strength of adhesives and surface roughness of joined parts,” <i>J. Materials Processing Tech.</i> , 127, 178-181	X

Exhibit No.	Description	Previously Submitted
1032	Yu, A., Gupta, V, 1998, “Measurement of In Situ Fiber/Matrix Interface Strength in Graphite/Epoxy Composites,” <i>Composites Science and Technology</i> 58,1827-1837	X
1033	November 2, 2023 Declaration of Vijay Gupta in Support of Plaintiff’s Second Amended Complaint, Dkt. 75, <i>Laser Spallation Technologies, LLC v. The Boeing Company</i> , Case No. 2:23-cv-02294 (C.D. Cal.)	X
1034	U.S. Patent No. 5,438,402	X
1035	March 15, 2024 Declaration of LaTonya Morris, ProQuest	X
1036	February 7, 2024 Declaration of Carl Mageski, ProQuest	X
1037	December 18, 2024 Declaration of LaTonya Morris, ProQuest	X
1038	Supp. Declaration of Junlan Wang, Ph.D. (“Supp. Wang Decl.”)	
1039	Deposition Transcript of Dr. Vijay Gupta taken on April 11, 2025	
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1047	“Online Dissertation Services” archived by Internet Archive on February 10, 2003.	
1048	Copyright registration record for v. 63, no. 11 of <i>Dissertation Abstracts International</i> that contains the index record for the Wang dissertation, obtained from the public catalog of the US Copyright Registration Office	
1049	Copy of the front matter of v. 63, no. 11 of <i>Dissertation Abstracts International</i> and the index record for the Wang dissertation, obtained from the Library of Congress	
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1054	Declaration of Dr. Vijay Gupta from 11/2/2023	
1055	Declaration of Dr. Vijay Gupta from 1/5/2024	
1056	Lili Hu, Phillip Miller, Junlan Wang, 2009, “High strain-rate spallation and fracture of tungsten by laser-induced stress waves,” <i>Materials Science and Engineering A</i> , 504 (2009) 73-80 (“Wang-2009”)	

I. Introduction

Patent Owner (“PO”) claims that no prior art of record discloses or renders obvious the claimed “glass element” recited in each independent claim. PO is not only incorrect, but exclusively supports its arguments with the testimony of Dr. Gupta—*a co-inventor of the ’684 Patent who has a financial interest in the outcome of this IPR*. The Board should give little or no weight to his biased and unreliable opinions.

The Board should also find that Wang-Dissertation is prior art. The testimony of both LaTonya Morris and Dr. Ingrid Hsieh-Yee confirm that Wang-Dissertation was publicly accessible prior to the March 5, 2003, critical date. Additionally, Dr. Hsieh-Yee’s testimony confirms that Wang-Dissertation is prior art at least under § 102(a). *Infra* § IV.4.

Finally, the Board should find the Challenged Claims unpatentable because the prior art relied upon in each of Grounds 1-7 discloses or renders obvious the claimed “glass element.”

II. Claim Construction

The parties agree that “no terms of the challenged claims require any special construction.” *See* PO Response (“POR,” Paper 19), 20.

III. The Board Should Give Little or No Weight to Dr. Gupta's Biased, Unreliable Opinions

As the inventor of the challenged '684 Patent, Dr. Gupta has an “intellectual[]” interest in the outcome of this IPR. Ex-1039, 33:5-15. Accordingly, the Board should regard Dr. Gupta's testimony with skepticism and search for independent corroboration. *Price v. Symsek*, 988 F.2d 1187, 1194 (Fed. Cir. 1993); *Nvidia Corp. v. Invensas Corp.*, IPR2020-00602, Paper 52 at 17 (PTAB Sept. 1, 2021) (“[T]he typical bias that an inventor would have is driven by his personal motivation to find his own invention valid”); *TransWeb, LLC v. 3M Innovative Props. Co.*, 812 F.3d 1295, 1302 (Fed. Cir. 2016).

Dr. Gupta also has a financial interest in the outcome of this IPR, motivating further bias. Ex-1039, 33:5-18; *Google LLC v. DDC Tech., LLC*, IPR2023-00709, Paper 76 at 38 (PTAB Nov. 4, 2024). Dr. Gupta is an owner and employee of Laser Spallation Technologies, LLC (“LST”), which is the entity asserting the '684 Patent in the related district court proceeding. Dr. Gupta therefore stands to benefit from any damages that LST may recover in connection with its assertion of the '684 Patent. *See* Ex-1022; Ex-1039, 33:5-18; *see also* Paper 1 (Pet.) at 1 (Related Matters section). If the Board finds the Challenged Claims unpatentable, there will be no damages. It is not surprising, then, that Dr. Gupta wants the Board to rule in favor of PO. Ex-1039, 36:11-14.

Dr. Gupta is additionally biased by his employment by PO (and LST). Ex-1039, 23:10-14. *Yita LLC v. Macneil IP LLC*, IPR2023-00173, Paper 70 at 107 (PTAB June 6, 2024).

Dr. Gupta's tight-knit relationship with LST and PO is further evidenced by the fact that he has no engagement letter or other document memorializing his expert retention and repeatedly could not answer questions regarding basic details of expert work. Ex-1039, 46:13-52:12. He could not even confirm who was paying his bills, only that PO's law firm was paying (though he had not yet received any payment). Ex-1039, 26:17-27:7. The blurry line between his role as inventor/assignee and expert casts serious doubt on his ability to offer fair and impartial testimony.

Dr. Gupta's inconsistent or downright conflicting statements cast further doubt on his credibility. For example, he first testified that he gained an understanding of the meaning of the '684 Patent claims through his discussions with counsel, but when probed for details of those discussions, he quickly tried to reverse course. Ex-1039, 57:19-22 ("Q: How did you gain an understanding of the meaning of the claims of the '684 patent? A: That would be a discussion with counsel."); *id.*, 59:5-60:13. Moreover, his attempted retraction directly conflicts with his testimony in the related district court infringement case against Boeing (Petitioner here), where he testified that all his knowledge came from counsel. *See, e.g.*, Ex-1040, 124:13-125:4, 125:16-22, 126:22-127:4 ("Q. What is your understanding of what a glass

element is?...[A] [T]o answer the question I would have to discuss the communication with my counsel, which I understand, is not something which I can disclose.”). As another example, he previously testified in the related district court case (in the context of infringement) that the claims were not limited to silica glasses (meaning they cover silica glasses and more) but has now changed course by articulating a narrower claim scope, presumably under the theory that such a scope would be to his (and PO’s) advantage. *Compare* Ex-1054 at 5 (“The term ‘glass element’ in the ’684 Patent is not limited to silica glasses”) *with* Ex-1039, 87:18-22.

In view of Dr. Gupta’s bias and lack of credibility, the Board should give his testimony little or no weight. When PO’s arguments and evidence are contrasted with Dr. Wang’s (Petitioner’s expert) testimony, it is clear that PO cannot prevail.

IV. The Undisputed Facts Confirm that Wang-Dissertation is Prior Art

1. Legal Requirements

“A printed publication is ‘publicly available’ upon a satisfactory showing that such document has been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it.” *Bruckelmyer v. Ground Heaters, Inc.*, 445 F.3d 1374, 1378 (Fed. Cir. 2006). “Whether a reference is publicly accessible is determined on a case-by-case basis based on the ‘facts and circumstances

surrounding the reference’s disclosure to members of the public.”” *Voter Verified, Inc., v. Premier Election Solutions, Inc.*, 698 F.3d 1374, 1380 (Fed. Cir. 2012).

Indexing of a reference is not “a necessary condition for a reference to be publicly accessible,” but it is one among various factors that may bear on public accessibility. *In re Lister*, 583 F.3d 1307, 1311 (Fed. Cir. 2009). When present, indexing is a strong factor indicating sufficient accessibility for establishing a document such as a dissertation is prior art. *In re Hall*, 781 F.2d 897 (Fed. Cir. 1986) (holding that a dissertation indexed in a university library catalog was a publicly accessible printed publication). Similar written evidence tending to show that a technical article was published to interested members of the public can also be sufficient to establish a printed publication under 35 U.S.C. § 102(b). *See Robert Bosch LLC v. Orbital Australia Pty Ltd*, Case IPR2015-01258, slip op. at 11 (PTAB Dec. 30, 2015) (Paper 11) (cover sheet sufficiently indicated a technical article was available for purchase from a website at a date sufficient to qualify the article as a prior art printed publication).

A printed document qualifies as a “publication” under 35 U.S.C. § 102(b) if it can be located via a title keyword search—full text searchability is not required. *Lister*, 583 F.3d at 1315–16; *M & K Holdings, Inc. v. Samsung Elecs. Co.*, 985 F.3d 1376, 1382 (Fed. Cir. 2021) (concluding the Board did not error in finding that documents “effectively indexed by subject matter in light of the title-search

functionality” were printed publications *despite a lack of “full-content-search capacity” on the host website*).

A printed document also qualifies as a “publication” under 35 U.S.C. § 102(b), notwithstanding that accessibility thereto is restricted to a “part of the public,” so long as accessibility is sufficient “to raise a presumption that the public concerned with the art would know of [the invention].” *In re Bayer*, 568 F.2d 1357 at 1361 (CCPA 1978). Furthermore, it is immaterial whether prior art is available free of charge or must be purchased. *See, e.g., VidStream LLC v. Twitter, Inc.*, 981 F.3d 1060, 1066 (Fed. Cir. 2020) (citing availability of book for purchase on Amazon as evidence of public availability); *Kyocera Wireless Corp. v. Int’l Trade Comm’n*, 545 F.3d 1340, 1351 (Fed. Cir. 2008) (citing availability of book for sale as evidence of public availability). “When there is an established publisher there is a presumption of public accessibility as of the publication date.” *VidStream*, 981 F.3d at 1066 (citing *Giora George Angres, Ltd. v. Tinny Beauty & Figure, Inc.*, 116 F.3d 1497, No. 96-1507, 1997 WL 355479 at *7 (Fed. Cir. 1997)).

“If accessibility is proved, there is no requirement to show that particular members of the public actually received the information.” *Constant v. Advanced Micro-Devices, Inc.*, 848 F.2d 1560, 1569 (Fed. Cir. 1988).

2. Morris Declaration

The Declaration of LaTonya Morris (Ex-1037, “Morris Declaration”) confirms Wang-Dissertation (Ex-1005) was publicly available by March 4, 2003. *See generally*, Ex-1035, Ex-1037. Morris is an employee of ProQuest, “a commercial purveyor of technical articles such as doctoral dissertations and master’s theses.” *Oned Material LLC v. Nexeon Ltd.*, IPR2016-01528, Paper 10, 7 (PTAB Feb. 9, 2017). She has no stake or interest in the outcome of this proceeding. Ex-2004, 65:14-18.

While PO spends much of its Response disparaging Morris, ProQuest, and Petitioner over the fact that Morris submitted a supplemental declaration in this proceeding, it fails to acknowledge that the *unchanged and undisputed* facts establish that Wang-Dissertation was publicly available as of March 4, 2003.

Indeed, both Morris Declarations (Ex-1035 and Ex-1037) confirm that a Record of Wang-Dissertation, comprising the “abstract, index record, and citation information including title, author name, degree granting institution and degree date” was published in text-searchable format in ProQuest’s Digital Dissertations and Theses database (“PQDT”) on March 4, 2003. Ex-1035, 1-3; Ex-1037, 1-3; Ex-2004, 36:10-22, 47:22-48:12. At the time of its publication, the Record was indexed and became “available to the students, faculty, staff and/or patrons of any institutions

that subscribe to the Abstract Database.” Ex-2004, 48:19-49:5; Ex-1035, 1-3; Ex-1037, 1-3; Ex-1041, ¶17.

On cross-examination, Morris confirmed that Records include a text-searchable abstract that “matches verbatim what is in the document.”¹ Ex-2004, 51:1-8, 51:22-52:2, 64:17-21; Ex-1041, ¶14. Morris also confirmed that as of March 4, 2003, “there [was] the opportunity for anyone finding [the Wang-Dissertation Record] to purchase² a copy of the full text dissertation or theses.” Ex-2004, 41:11-42:8; *see also* 44:7-19 (“anyone wanting to purchase that document could do so as of the date of publication which was March 2003.”). Morris further described how a POSITA might have purchased the complete Wang-Dissertation in 2003, and confirmed the process in 2003 is the same as today (*id.*, 45:17-46:3):

If someone wished to purchase a dissertation in 2003, they could do so in multiple ways. They could obtain one of our order forms and submit

¹ To the extent there were, as of March 4, 2003, any differences between the Wang-Dissertation abstract and that published on ProQuest, those differences can be explained by ProQuest’s requirement that abstracts not exceed 350 words. *See* Ex-1041, ¶22. A comparison between the abstract included in Ex-2010 (accessed in January 2025) and Wang-Dissertation abstract is shown at Ex-1041, Ex. I. There are no differences between these abstracts material to searchability. Ex-1041, ¶23.

² Contrary to PO’s assertions, Petitioner is not relying on the fact that Wang-Dissertation was “on-sale” as of March 4, 2002. *See* POR, 12-13.

it to us by sending it to dispub@proquest.com, or they can send us an e-mail directly and request assistance with ordering it, or they could call our 800 number to place an order over the phone with a credit card, or they could go to the website, PQDT, and within that database search for this title and click on a button in that site that says “order a copy.”

Ex-2004, 46:12-47:4; *see also id.*, 62:3-8 (confirming that “ProQuest had online credit card transaction capability” in 2003). Morris based her testimony on her “knowledge and...hands-on experience” with ProQuest’s sales procedures, as well as her familiarity with ProQuest’s sales records. *Id.*, 61:1-19. These facts alone establish that Wang-Dissertation was publicly available as of March 4, 2003.

PO makes a series of irrelevant and flawed arguments regarding Ms. Morris’s credibility.³ PO first argues that Morris is unreliable because she submitted a supplemental declaration to correct a copy-paste error. *See* POR (Paper 19), 7-10; *see also* Ex-2004, 23:12-24:7. The first Morris Declaration states the full text of Wang-Dissertation was loaded into PQDT on March 4, 2003, the same date the Record published. Ex-1035, 3. During her deposition preparation, Morris discovered that this date was incorrect, and the full text of Wang-Dissertation was not loaded

³ To the extent PO is seeking to strike Morris’s declaration(s) (*see* POR at 12 (“The entire doctored Declaration should be thrown out”)), PO’s request should be denied at least because PO (a) failed to timely object and (b) has not sought permission to move to strike.

into PQDT until September 6, 2010. Ex-2004, 23:12-24:7, 31:12-32:4. Morris promptly submitted a supplemental declaration to correct this error. Ex-1037. If anything, the fact that Morris double-checked her work and then, upon realizing her error, corrected her prior declaration speaks to her credibility and truthfulness.

To be clear, Petitioner is not relying on the date the full text was loaded into PQDT to establish Wang-Dissertation was publicly available by March 4, 2003. As discussed above, it is enough that an interested person could locate—via ProQuest’s Record index search—and access Wang-Dissertation (either directly on ProQuest’s website or by ordering a full copy of the dissertation) on March 4, 2003. Full text searchability is not required under the law. *Lister*, 583 F.3d at 1315-16; *M & K Holdings*, 985 F.3d at 1382.

PO next argues that Morris is unreliable because certain portions of her declaration and testimony are not based on personal knowledge. *See* POR, 9-12, 17-20. For example, PO notes that Morris did not personally write her entire declaration. POR, 9. However, Morris testified that she has provided similar declarations for other ProQuest customers, each of which follow the same format, and relied “on the historical context that [ProQuest’s] legal team and employees are privy to or taught when [they] join the company.” Ex-2004, 34:20-22. As another example, PO notes that Morris herself did not make several changes (none of which Petitioner relies on) to paragraphs 8, 9, 12, and 14 of her declaration (Ex-1037). *See* POR, 10-11.

Consistent with ProQuest’s practices, these changes were made by ProQuest’s legal department (whom PO did not seek to depose), were approved by Morris prior to her signing, and are each consistent with the change Morris did provide—the change in full text availability date. Ex-2004, 32:11-15. PO is also incorrect that Morris was unaware of the contents of her declaration until her deposition—Morris declared that the contents of her declaration were “true and correct” at the time of signing, meaning she had to have reviewed the contents prior.

PO finally argues that Morris is unreliable because she did not testify in her personal capacity, but PO is incorrect.⁴ As the Board correctly recognized, Morris “formed an opinion based on her expertise in library management systems” (ID (Paper 8, 15)), and “the Morris Declaration states that Ms. Morris is testifying as a corporate representative of ProQuest, to describe ProQuest’s business practices relating to how it receives and publishes documents.” *Id.*, 16. Indeed, Morris confirmed she understood that she was testifying “on behalf of [ProQuest]” and based her testimony on her professional training and job responsibilities. *See, e.g.*, Ex-2004, 22:6-11; *see also* ID, 16.

⁴ PO chose to subpoena Morris in her personal capacity rather than ProQuest. *See* Ex-2002. Morris was therefore under no obligation to testify on behalf of ProQuest.

3. The Hsieh-Yee Declaration Corroborates Morris' Testimony

Ex-1045 is a copy of “About ProQuest Digital Dissertations” from August 15, 2000. Ex-1041, ¶14. Dr. Hsieh-Yee states that—based on her personal experience and evidence of record—since 2000 ProQuest users affiliated with an institutional subscriber (such as a research institution or university) have been able to search for and immediately preview full dissertations online. *Id.*, ¶15; Ex-1046. This confirms that the entirety of Wang-Dissertation was available for institutional subscribers as of March 4, 2003. Moreover, ProQuest users not affiliated with an institutional subscriber could freely “access the most current two years of citations and abstracts in the Dissertation Abstracts database” (*see* Ex-1041, Ex. C) in searchable format and would simply pay to access beyond page 24 of a dissertation. *Id.*

4. Wang-Dissertation is § 102(a) Prior Art

PO is also incorrect that Wang-Dissertation is not available as § 102(a) prior art. *See* PO Preliminary Response (“POPR,” Paper 7), 3. As Dr. Hsieh-Yee confirms, an OCLC FirstSearch record for Wang-Dissertation was entered into the WorldCat database on March 10, 2003. Ex-1041, ¶1-5 (describing OCLC WorldCat database of MARC records), ¶6-12. Therefore, the Wang-Dissertation was “publicly discoverable to the UIUC community, to subscribers of OCLC FirstSearch, and to the general public who have free access to WorldCat.org, the free web portal” as of March 10, 2003, which is prior to the March 5, 2004, provisional filing date to which

the '684 Patent claims priority. *Id.*, ¶12. While PO previously alleged Ex-2001 could demonstrate invention prior to this date (*see* POPR, 3), PO waived this argument by failing to raise it after institution. *In re Nuvasive, Inc.*, 842 F.3d 1376, 1380 (Fed. Cir. 2016).

V. The Prior Art Anticipates or Renders Obvious the Challenged Claims

A. Ground 1 – Claims 1-22 Are Anticipated by Wang-Dissertation

PO criticizes Wang-Dissertation by alleging (a) that Wang's experimental data (Chapter 3) does not mirror her theoretical analysis (Chapter 2), and (b) that Wang failed to perform experiments using the setup disclosed as a "Future Work." Both critiques are irrelevant. The Wang-Dissertation discloses each element of Claims 1-22.

1. Independent Claims 1 and 13

PO first argues that Wang-Dissertation does not disclose a "glass element" "disposed on the second side of the substrate and axially spaced along the first axis." POR, 24. PO is incorrect. Wang-Dissertation's "Future Work" discloses inserting an extra layer of desired substrate between the existing fused silica layer (the "glass element") and thin film, resulting in a glass element-substrate-thin film arrangement, as claimed. Ex-1005, 124.

PO next argues that Wang-Dissertation does not disclose a "glass element" that is "configured to propagate and modify a stress wave to the coating/substrate

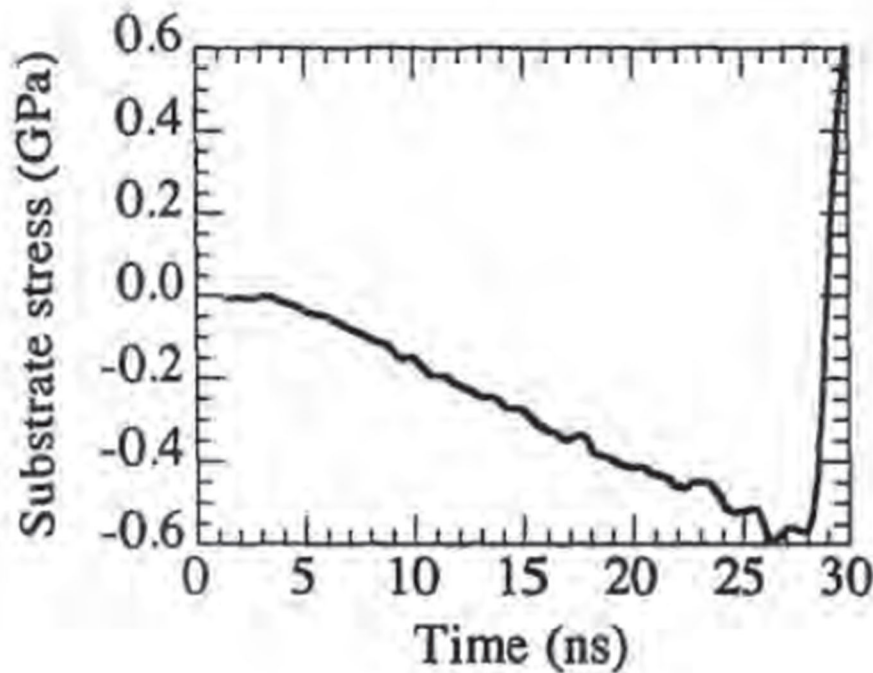
interface to generate a tensile stress between the substate and the coating.” Ex-1001, 20-21. PO is incorrect.

Wang-Dissertation’s glass element is fused silica. There is no dispute that fused silica is a “glass.” *See* Ex-1039, 85:15-86:4, 87:8-16. There is also no dispute that Wang-Dissertation teaches that fused silica, due to its nonlinear elasticity, “helps to develop a shock in the substrate” (modify a stress wave), “enhances film loading at the film interface,” and can “apply sufficient stress [] at the interface in order to initiate interface failure” of the film at the substrate interface. *See* POR at 22; *see also id.*, 39, 41.

PO, however, argues that Wang’s *experimental* evidence does not show (a) modification of compression-wave-1 by the fused silica and (b) propagation of compression-wave-1 to the substrate interface, and thus Wang-Dissertation does not disclose the claimed “glass element.”

As an initial matter, PO’s suggestion that Wang need have performed her “Future Work” is contrary to the law. *See, e.g., Bristol-Myers Squibb Co. v. Ben Venue Laboratories, Inc.*, 246 F.3d 1368, 1379, 58 U.S.P.Q.2d 1508 (Fed. Cir. 2001). Regardless, Wang-Dissertation’s experimental evidence *does* show that fused

silica modifies a stress wave.⁵ As shown in Fig. 3.15c, the fused silica stress wave is modified to a long linear ramp of ~26 ns in length, and a sharp decompression shock (or pressure drop from 0.6 GPa to 0 GPa) of only a couple nanoseconds.⁶

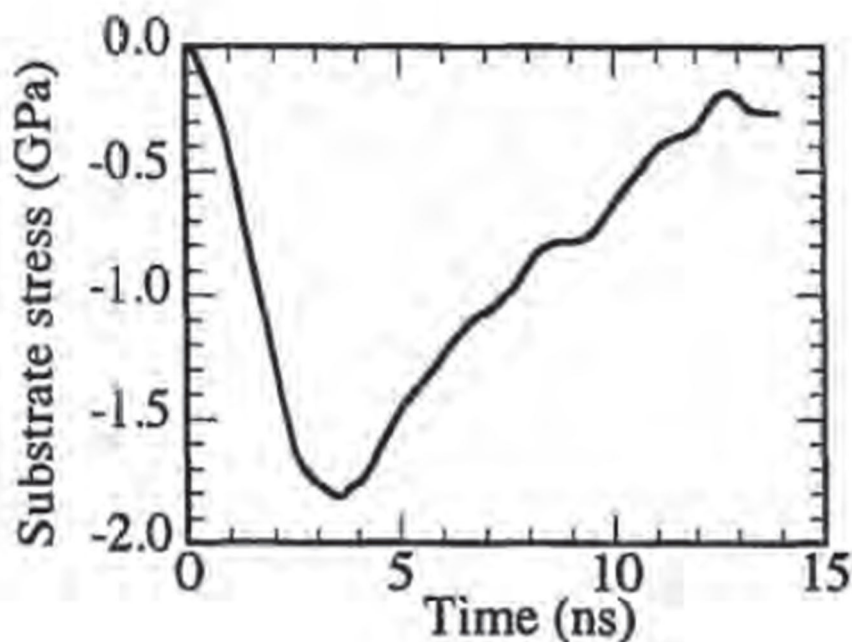


Ex-1005, Fig. 3.15(c); *see also* Ex-2009, 90:4-12 (“That experimental data shows and also clear, clearly indicates it’s a shock.”).

⁵ PO claims that Ex-2009, ¶¶182-192 evidence that Dr. Gupta performed experiments similar to those disclosed in Wang-Dissertation’s “Future-Work,” but Ex-2009 does not include those numbered paragraphs.

⁶ The existence of a tensile peak following a decompression shock does not change the fact that there is a decompression shock, i.e., a sudden drop of pressure. Ex-1038, ¶2.

This is confirmed by comparing this fused silica stress wave profile to a silicon stress wave profile, which has a rise time around 3 nanoseconds and long post-peak decay of ~12 nanoseconds.



Ex-1005, Fig. 3.14(c); *see also* Ex-2009, 90:17-91:8.

This comparison, as well as the referenced Barker paper (Ex-1021) and PO's (and its expert's) own admissions, confirms that fused silica modifies a stress wave. *See* Ex-1016, 78, 82 (citing Ex-1021); POR, 41-42; Ex-2011, ¶95; Ex-1039, 121:3-125:1 (Gupta declining to say that "fused silica" can never modify and propagate a stress wave).

Wang-Dissertation's experimental evidence also shows that fused silica propagates the modified stress wave to the substrate/film interface.⁷ Wang-Dissertation's experimental signals were measured on the free surface after the stress wave traveled all the way from the absorbing layer, through the substrate, to the film. Ex-1038, ¶4. It is therefore illogical to suggest the stress wave failed to reach the interface—had it not, there would be no signal to measure. *Id.*, ¶4. It is also illogical to suggest that compression-wave-2 would have time to travel through the constraining layer, reflect from the free surface, then travel as tension-wave-1 through the substrate before compression-wave-1 reached the interface. *Id.*, ¶5. Indeed, Wang-Dissertation conclusively shows that the reflected tensile stress from compression-wave-1 will reach the interface well before the tensile tail of tension-wave-1 arrives at the interface:

$$\frac{2h}{c} = \frac{2 * 1\mu m}{6400 \frac{m}{s}} = 0.3 ns$$

Id., ¶5.

⁷ As Dr. Wang testified, Dr. Gupta's prior experiments were run at too low a resolution to detect the shock generated in fused quartz. Ex-2009, 187:9-17 (discussing Gupta-1992 (Ex-1011)).

It is for this very reason that Wang-Dissertation's compression-wave-1 is responsible for "separating the coating from the substrate as a result of the stress wave-generated tensile force" as recited in claim 13.

To the extent the modified wave experiences any attenuation, a POSITA would have known how to counter the effects of attenuation by optimizing the laser power. Ex-1038, ¶6. For example, a POSITA would have understood that the reason the stress profiles depicted in the '684 Patent (Ex-1001) have a higher stress amplitude than those depicted in Wang-Dissertation (Ex-1005) is due to the higher power pulse laser (pulse energy of 3-8J vs. 100mJ in Wang-Dissertation). *Id.*, ¶6. A POSITA would also have known how to counter the effects of attenuation by optimizing the substrate thickness. *Id.*, ¶6; Ex-1005, 69-70; POR, 69. For example, decreasing substrate thickness was known to mitigate the alleged attenuation described at POR, 27-28.⁸ *Id.*, ¶6. A POSTIA would have also known how to vary confining layer thickness to counter the effects of attenuation. *Id.*, ¶6.

Additionally, fused silica is a "similar material" because it is both chemically and physically similar to the glass elements listed in the '684 Patent. Ex-1001, 3:18-20. Like quartz, fused silica has a chemical composition of SiO₂. Ex-1038, ¶7. And,

⁸ While Dr. Gupta claims to have calculated attenuation, he failed to disclose his methodology, and accordingly his opinion regarding this point should not be credited. *See* 37 C.F.R. § 42.65(a).

like Pyrex, Soda lime and borosilicate, fused silica is a non-crystalline arrangement. *Id.*, ¶8. Fused silica propagates and modifies a stress wave just like the other materials listed in the specification. *Id.*, ¶9.

To the extent PO argues that Dr. Wang’s subsequent publications—including Wang-2009 (Ex-1056)—contradict or are inconsistent with the fact that Wang-Dissertation discloses the claimed “glass element,” PO is incorrect. In fact, Wang-2009 only further confirms that Wang-Dissertation discloses a fused silica “glass element.”

Wang-2009 discloses an experimental setup comprising a Nd:YAG laser, waterglass confining layer, aluminum energy absorbing layer, an optional fused silica glass element, tungsten substrate, and tungsten test film:

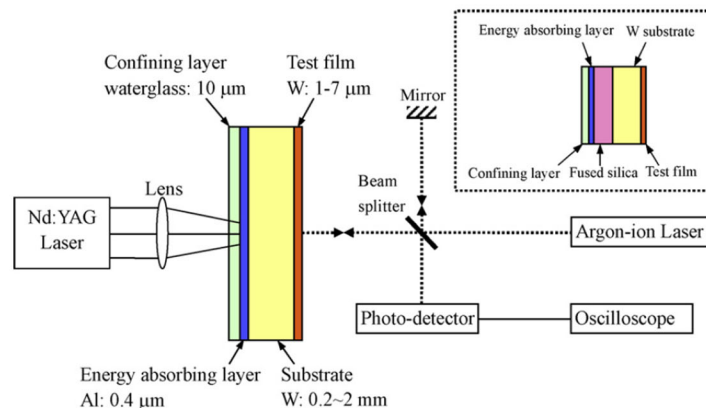


Fig. 1. Schematic of the experimental setup and sample configuration. The inset shows an alternative sample configuration for inducing shock wave loading using fused silica as pulse-shaping material.

Ex-1056, 74. Both Wang-2009 and Dr. Gupta confirm this experimental setup mirrors those taught by Wang-Dissertation. *Compare* Ex-1005, Fig. 2.1, 124 with Ex-1056, 74.

Figure 3 of Wang-2009 shows the substrate stress profiles of non-modified waves generated in the absence of a fused silica glass element positioned between the energy absorbing layer and tungsten substrate:

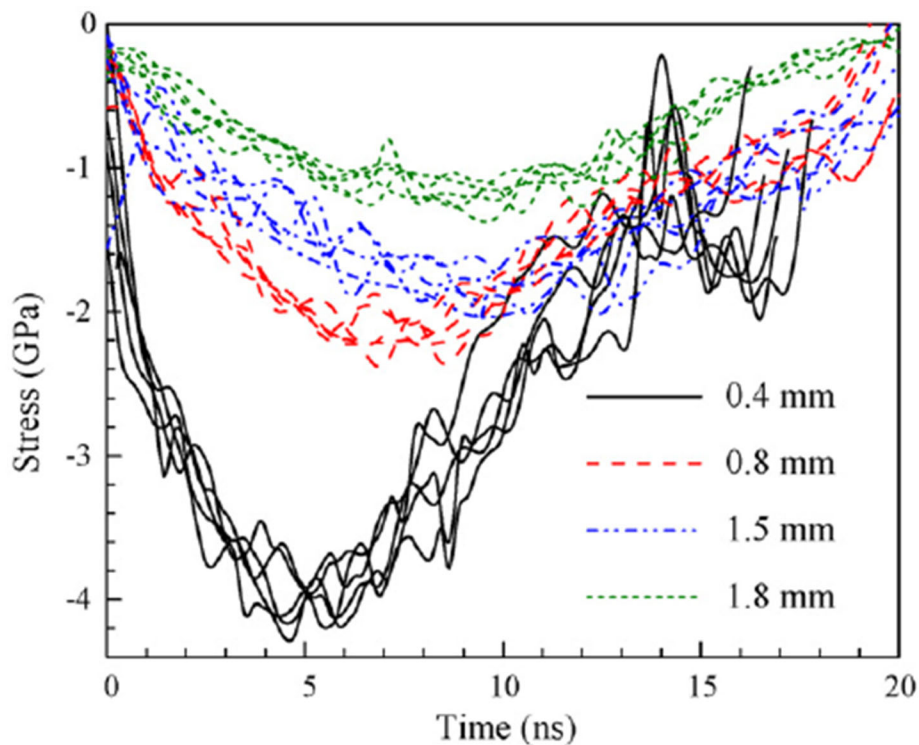


Fig. 3. Substrate stress profiles in W substrates with different thicknesses: 0.4, 0.8, 1.5 and 1.8 mm due to Gaussian wave loading.

Ex-1056, 75; Ex-1038, ¶12.

Figure 5 of Wang-2009 shows the substrate stress profiles of modified waves generated by a fused silica glass element positioned between the energy absorbing layer and tungsten substrate:

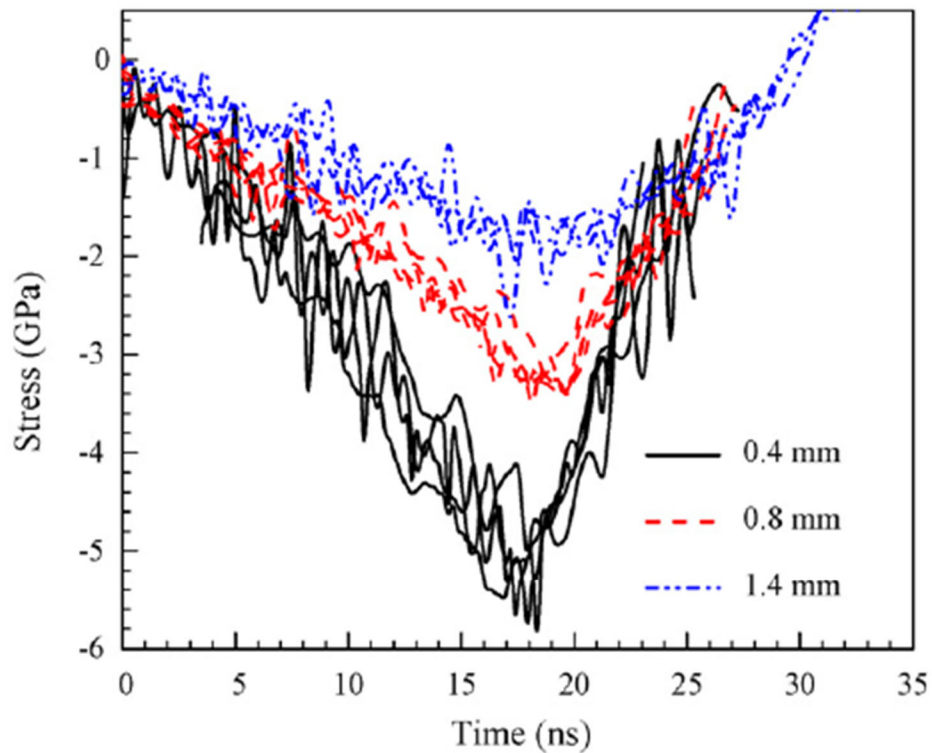


Fig. 5. Substrate stress profiles obtained on W substrate of different thicknesses: 0.4, 0.8 and 1.4 mm due to shock wave loading.

Ex-1056, 76; Ex-1038, ¶13. As can be seen by comparing Figures 3 and 5, above, the fused silica glass element modifies the Gaussian stress of a few nanoseconds to a ramp load of ~18 ns. *Id.*, ¶¶12-14. The unloading portion of the wave has been compressed from ~15 ns to about 10 ns. *Id.*, ¶14.

Wang-2009 further confirms that in Figure 5 a “500µm thick fused silica plate was used to evolve the originally generated Gaussian stress wave at the energy absorbing layer into a shock wave,” and that “a 500µm thick fused silica is expected to be thick enough to generate a shock wave while maintaining the stress wave attenuation.” *Id.*, 76.

Therefore, just like the experimental evidence discussed in Wang-Dissertation, the experimental evidence discussed in Wang-2009 confirms that fused silica modifies and propagates a stress wave to the test film interface.

2. Claims 7 and 18

Wang-Dissertation's "Future Work" discloses a configuration comprising a layer of fused silica ("glass element"), the desired substrate that is inserted between the fused silica and thin film ("substrate"), and test film, wherein the fused silica is bonded to the substrate. Ex-1003, ¶123.

3. Claims 8 and 19

As discussed above (*supra* §V.A.1), Wang-Dissertation discloses a fused silica glass element. Fused silica is chemically identical to quartz, and a POSITA would have understood that "quartz" is a type of "silica glass." Ex-1038, ¶7; Ex-1039, 84:2-10, 87:3-16; POR, 52.

4. Claim 10

Fused silica, or SiO₂, comprises the silicon element. Ex-1038, ¶7; Ex-1039, 85:15-86:4. Therefore, Wang-Dissertation discloses this claim element. *Supra* §V.A.1.

5. Claims 11 and 21

Wang-Dissertation discloses a confining layer of waterglass (“a constraining element”) disposed adjacent to the fused silica glass element. *See* Ex-1005, 44-45; *see also id.*, 124 (disclosing using an additional substrate layer).

6. Claims 12 and 22

As discussed above, *supra* §V.A.1, Wang-Dissertation’s “Future Work” section discloses inserting an extra layer of desired substrate between the existing fused silica layer (the “glass element”) and thin film, resulting in a glass element-substrate-thin film arrangement, as claimed. Ex-1005, 124. The layer of fused silica through which the wave first travels (the layer in contact with the energy-absorbing layer) acts as the “glass element.” Ex-1003, ¶130.

7. Claims 2-5, 8-9, 14-16, 20

PO does not appear to dispute the patentability of these claims beyond arguing Wang-Dissertation does not disclose the claimed “glass element.” *See* POR, 47-50. As discussed above (*supra* §V.A.1), Wang-Dissertation discloses a fused silica glass element.

B. Ground 2 – Wang-Dissertation Renders Obvious Claims 4, 6, 9, 15, 17, 20, 23-24

PO does not appear to dispute that Wang-Dissertation renders obvious the additional limitations of these claims. This is not surprising, as Wang-Dissertation discloses specific points within the ranges of these dependent claims. *See* Pet., 27-

30, 33-35, 37-38. Furthermore, a POSITA would have been motivated and able to modify the coating and substrate thickness, as well as laser energy and confining layer thickness, with a reasonable expectation of success. Ex-1038, ¶6.

C. Ground 3 – Wang-Dissertation in View of Gupta-1992⁹ Renders Obvious Claims 1-24

PO argues that a POSITA would not have been motivated to combine Wang-Dissertation and Gupta-1992, and that Gupta-1992 does not disclose a glass element. PO is wrong on both fronts.

First, PO concedes that Wang-Dissertation and Gupta-1992 include similar disclosures. POR, 2. Dr. Gupta also concedes that academics like Wang followed his work and would have been motivated to build upon it. Ex-1039, 14:16-15:15. 16:10-17:3. A POSITA would thus have been motivated to combine these references and had a reasonable expectation of doing so. Ex-1038, ¶10.

Second, much like Wang-Dissertation’s fused silica, Gupta-1992’s fused quartz is a “glass element” for the reasons stated above. *See supra* §V.A.1; Ex-1039, 85:15-17 (confirming “fused quartz” and “fused silica” are the same).

PO does not separately dispute that Ground 3 renders obvious the additional limitations of the dependent claims challenged in this ground. POR, 66.

⁹ PO (correctly) does not claim that Gupta-1992 itself was before the USPTO examiner. POR, 51.

D. Ground 4 – Claims 1-8, 10-19, 21-22 Are Anticipated by Gupta-1992¹⁰

PO's complaint that Gupta-1992 is cumulative of Wang-Dissertation (POR, 2), only supports Ground 4. Petitioner does not disagree because both Gupta-1992 and Wang-Dissertation disclose the claimed glass element-substrate-test film arrangement. *See* Ex-1011, Fig. 2; *see also* Ex-1005, 124. The main "difference" between the two is Wang-Dissertation's disclosure of a fused silica glass element verses Gupta-1992's disclosure of a fused quartz glass element. And as PO admits, "fused quartz and fused silica are identical materials as far as wave propagation is concerned." POR, 52. Fused quartz is therefore a glass element as claimed, for the same reasons discussed above regarding fused silica. *Supra* §§V.A.1-7. Thus, Grounds 1 and 4 similarly show the invalidity of these claims.

E. Ground 5 – Gupta-1992 in View of Gupta-1993 Renders Obvious Claim 9 and 20

PO does not appear to dispute that Ground 5 renders obvious the additional limitations of these dependent claims. POR, 67. Instead, PO again argues that Gupta-1992 does not disclose a "glass element." *Id.* As discussed above, PO is incorrect. *Supra* §§V.A.1-7.

¹⁰ PO does not separately dispute the unpatentability of the dependent claims. POR, 58-60. To the extent PO later does so, Petitioner incorporates its arguments for Ground 1, and PO is therefore wrong.

F. Ground 6 – Gupta-1992 Renders Obvious Claims 4, 6, 10, 15, 17, 23-24

As discussed *supra*, PO states that Gupta-1992 is cumulative of Wang-Dissertation. POR, 2, 67. Thus, Gupta-1992 discloses a glass element and renders these claims obvious for the reasons stated above just as in Ground 1. *Supra* §§V.A.1-7.

PO does not dispute that Ground 6 renders obvious the additional limitations of dependent claims 4, 6, 10, 15, 17, 23-24 beyond (incorrectly) arguing that Gupta-1992 does not disclose the claimed glass element. POR, 68-70; *see also supra* §§V.A.1-7 (quartz, SiO₂, comprises silicon).

G. Ground 7 – Wang-2002 in View of Gupta-1992 Renders Obvious Claims 1-24

PO does not appear to separately dispute that Ground 7 renders obvious the Challenged Claims, instead incorporating its arguments regarding Wang-Dissertation, alleging that “Wang-2002 is completely cumulative of the Wang-Dissertation.” POR, 71. Thus, Ground 7 similarly render the Challenged Claims obvious for the reasons discussed above regarding Ground 1 and 3. *Supra* §§V.A and V.C.

VI. CONCLUSION

For the reasons given above, in the Petition, and in the Board’s Institution Decision, the Challenged Claims should be found unpatentable.

Dated: April 28, 2025

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CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that the foregoing Petitioner's Reply contains, as measured by the word processing system used to prepare this paper, **X,XXX** words. This word count does not include the items excluded by 37 C.F.R. § 42.24 as not counting towards the word limit.

Dated: April 28, 2025

Respectfully submitted,

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of this **PETITIONER'S
REPLY TO PATENT OWNER'S RESPONSE** and supporting exhibits has been
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