

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.

IPR2024-00761
Patent 7,487,684 B2

Before JENNIFER S. BISK, JOHN A. HUDALLA, and
DONALD E. DAYBELL, *Administrative Patent Judges*.

DAYBELL, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

The Boeing Company (“Petitioner”) filed a Petition requesting *inter partes* review of claims 1–24 (“challenged claims”) of U.S. Patent No. 7,487,684 B2 (Ex. 1001, “the ’684 Patent”) pursuant to 35 U.S.C. §§ 311–

319. Paper 1 (“Pet.”).¹ The Regents of the University of California (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”).

We have authority under 35 U.S.C. § 314 and 37 C.F.R. § 42.4 to determine whether to institute review. Upon consideration of the arguments and evidence before us, we conclude that Petitioner has shown a reasonable likelihood that it would prevail in establishing unpatentability of at least one challenged claim of the ’684 Patent.

The Petition is *granted*, and *inter partes* review is instituted. A scheduling order will follow this decision.

A. Real Parties in Interest

Petitioner identifies itself (The Boeing Company) as real party in interest. Pet. 1. Patent Owner identifies itself (The Regents of the University of California) and Laser Spallation Technologies, LLC as real parties in interest. Paper 4, 2 (Mandatory Notices).

B. Related Matters

Each party identifies the following related matters:

Laser Spallation Technologies, LLC v. The Boeing Company, No. 2:23-cv-02294 (C.D. Cal.) (“the underlying litigation”). Pet. 1; Paper 4, 2 (Mandatory Notices). The underlying litigation has been stayed pending the outcome of this proceeding. *Laser Spallation Technologies, LLC v. The Boeing Company*, No. 2:23-cv-02294, Dkt. No. 136 (C.D. Cal. May 22, 2024).

¹ Petitioner does not challenge claims 25–36 in this proceeding.

C. The '684 Patent²

The '684 Patent is directed to an apparatus for generating tensile stress between a thin-film substrate and a thin-film coating on that substrate. Ex. 1001, 1:47–53. An objective of the invention is to generate shock waves in a thin-film assembly, sufficient to cause coating separation, and then measure the tensile stress caused by those shock waves, to determine the strength of the substrate-coating bond. *Id.* at 2:1–15, 46–48. An illustrative embodiment of this apparatus is depicted in Figure 4 reproduced below.

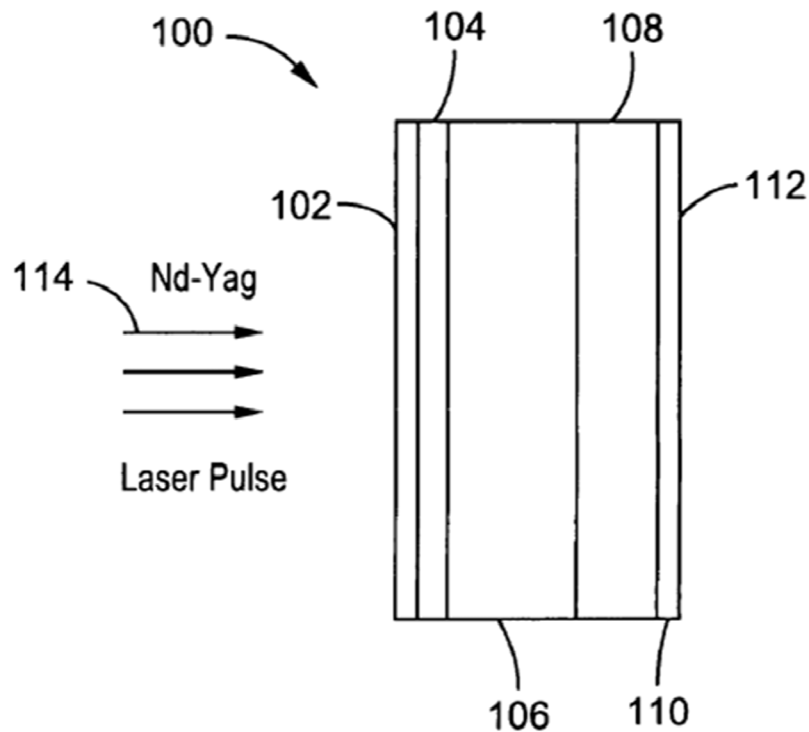


FIG. 4

² The '684 Patent issued from Application No. 11/504,981, filed Aug. 15, 2006, which is a continuation of Application No. PCT/US2005/007304, filed Mar. 7, 2005. Ex. 1001, codes (21), (22), (63). The '684 Patent also claims the benefit of priority to Provisional Patent Application No. 60/550,803, filed Mar. 5, 2004. *Id.* at code (60).

Figure 4 depicts the layers of a thin-film sample assembly used in accordance with the invention disclosed in the '684 Patent. Ex. 1001, 4:60–61, Fig. 4. These layers include a constraining element 102, an energy absorbing layer 104, a glass substrate element 106, a silicon substrate element 108, and a coating 110. *Id.* at 8:52–58. In operation, a laser pulse 114 is applied to the constraining element 102. *Id.* at 8:59–61. This pulse propagates through the other layers of the sample assembly. *Id.* at 8:61–67.

As the laser pulse impacts the energy absorbing layer 104, that layer absorbs some of the laser energy and heats up. *Id.* This heating effect causes the energy absorbing layer to expand, which generates a shock wave that propagates through the glass substrate and the silicon substrate, and into the coating. *Id.* When the shock wave impacts the coating, it can cause the coating to separate from the silicon substrate. *Id.* at 7:36–40. The tensile stress created by the shock wave is measured, to determine how strong the bond was between the substrate and the coating. *Id.* at 9:17–29.

In order to increase the utility of the apparatus, it is desirable to use a configuration of layers in the sample assembly which has the effect of modifying the stress wave generated by the expansion of the energy-absorbing layer, such that this stress wave at the interface between the silicon substrate and the coating exhibits a very rapid drop in intensity from the peak stress level. *Id.* at 8:42–51, 9:38–44. According to the teachings of the '684 Patent, inserting a glass element, such as Pyrex, soda lime, quartz, or borosilicate glass, between the energy-absorbing layer and the silicon substrate layer modifies the stress wave to generate a “virtually

instantaneously” dropping peak stress level, creating a desirable “rarefaction shock.”³ *Id.* at 9:30–44.

D. Illustrative Claim

Claim 1 is independent and reproduced below.⁴

[1.pre] An apparatus for generating a tensile stress between a substrate and a coating:

[1.a] a substrate having a thickness, said thickness defined by a first side and a second side in a first axis;

[1.b] a coating applied to the first side of the substrate such that the coating and substrate are axially spaced along the first axis in intimate facing contact with each other such to form a coating/substrate interface; and

[1.c] a glass element disposed on the second side of the substrate and axially spaced along the first axis;

[1.d] wherein the glass element is configured to propagate and modify a stress wave to the coating/substrate interface to generate a tensile stress between the substrate and the coating.

Claim 13 is a method claim covering similar subject matter as claim 1.

Petitioner largely relies on the same teachings and arguments as claim 1 for its positions on claim 13. *Compare* Pet. 20–26, *with id.* at 31–33. Patent Owner likewise addresses claims 1 and 13 together. Prelim. Resp. 26, 48–49, 57, 69–70.

³ A “rarefaction shock” is created by a stress wave that has a linear ramp followed by a weak shock that has a fast fall time. Ex. 1001, 8:45–49, 9:38–41; Ex. 1003 ¶ 57.

⁴ The headings with bracketed letters identifying each of the claim elements correspond to those used by Petitioner to reference the claim elements. *See* Pet. 20–26, 31–33. We use them here for ease of reference, understanding, and consistency.

E. Evidence relied on by Petitioner

Petitioner relies on the following references.

Name	Reference	Exhibit
Wang	Wang J., Ph.D. Dissertation at University of Illinois at Urbana-Champaign, “Thin-Film Adhesion Measurement by Laser-Induced Stress Wave” (“Wang-Dissertation” or “Wang”)	1005
Gupta-1992	Gupta, V., Argon, A., Parks, D., and Cornie, J., “Measurement of Interface Strength by a Laser Spallation Technique,” J. Mech. Phys. Solids, 40(1), pp. 141–80, 1992 (“Gupta-1992”)	1011
Gupta-1993	Yuan, J., Gupta, V., Pronin, A., “Measurement of Interface Strength by the Modified Laser Spallation Technique. III. Experimental Optimization of the Stress Pulse,” J. Appl. Phys., 74(4), pp. 2405–10, 1993 (“Gupta-1993”)	1013
Wang-2002	Wang, J., Weaver, R. L., and Sottos, N. R., “A Parametric Study of Laser Induced Thin Film Spallation,” Exp. Mech., 42(1), pp. 74–83, 2002 (“Wang-2002”)	1016

Petitioner also relies on the Declaration of Junlan Wang, Ph.D. (“Wang Declaration”) (Ex. 1003).

F. Asserted Grounds

Petitioner asserts that claims 1–24 are unpatentable on the following grounds:

Ground	Claims Challenged	35 U.S.C. § ⁵	Reference(s)/Basis
1	1–22	102(b)	Wang
2	4, 6, 9, 15, 17, 20, 23, 24	103(a)	Wang
3	1–24	103(a)	Wang, Gupta-1992
4	1–8, 10–19, 21, 22	102(b)	Gupta-1992
5	9, 20	103(a)	Gupta-1992, Gupta-1993
6	4, 6, 10, 15, 17, 23, 24	103(a)	Gupta-1992
7	1–24	103(a)	Wang-2002, Gupta-1992

II. ANALYSIS

Petitioner bears the burden to demonstrate unpatentability, and that burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

A. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art (“POSITA”) as of the time of the invention of the ’684 Patent “would have had an M.S. in Mechanical Engineering or a related field, and at least five years of experience using laser systems to characterize and test mechanical behavior in materials.” Pet. 5. Patent Owner “generally agrees” with this definition. Prelim. Resp. 26. At this juncture, we adopt Petitioner’s definition. This definition appears to be consistent with what is reflected by the content of the applied prior art references. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350,

⁵ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103. Because the ’684 Patent was filed before March 16, 2013 (the effective date of the relevant amendments), the pre-AIA versions of §§ 102 and 103 apply.

1354–55 (Fed. Cir. 2001) (the applied prior art may reflect an appropriate level of skill).

B. Claim Construction

We use “the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b) (2023). We apply the claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

Claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and extrinsic evidence including declarant and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Phillips*, 415 F.3d at 1312–17. Usually, the specification is dispositive, and “it is the single best guide to the meaning of a disputed term.” *Id.* at 1315.

The specification may reveal a special definition given to a claim term by the patentee, or the specification or prosecution history may reveal an intentional disclaimer or disavowal of claim scope by the inventor. *Id.* at 1316. If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa’ per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). A disavowal of claim scope, if any, can be

effectuated by language in the specification or the prosecution history. *Poly-America, L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016).

Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019). Neither Petitioner nor Patent Owner identifies any terms it contends require construction. On this record, we determine that no terms need be construed in order for us to render a decision on institution.

C. Ground 1: Anticipation by Wang

1. Wang

Wang is a dissertation authored by Petitioner's declarant, Dr. Junlan Wang. Ex. 1005.⁶ Petitioner avers that Wang was publicly available as of March 4, 2003. Pet. 13 (citing Ex. 1006 ¶¶ 27–34). We discuss the public availability issue in further detail below.

Wang discusses tensile laser spallation techniques, used to measure thin-film adhesion. *See, e.g.*, Ex. 1005, Abstract. Wang teaches a layered structure used to test thin film–substrate interfaces and measure the strength of the bonds between those layers. *Id.* at 7. Such a structure is shown in Figure 2.1 of Wang, as shown below:

⁶ Petitioner added its own page numbers to the margin of each page in Exhibit 1005. However, both Petitioner and Patent Owner cite to Exhibit 1005 using its own internal pagination. *See, e.g.*, Pet. 15 (quoting Ex. 1005, 65) (internal pagination); Prelim. Resp. 3 (quoting Ex. 1005, 124) (internal pagination). We follow the same convention where Wang's pages contain internal pagination, and cite to the added page numbers where needed.

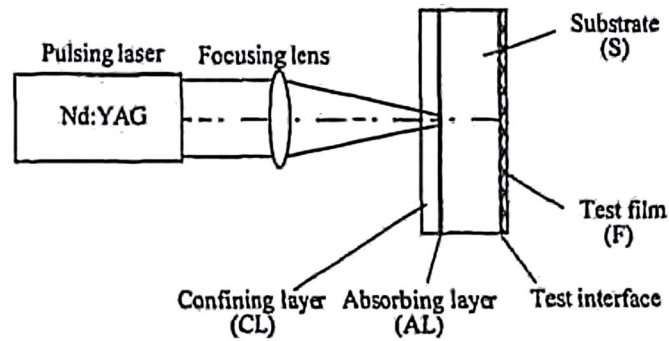


Figure 2.1: Schematic of the tensile laser-spallation technique.

In Figure 2.1, a pulsing laser directs a beam through a focusing lens. *Id.* at Fig. 2.1. The laser beam is directed at a test structure. *Id.* The test structure is made up of a confining layer (CL), an absorbing layer (AL), a substrate (S), and a test film (F). *Id.* In operation, the laser pulse passes through the confining layer and impacts the absorbing layer. *Id.* at 3. This impact rapidly heats the absorbing layer, as it absorbs the laser energy. *Id.* That causes the absorbing layer to expand and generate a stress wave. *Id.* This wave passes through the substrate and impacts the test film. *Id.* The stress wave rebounds off of the substrate/test film boundary, which causes a shock that pushes against the test film. *Id.* If the shock is large enough, this causes the test film to spallate (i.e., separate from the substrate.) *Id.*

Wang further discloses that the structure used in Wang results in “[a]n initial fall time of a few nanoseconds” for a shock wave propagated through the layers of the structure being “reduced to near zero” by the time “the pulse arrives at the test film.” *Id.* at 65. This “decompression shock” is recognized by Wang as “especially beneficial for tensile thin film tests, where the optimal compressive pulse ought to have a rapid fall time.” *Id.* at 65–66, 81.

In a section titled “Future Work,” Wang further discloses that the substrate (S) used for “launching high-amplitude shock waves” is ideally

formed out of “fused silica,” because fused silica’s “negative non-linear elasticity” was recognized as “critical for the development of a decompression shock.” Ex. 1005, 124. Finally, in the same section Wang observed that “[b]y inserting an extra layer of the desired substrate material between the fused silica and the thin film, the current technique can be used to test a variety of substrates and thin films,” including “polysilicon [film] on single-crystal silicon substrates.” *Id.*

In addition to testing fused silica as a substrate, Wang also tested bare silicon substrates. Ex. 1005, 45. Wang found that bare silicon substrates were sometimes damaged by the shock waves generated by the laser striking the absorbing layer. *Id.* at 47. Such damage is not desirable in laser spallation experiments, as the damage can cause the test film layer to separate from the substrate layer prior to the interface between the two layers failing. *Id.* Put another way, laser spallation is intended to test the strength of the bond between the substrate layer and the thin film layer. *Id.* at 3–4, 47. However, if the substrate layer suffers physical damage from the strength of the laser-induced stress wave propagating through it, that damage can cause the thin film to break away from the substrate, even though the interface bond has not yet failed. *Id.* at 47. Wang found that using fused silica as a substrate avoided this damage, because the fused silica was strong enough to resist being damaged by the stress wave. *Id.* at 51, 61.

2. *Status of Wang as a Printed Publication*

The parties dispute whether Wang qualifies as a printed publication pursuant to Section 102(b). “[A]t the institution stage, the petition must identify, with particularity, evidence sufficient to establish a reasonable likelihood that the reference was publicly accessible before the critical date

of the challenged patent and therefore that there is a reasonable likelihood that it qualifies as a printed publication.” *Hulu v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 13 (PTAB Dec. 20, 2019) (precedential).

The ’684 Patent claims priority to a provisional application filed on March 5, 2004. Ex. 1001, code (60). Therefore, assuming that the ’684 Patent is entitled to rely on the provisional filing date, the critical date under 35 U.S.C. § 102(b) for the ’684 Patent is March 5, 2003.⁷

Petitioner contends that Wang was available to the public as of March 4, 2003, one day prior to the critical date. Pet. 13. The evidence of record includes Wang itself, as well as a declaration from Ms. LaTonya Morris and a declaration from Ingrid Hsieh-Yee, Ph.D. Ex. 1005; Ex. 1006; Ex. 1035. For the reasons set forth below, we find that this evidence is sufficient to meet the *Hulu* standard.

Wang states on its face that it was “submitted in partial fulfillment of” the requirements for obtaining a Ph.D., and bears a date of “2002.” Ex. 1005, 3 (added page numbers). Wang bears a copyright notice “Copyright by Junlan Wang, 2002.” *Id.* at 5 (added page numbers). Additionally, Wang bears a certification dated “July 2002,” recommending that the document be accepted in partial fulfillment of the requirements for a Ph.D., and bearing six signatures of individuals apparently affiliated with the University of Illinois. *Id.* at 6 (added page numbers). Finally, Wang bears a UMI Microform number of “3070468” and a second, later copyright notice

⁷ We express no opinion on the sufficiency of the provisional application, as that issue is not before us.

“Copyright 2003 by ProQuest Information and Learning Company.” *Id.* at 4 (added page numbers).⁸

The 2002 claim of copyright by Junlan Wang suggests that the document existed as of 2002. The certification dated July 2002 suggests that the document was received and reviewed by others at the University of Illinois as of that date. The ProQuest copyright claim suggests that the document was at least received, if not actually published, by ProQuest as of 2003.

The Morris Declaration states that “[s]hortly after [dissertations and master’s theses] are received, ProQuest makes them available for sale to the public.” Ex. 1035 ¶ 3. For each document, a record consisting of “an abstract, index record and citation information” is published in ProQuest’s Digital Dissertations and Theses (“PQDT”) Database. *Id.* ¶¶ 4–5.⁹ This database is searchable by “title, author, index terms and the abstract.” *Id.* ¶ 4. In addition, the PQDT database includes the full text of certain dissertations. *Id.* ¶ 5.

Relating specifically to Wang, the Morris Declaration states that “[a]t the time of the Dissertation’s publication, the Record and full PDF of the

⁸ UMI Company and University Microfilms Inc. are predecessor entities to ProQuest. Ex. 1035 ¶ 3 n.1. It thus appears on this record that the “UMI Microform number” is an identifier provided by ProQuest’s predecessor for this dissertation. As noted below, this number matches the “Dissertation No.” reflected in ProQuest’s records. *Infra*, at 14 (citing Ex. 1035 ¶ 8).

⁹ Historically, this record was published in ProQuest’s Abstract Database. Ex. 1035 ¶ 4. However, during the time period relevant to Wang’s publication, the contents of the Abstract Database were made available in the PQDT Database as well. *Id.* ¶ 5.

Dissertation was [sic] added to PQDT as specified below.” Ex. 1035 ¶ 7.

Ms. Morris testifies that:

I have reviewed ProQuest’s records regarding the Dissertation cited as:

Dissertation No.	3070468
Title:	<i>Thin -film adhesion measurement by laser - induced stress waves</i>
Author:	Wang, Junlan
Degree Date:	2002, PhD
University:	University of Illinois at Urbana-Champaign

Id. ¶ 8. This information matches the information found on Wang itself.

Compare Ex. 1035 ¶ 8, *with* Ex. 1005, 3–4 (added page numbers).

The Morris Declaration then presents information about “Full Text availability” of Wang:

Full Text Availability

First Made Available for Sale in PDF format and placed in PQDT	2003-03-04
DAI volume issue:	B 63/11
DAI publication month and year:	
Date full text is loaded into PQDT:	2003-03-04

Ex. 1035 ¶ 8. This information indicates that the “full text” of Wang was loaded into ProQuest’s PQDT database as of March 4, 2003. *Id.*

Additionally, the PDF format document was made available for sale and placed in the PQDT database as of March 4, 2003. *Id.* ¶ 9.

Dr. Hsieh-Yee, Petitioner’s declarant with respect to public accessibility issues, testifies that she has an “understanding that the standard practice of ProQuest is to create records for theses and dissertations submitted to ProQuest.” Ex. 1006 ¶ 31. Dr. Hsieh-Yee further testifies that,

having reviewed the contents of the Morris Declaration, she has formed an opinion based on her expertise in library management systems, that “as of March 4, 2003, the data elements in the record for Wang . . . became searchable in PQDT” and that “interested users[] would be able to search ProQuest to discover Wang and access it freely from any institutions that subscribe to PQDT.” *Id.* ¶ 33.

On this record, we find that the above noted evidence comprises “evidence sufficient to establish a reasonable likelihood that the reference was publicly accessible before the critical date of the challenged patent and therefore that there is a reasonable likelihood that [Wang] qualifies as a printed publication.” *Hulu*, IPR2018-01039, Paper 29 at 13.

Patent Owner raises a number of questions about Petitioner’s showing. First, Patent Owner contends that the Morris Declaration “is not credible or legally sufficient for various reasons,” including a lack of corroborating evidence. Prelim. Resp. 28–30 (citing, *inter alia*, *Finnigan Corp. v. Int’l Trade Comm’n*, 180 F.3d 1354, 1369 (Fed. Cir. 1999)). Nonetheless, Ms. Morris’s testimony at least is consistent with the indicators of publication appearing in the front matter of Wang. *See* Ex. 1005, 1, 3–6 (added page numbers). As such, we find Ms. Morris’s testimony sufficiently reliable to support a reasonable likelihood that Wang would qualify as a prior art printed publication. At trial, the parties can develop the record about whether, and, if so, the extent to which, testimony regarding publication by a non-inventor witness must be corroborated with other evidence.

Second, Patent Owner contends that the Morris Declaration is unreliable because it is not based on first-hand evidence given that

Ms. Morris was not employed at ProQuest in 2003 when Wang was loaded into PQDT. Prelim. Resp. 29. Patent Owner cites to no authority for the proposition that first-hand knowledge is required under such circumstances. We observe that 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. Ex. 1035 ¶¶ 1–2. Ms. Morris testifies that she has developed personal knowledge of these subjects based on her training and her employment with ProQuest. *Id.* The parties may further discuss the applicable legal standards for this issue during the trial. Patent Owner is also free to cross-examine Ms. Morris should it choose to do so.

Third, Patent Owner contends that the Morris Declaration is unreliable because Ms. Morris failed to explain how she knew about the capabilities of the ProQuest database from this period. Prelim. Resp. 29. We observe that Ms. Morris testifies that she has personal knowledge of the facts set forth in her declaration, “based upon practices and training encountered in the course of [her] work, including review of available business records.” Ex. 1035 ¶ 1. She further discusses her job duties at ProQuest and testifies that she is familiar with ProQuest's sales and publication practices. *Id.* ¶ 2. Patent Owner is free to test Ms. Morris' declaration via cross-examination at trial.

Fourth, Patent Owner contends that the Morris Declaration asserts certain facts about the contents of the ProQuest database, without providing an actual printout from the database. Prelim. Resp. 30. Under the *Hulu* standard, Petitioner's showing is sufficient for institution. Patent Owner raises what is essentially an evidentiary issue here. We need not address this

evidentiary issue at this time. The parties may further develop the sufficiency of Petitioner's evidence of publication at trial.

Fifth, Patent Owner contends that in order to use Wang as a prior art reference before the March 5, 2003, critical date, a person would have had to run a keyword search¹⁰ on a first ProQuest database to find Wang, then order Wang using a second database,¹¹ and actually take delivery of Wang, all on the same day. Prelim. Resp. 31. Patent Owner contends that it would have been "highly unlikely, and perhaps impossible," for this to happen. *Id.* at 32.

Petitioner, however, provides evidence including the testimony of Ms. Morris that the PQDT database included the "full text" of Wang as of March 4, 2003, and that the "full text" of Wang was available for sale as of March 4, 2003. Ex. 1035 ¶¶ 8–9. Petitioner also provides the opinion of its declarant Dr. Hsieh-Yee that interested users would have been able, as of March 4, 2003, to "access [Wang] freely from any institutions that subscribe to PQDT." Ex. 1006 ¶ 33. This is sufficient to meet the *Hulu* standard for

¹⁰ Patent Owner contends that Petitioner has not shown that Wang's Abstract was available for search. Prelim. Resp. 31. We do not agree. Wang's Abstract was in PQDT as part of the Record for Wang. Ex. 1035 ¶¶ 4, 11. PQDT could have been searched electronically for the Record. *Id.* ¶ 12. Furthermore, the Record includes an "index record" (i.e., keywords) which allowed for searching of "index terms." *Id.* ¶¶ 3–4. Patent Owner's contentions that in 2003 a full-text search of the Abstract "could not be expected" are merely unsupported attorney argument. *See In re Geisler*, 116 F.3d 1465, 1470 (Fed. Cir. 1997); *see also In re Pearson*, 494 F.2d 1399, 1405 (CCPA 1974) (indicating attorney argument is not evidence).

¹¹ We disagree on this record with Patent Owner's characterization that two ProQuest databases needed be accessed. Prelim. Resp. 30. The PQDT database included the contents of the Record from the Abstract Database. Ex. 1035 ¶¶ 4, 11.

institution. Patent Owner is free to test these declarations via cross-examination at trial.

We need not decide at this time whether actual dissemination of Wang is required, as Patent Owner contends (Prelim. Resp. 31), but we have concerns that Patent Owner's contention may be contrary to the law. *See, e.g., GoPro, Inc. v. Contour IP Holding LLC*, 908 F.3d 690, 693 (Fed. Cir. 2018) (“We have interpreted § 102 broadly, finding that even relatively obscure documents qualify as prior art so long as the relevant public has a means of accessing them. For example, we have determined that a single cataloged thesis in a university library was sufficient[ly] accessible to those interested in the art exercising reasonable diligence. Subsequently, we explained that [a]ccessibility goes to the issue of whether interested members of the relevant public could obtain the information if they wanted to and *[i]f accessibility is proved, there is no requirement to show that particular members of the public actually received the information.* Accordingly, [a] reference will be considered publicly accessible if it was 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.” (citations and internal quotation marks removed) (emphasis added)). As discussed above, the evidence of record supports a conclusion that Wang was “made available” such that an interested person could “locate it.”

Accordingly, we find that Petitioner has satisfied the *Hulu* standard as regards Wang, and thus Wang preliminarily qualifies as prior art under pre-AIA Section 102(b). The parties can further develop the record regarding these publication issues during the course of the trial.

3. *Analysis of Claim 1*

Petitioner contends that Wang anticipates claims 1–22. Pet. 3. To show anticipation under 35 U.S.C. § 102, each and every claim element, arranged as in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359 (Fed. Cir. 2008). The prior art need not, however, use the same words as the claims. *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009). The anticipation inquiry takes into account the literal teachings of the prior art reference and inferences the ordinarily skilled person would draw from it. *Eli Lilly and Co. v. Los Angeles Biomedical Res. Inst. at Harbor-UCLA Med. Ctr.*, 849 F.3d 1073, 1074–75 (Fed. Cir. 2017).

Patent Owner does not at this time dispute that Wang discloses all limitations of claim 1. Prelim. Resp. 34–48.¹² Instead, Patent Owner contends that Wang fails to enable the combination of a silicon substrate with a fused silica substrate. *See, e.g., id.* at 35, 37, 38, 45, 47, 48.

a) *Preamble [1.pre] An apparatus for generating a tensile stress between a substrate and a coating*

Petitioner does not address whether the preamble is limiting, but contends that Wang discloses the preamble, noting that Wang discloses a

¹² Patent Owner cursorily states that “[n]o combinations of different substrates in combination with a fused silica substrate are *described* or *enabled*.” Prelim. Resp. 34 (emphasis added). Patent Owner does not further develop its argument that Wang fails to describe any combination of a silicon substrate with a fused silica substrate. Regardless, we find preliminarily on this record that Wang does disclose the combination of a silicon substrate with a fused silica substrate, as discussed in further detail below with respect to limitation [1.d]. *Infra*, Section II.C.3.(5).

“tensile spallation experiment to measure thin-film adhesion.” Pet. 20 (citing Ex. 1005, 7–8, 40–81).

We have reviewed the evidence cited by Petitioner, and find Wang discloses the subject matter of the preamble sufficiently to meet Petitioner’s burden on institution, and thus need not determine whether the preamble is limiting.

b) Limitation [1.a]: a substrate having a thickness, said thickness defined by a first side and a second side in a first axis;

Petitioner points to Figure 2.1 of Wang as showing a substrate (S) having a first side (the side in contact with the test film (F)), a second side (the side in contact with the absorbing layer (AL)), and a thickness (the space between the first and second sides). Pet. 21 (citing Ex. 1005, 45, 56–59. Patent Owner does not dispute that Wang discloses this limitation, but argues that certain aspects of the claim related to this limitation are not enabled. Prelim. Resp. 32–48. We discuss the enablement issue below. *Infra*, Section II.C.3.(6).

We have reviewed the evidence cited by Petitioner, and we agree that Wang’s Figure 2.1 teaches the subject matter of this limitation sufficiently to meet Petitioner’s burden on institution.

c) Limitation [1.b]: a coating applied to the first side of the substrate such that the coating and substrate are axially spaced along the first axis in intimate facing contact with each other such to form a coating/substrate interface

Petitioner points to Wang’s disclosure of an aluminum film for the test film, which Petitioner contends is a “coating” as claimed. Pet. 22 (citing Ex. 1005, 44–45). This aluminum film is evaporated or sputtered onto the

substrate, which process forms an intimate facing contact with the substrate. Ex. 1005, 44–45. As shown in Figures 2.1 and 3.2, the test film is axially spaced along a horizontal axis. *Id.* at Figs 2.1, 3.2. Petitioner further notes that Wang discloses inserting an extra layer of substrate material between the fused silica layer and the test film. Pet. 23 (citing Ex. 1005, 124).

Patent Owner does not dispute this contention at this time. We have reviewed the evidence cited by Petitioner, and find Wang discloses the subject matter of this limitation sufficiently to meet Petitioner’s burden on institution.

d) Limitation [1c]: a glass element disposed on the second side of the substrate and axially spaced along the first axis;

Petitioner recites Wang’s disclosure that fused silica “is an ideal substrate material for launching high-amplitude shock waves.” Pet. 23–24 (citing Ex. 1005, 124). Wang further discloses inserting a layer of a desired substrate material between the fused silica and the thin film. *Id.* According to Petitioner, these passages would have been understood by a POSITA to disclose placing a glass element (e.g., fused silica) on the side of the substrate opposite the test film. *Id.*

Patent Owner disagrees that Wang discloses this limitation, but all of Patent Owner’s arguments are directed at a lack of enablement. Prelim. Resp. 32–48. We discuss the enablement issue below. *Infra*, Section II.C.3.(6). We have reviewed the evidence cited by Petitioner, and find Wang discloses the subject matter of this limitation sufficiently to meet Petitioner’s burden on institution.

e) Limitation [1d]: wherein the glass element is configured to propagate and modify a stress wave to the

coating/substrate interface to generate a tensile stress between the substrate and the coating;

Petitioner first points to the '684 Patent's teachings of creating a "rarefaction shock" by reducing the post-peak decay time of an incoming stress wave to zero. Pet. 24 (citing Ex. 1001, 8:43–49). Petitioner then identifies Wang's disclosure of its fused silica layer being "an ideal substrate material for launching high-amplitude shock waves." Pet. 25 (citing Ex. 1005, 124). Petitioner's declarant testifies that a POSITA would have recognized that fused silica will propagate a stress wave and generate "rarefaction shocks." Ex. 1003 ¶¶ 108–109. Wang discloses that "fused silica substrates, with their negative nonlinear elasticity, cause the compressive stress wave generated by the pulsing laser to evolve a decompression shock, which is critical for generation of the fast fall times needed for significant loading of thin-film interfaces." Ex. 1005, 11–12 (added page numbers). Petitioner's declarant testifies that this "decompression shock" is the same thing as a "rarefaction shock." Ex. 1003 ¶ 108.

Patent Owner disagrees that Wang discloses this limitation, but all of Patent Owner's arguments are directed at a lack of enablement. Prelim. Resp. 32–48. We discuss the enablement issue below. *Infra*, Section II.C.3.(6). We have reviewed the evidence cited by Petitioner, and find Wang discloses the subject matter of this limitation sufficiently to meet Petitioner's burden on institution. Specifically, we agree on this record that Wang's fused silica layer causes the stress wave generated by the laser pulse to "evolve" (i.e., be modified) into a rarefaction/decompression shock wave, which creates a stress between the substrate and the coating. Ex. 1005, 81; Ex. 1003 ¶¶ 107–108.

f) Enablement of Wang

In order for a prior art reference to anticipate a claim, that reference must enable a person of ordinary skill in the art to make the claimed subject matter. *PPG Indus., Inc. v. Guardian Indus. Corp.*, 75 F.3d 1558, 1566 (Fed. Cir. 1996) (“To anticipate a claim, a reference must disclose every element of the challenged claim and enable one skilled in the art to make the anticipating subject matter.”) Enablement of a prior art reference does not require that the prior art reference show that the disclosed subject matter would have utility; that is, that it would work for any particular purpose. *Rasmusson v. SmithKline Beecham Corp.*, 413 F.3d 1318, 1326 (Fed. Cir. 2005). (“[T]his court has continued to recognize that a prior art reference need not demonstrate utility in order to serve as an anticipating reference under section 102.”), *In re Schoenwald*, 964 F.2d 1122, 1124 (Fed. Cir. 1992) (“[I]t is beyond argument that no utility need be disclosed for a reference to be anticipatory.”)

All that matters is whether the skilled person could have made the claimed subject matter, without undue experimentation. *In re Antor Media Corp.*, 689 F.3d 1282, 1290 (Fed. Cir. 2012) (“Enablement of prior art requires that the reference teach a skilled artisan to make or carry out what it discloses *in relation to the claimed invention*.”) (emphasis added). Even references that disclose inoperative devices are still prior art for all that they teach. *Id.* (citing *Beckman Instruments, Inc. v. LKB Produkter AB*, 892 F.2d 1547, 1551 (Fed. Cir. 1989)). Therefore, questions of whether the prior art may teach away from making the claimed subject matter are not relevant to anticipation. *Bristol-Myers Squibb Co. v. Ben Venue Lab’ys, Inc.*, 246 F.3d 1368, 1378 (Fed. Cir. 2001) (“Thus, the question whether a reference

‘teaches away’ from the invention is inapplicable to an anticipation analysis.”)

To anticipate the “substrate,” “glass element,” and “wherein the glass element is configured . . .” limitations of claim 1 (Pet. 22–25), Petitioner relies in part on a section of Wang titled “Future Work,” and in particular on Wang’s disclosure that:

By inserting an extra layer of the desired substrate material between the fused silica and the thin film, the current technique can be used to test a variety of substrates and films, especially those of interest to the microelectronics industry, such as polyimide, copper (Cu), aluminum (aluminum) and polysilicon on single-crystal silicon substrates.

Ex. 1005, 124.

The sole argument that Patent Owner advances as for why Wang does not anticipate claim 1 is that Wang allegedly fails to enable the “Future Work” disclosure of Wang. Prelim Resp. 34–48.

Patent Owner advances several reasons why it contends that Wang is not enabled. First, Patent Owner contends that Wang never tested the combination of a fused silica layer with a silicon substrate. Prelim. Resp. 35–36. It is, however, irrelevant whether the prior art reference actually created or tested the subject matter it discloses. *Novo Nordisk Pharms., Inc. v. Bio-Tech. Gen. Corp.*, 424 F.3d 1347, 1355 (Fed. Cir. 2005) (“[A]nticipation does not require actual performance of suggestions in a disclosure. Rather, anticipation only requires that those suggestions be enabled to one of skill in the art.”) What matters is whether the disclosure is sufficient to enable a person of skill to make the claimed subject matter. *Id.*

Second, Patent Owner contends that the only structure for which Wang was able to “show[] successful results, i.e., high interface stress and

no substrate damage,” was with fused silica alone (that is, without the extra layer required by the claim). Prelim. Resp. 38. This again misstates the test for prior art enablement. The prior art need not show any test results in order to enable a disclosed structure, much less show that the disclosed structure demonstrated successful results. *Bristol-Myers Squibb*, 246 F.3d at 1378 (“[Prior art reference] enabled the performance of those steps even though he did not achieve a favorable outcome, which was not a requirement of the claim.”).

Indeed, there is nothing in claim 1 which requires any given level of interface stress, much less a “high” interface stress. Nor does claim 1 require an absence of substrate damage. A prior art reference need only enable the claimed subject matter; it need not enable non-claimed elements such as particular levels of interface stress or substrate damage avoidance. *Antor*, 689 F.3d at 1290.

Third, Patent Owner contends that a person of skill in the art would have recognized that Wang’s laser causes damage to a silicon substrate, and that the stress wave generated by Wang’s laser would be attenuated by passing through a silicon substrate. Prelim. Resp. 39–45. According to Patent Owner, these drawbacks of Wang would have caused a person of skill to have to engage in undue experimentation in order to make a structure that avoided damaging the substrate, and that generated a strong stress wave. *Id.*

To be enabled, however, the prior art need only provide sufficient disclosure that a person of ordinary skill in the art could have made the claimed subject matter. *Bristol-Myers Squibb*, 246 F.3d at 1378. Here, the claimed structure has a substrate, a coating, and a glass element in the claimed configuration, with the glass element propagating and modifying a

stress wave to generate a tensile stress between the substrate and the coating. Ex. 1001, 13:33–48. On this record, Petitioner has identified sufficiently the knowledge of a person of skill in the art (Pet. 5–9) and the teachings of Wang that would have enabled a person of skill in the art to construct such a structure. Pet. 13–16, 20–26.

There is nothing in claim 1 that requires avoiding damage to the substrate or the coating. Nor is there anything in claim 1 that requires any particular intensity of the stress wave or tensile stress. As long as a tensile stress is generated at the substrate/coating boundary, that is all that claim 1 requires. Patent Owner does not provide any argument, much less evidence, that a person of ordinary skill in the art would not have been able to make a structure having a substrate with a coating on one side and a glass element on the other side. Nor does Patent Owner even argue that Wang’s fused silica layer would not be able to propagate and modify a stress wave to generate at least some level of tensile stress between the substrate and the coating. Accordingly, we determine on this record that Petitioner has met its burden on institution for claim 1.

g) Conclusion Regarding Claims 1 and 13

Based on the present record, Petitioner shows sufficiently that Wang discloses all limitations of claim 1 arranged as in the claim. We also find sufficient evidence that Wang enables a person of ordinary skill in the art to make the claimed subject matter. Therefore, we determine that Petitioner has shown a reasonable likelihood of success in establishing that claim 1 is anticipated by Wang.

Claim 13 recites a method for separating a coating from a substrate, which uses a structure similar in scope to claim 1. Ex. 1001, 14:43–58. The

claim recites positioning a glass element on the second side of the substrate, directing a laser pulse at the glass element, and propagating and modifying a stress wave through the glass element to the substrate, to generate a tensile force between the substrate and the coating. *Id.* Patent Owner does not separately argue independent claim 13. Prelim. Resp. 32–33. We have reviewed Petitioner’s contentions for claim 13, which largely overlap its contentions for claim 1. Pet. 31–33. We determine that Petitioner has shown a reasonable likelihood of success in establishing that claim 13 is also anticipated by Wang.

4. *Analysis of Claims 2–12 and 14–22*

We have reviewed Petitioner’s evidence for dependent claims 2–12 and 14–22. Pet. 26–35. Patent Owner does not separately dispute any limitations of these dependent claims. Prelim. Resp. 26–47. In view of our conclusions as to claims 1 and 13, we need not opine in detail on these dependent claims. Based on our review of Petitioner’s evidence cited in the Petition, we determine that Petitioner has shown a reasonable likelihood of success in establishing that claims 2–12 and 14–22 are anticipated by Wang.

D. *Ground 2: Obviousness of claims 4, 6, 9, 15, 17, 20, 23, and 24 in view of Wang*

Petitioner contends in the alternative that claims 4, 6, 9, 15, 17, 20, 23, and 24 would have been obvious in view of the teachings of Wang. Pet. 35–36. A claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious to a person having ordinary skill in the art to which said subject matter pertains. *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and

content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called secondary considerations, including commercial success, long-felt but unsolved needs, failure of others, and unexpected results. *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

Claims 4, 6, 9, 15, 17, 20, 23, and 24 recite various ranges for parameters of claims 1 and 13. Ex. 1001, 13:48–15:43. For claims 4, 6, 9, 15, 17, and 20, Petitioner contends that Wang discloses particular points within the recited ranges, that these disclosures overlap with the recited ranges, and that the '684 Patent does not disclose that any given claimed range of values is critical. Pet. 35–36. For claims 23 and 24, Petitioner contends that a person of skill in the art would have known how to and would have been motivated to vary the laser pulse energy to the values recited in these claims, in order to fail different thin-film/substrate interfaces. Pet. 37–38 (citing Ex. 1003 ¶ 163; Ex. 1005, 42). Patent Owner does not separately argue any of these claims. We have reviewed Petitioner's contentions for these claims, and determine that Petitioner has shown a reasonable likelihood of success in establishing that these claims would have been obvious over Wang.

E. Ground 3: Obviousness of claims 1–24 over Wang in view of Gupta-1992

Petitioner contends that claims 1–24 would have been obvious over Wang in view of Gupta-1992. Pet. 38. Because we determine that Petitioner has established a reasonable likelihood of showing at least one claim is unpatentable over Wang alone, we need not address in detail Petitioner's contention that claims 1–24 are unpatentable over Wang in view of Gupta-1992. However, we write to provide guidance to the parties as to our

preliminary views of this combination to assist them in further briefing during the trial.

1. *Gupta-1992*

Gupta-1992 describes a laser spallation experiment designed to measure the strength of the interface between a substrate and a thin coating. Ex. 1011, 1. Gupta-1992 discloses two different structures that were used for the experiments. *Id.* at 4. These structures are shown in Figures 2(a) and 2(b) of Gupta-1992:

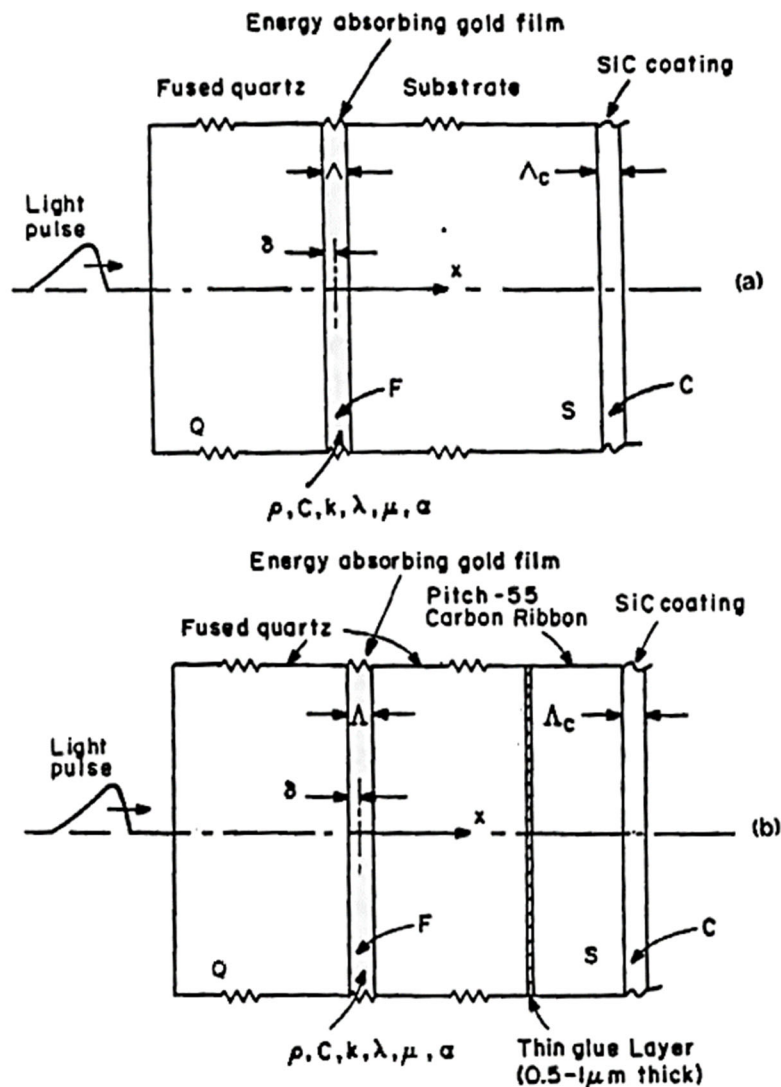


FIG. 2. (a) Configuration of the laser spallation probe with a homogeneous substrate. (b) Configuration for testing the Pitch-55 Ribbon/SiC system.

Figure 2(a) depicts a layered structure having a fused quartz confining layer, an energy absorbing gold film layer, a substrate, and a silicon carbide (SiC) coating layer. Ex. 1011, 145. A laser pulse is directed at and through the fused quartz confining layer, and into the energy absorbing layer. *Id.* at 141. The energy absorbing layer undergoes rapid expansion, which generates a stress wave through the substrate. *Id.* at 142. The stress wave rebounds off of the interface between the substrate and the SiC coating, causing tensile stress which can delaminate the coating from the substrate. *Id.* at 141.

Figure 2(b) depicts a similar structure, except that an additional layer of fused quartz is deposited between the energy absorbing layer and the substrate. In Figure 2(b), the substrate is formed of Pitch-55 Carbon Ribbon. The structure of Figure 2(b) is what Petitioner alleges teaches claims 1 and 13. Pet. 47–48, 55. Gupta-1992 also reports that the Pitch-55 ribbon suffered damage during testing. *Id.* at 28–29, 35–36.

2. *Analysis of claims 1–24*

Petitioner relies on Wang to meet limitations [1.pre], [1.a], [1.b], and [1.d]. Pet. 38. Petitioner relies on similar arguments for claim 13 as for claim 1. *Id.* at 43. Petitioner’s arguments for the dependent claims track its arguments for claims 1 and 13, and for Wang’s teachings in Ground 1 for the dependent claims. *Id.* at 41–43.

For limitation [1.c], Petitioner relies on the same teachings of Wang as for Ground 1 above. Pet. 39. Petitioner also relies on Gupta-1992 for limitation [1.c], as a fallback position “to the extent [Patent Owner] argues that Wang does not disclose or suggest fused silica (‘glass element’) on the second side of a substrate.” *Id.* at 40. As we analyze above, Patent Owner

does not dispute that Wang discloses limitation [1.c]. Patent Owner instead contends that Wang does not enable a person of ordinary skill in the art to make the claimed structure. Prelim. Resp. 32–48. Because we find a reasonable likelihood of success on Ground 1, including Wang’s disclosure of limitation [1.c], we need not opine in detail on this ground.

We note, however, that Patent Owner has advanced arguments, supported by at least certain teachings of Wang, that Wang’s device when used with a silicon substrate is susceptible to damage being done to the silicon layer. Prelim. Resp. 38–46. Patent Owner advances similar arguments that the embodiment of Gupta-1992 relied upon by Petitioner also suffered substrate damage. Prelim. Resp. 65–68. Patent Owner also suggests that the potential for substrate damage undermines Petitioner’s rationale for combining Gupta-1992 with Wang. *Id.* In light of these arguments, we encourage the parties to address at trial whether a person of ordinary skill in the art would have expected success when combining Wang and Gupta-1992, and whether Wang and/or Gupta-1992 may teach away from being used in such a combination.

F. Ground 4: Anticipation of claims 1–8, 10–19, 21, and 22 by Gupta-1992

Having found that Petitioner has demonstrated a reasonable likelihood of success in showing that claim 1 is unpatentable over Wang, we need not address Ground 4 in detail. However, we write to provide guidance to the parties as to our preliminary views of Ground 4 to assist them in further briefing during the trial.

Petitioner contends that Gupta-1992 discloses each of the claimed layers, namely the substrate, the coating, and the glass element. Pet. 45–47. Petitioner contends, and on this record we agree, that Gupta-1992 discloses

the same structural elements as that recited in claim 1 and 13 of the '684 Patent. Pet. 48.

Petitioner further contends that “it was a well-known property that glass elements such as fused silica (*i.e.*, quartz) propagate and modify a stress wave to cause a rarefaction shock in experimental laser techniques.” Pet. 49. Petitioner thus contends that the final “wherein” clause of claims 1 and 13 is inherently disclosed in Gupta-1992. Pet. 50. Petitioner focuses on a general property of glass elements, but does not discuss whether this general property is always present, regardless of how the glass element is used or configured in structures for use in laser spallation. *Hospira, Inc. v. Fresenius Kabi USA, LLC*, 946 F.3d 1322, 1329 (Fed. Cir. 2020) (“Inherency is established in the context of obviousness when ‘the limitation at issue necessarily must be present.’”). For example, Petitioner does not address whether changes in dimensions of the glass element or changes in how the glass element is used (e.g., varying intensities of laser pulses) might affect this general property. Thus, we question whether Petitioner’s showing of inherency is sufficient, but we leave it to the trial to decide this issue based on the fully developed trial record.

Patent Owner raises two disputes regarding this Ground. First, Patent Owner contends that Gupta-1992 fails to describe a glass element that propagates and modifies a stress wave. Prelim. Resp. 52. Patent Owner relies on evidence in Gupta-1992 that the experimental results of using a fused quartz/substrate/coating interface structure (corresponding to what is claimed in claims 1 and 13) exhibited a lower average interface strength than found with Gupta’s experiments that did not use the fused quartz (*i.e.*, “glass element”) layer. Prelim. Resp. 54. However, as Patent Owner recognizes,

Gupta-1992 indicates that this lower interface strength was “due to failures in the Pitch-55 ribbon substrate,” and not due to any failure of the fused quartz to exhibit the properties that Petitioner contends are inherent in that substance. *Id.* Thus, we are not persuaded on this record that Patent Owner’s first dispute has merit.

Patent Owner’s second dispute is that the Petition fails to provide any support for its contention that fused silica and fused quartz have the same properties. Prelim. Resp. 55. On this record, we disagree. Dr. Wang testifies that a person of skill in this field would understand that the terms “fused silica” and “fused quartz” are used interchangeably to refer to the same material with the same properties. Ex. 1003 ¶ 124. The Petition cites to this testimony. Pet. 29–30. In the absence of any countervailing evidence or testimony, we are persuaded preliminarily by Dr. Wang’s testimony at this stage of the proceeding.

G. Ground 5: Obviousness of claims 9 and 20 over Gupta-1992 in view of Gupta-1993

Having found that Petitioner has demonstrated a reasonable likelihood of success in showing that claim 1 is unpatentable over Wang, we need not address Ground 5 in detail. However, we write to provide guidance to the parties as to our preliminary views of Ground 5 to assist them in further briefing during the trial.

Petitioner relies on Gupta-1993 as describing the thickness of the glass element as recited in claims 9 and 20. Pet. 56–57 (citing Ex. 1013, 12, 16). We observe that Gupta-1993 states that “[w]hen fused quartz was used as a constraining material,” the Gupta-1992 structure was used, with “[t]he fused quartz was 3 mm in thickness.” Ex. 1013, 16. Gupta-1992, however, describes two embodiments, only one of which has a fused quartz layer

disposed on the side of the substrate opposite the coating, as required by claims 1 and 13. Ex. 1011, Fig. 2(a), (b). Furthermore, the embodiment of Figure 2(b) includes two fused quartz layers, one on each side of the energy absorbing layer. Pet. 56; Ex. 1011, Fig. 2(b). It is unclear on this record, however, which embodiment and which layer in Gupta-1992 was referred to by Gupta-1993's statement that "the fused quartz was 3 mm in thickness." Thus, we question whether a person of ordinary skill would have understood Gupta-1993's statement to be referring to the fused quartz layer of Gupta-1992 that corresponds to the claimed "glass element" of claims 1 and 13. Petitioner's remaining analysis is supported by rational reasoning and the testimony of its declarant, and on this record is preliminarily persuasive. Pet. 56–87 (citing Ex. 1003 ¶¶ 222–224).

H. Ground 6: Obviousness of claims 4, 6, 10, 15, 17, 23, and 24 over Gupta-1992

Having found that Petitioner has demonstrated a reasonable likelihood of success in showing that claim 1 is unpatentable over Wang, we need not address Ground 6 in detail. However, we generally agree that Petitioner has presented sufficient argument and evidence that the additional subject matter in claims 4, 6, 10, 15, 17, 23, and 24 would have been obvious over Gupta-1992 subject to our concerns expressed above relating to Petitioner's inherency argument for anticipation of independent claims 1 and 13 by Gupta-1992.

I. Ground 7: Obviousness of claims 1–24 over Wang-2002 in view of Gupta-1992

Having found that Petitioner has demonstrated a reasonable likelihood of success in showing that claim 1 is unpatentable over Wang, we need not address Ground 7 in detail. We note, however, that Patent Owner has

advanced arguments, supported by at least certain teachings of Wang-2002, that Wang-2002's device when used with a silicon substrate is susceptible to damage being done to the silicon layer. Prelim. Resp. 73–77. Furthermore, Wang-2002 reported stress attenuation when using wider layers. *Id.* at 77–79. Patent Owner advances similar arguments that the embodiment of Gupta-1992 relied upon by Petitioner also suffered substrate damage. *Id.* at 80–81. Patent Owner suggests that the potential for substrate damage undermines Petitioner's rationale for combining Gupta-1992 with Wang-2002. *Id.* at 71–81. In light of these arguments, we encourage the parties to address at trial whether a person of ordinary skill in the art would have expected success when combining Wang-2002 and Gupta-1992 despite the reported damage issues, and whether Wang-2002 and/or Gupta-1992 may teach away from being used in such a combination.

III. CONCLUSION

For the foregoing reasons, we determine that Petitioner has shown a reasonable likelihood that it would prevail in showing that at least one of the challenged claims of the '684 Patent is unpatentable. Accordingly, we institute an *inter partes* review on all of the challenged claims and all grounds presented in the Petition. At this stage of the proceeding, we have not made a final determination as to the patentability of any challenged claim.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that pursuant to 35 U.S.C. § 314, an *inter partes* review is instituted as to claims 1–24 of the '684 Patent, with respect to all grounds of unpatentability presented in the Petition; and

FURTHER ORDERED that *inter partes* review is commenced on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of trial.

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