

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

POSCO CO. LTD.,
Petitioner,

v.

ARCELORMITTAL,
Patent Owner.

Case No. IPR2024-01376
U.S. Patent No. 10,961,602

PATENT OWNER'S RESPONSE

TABLE OF CONTENTS

	<u>Page</u>
TABLE OF ABBREVIATIONS	v
TABLE OF EXHIBITS	vi
I. INTRODUCTION	1
II. SUMMARY OF THE ’602 PATENT	2
III. SUMMARY OF THE DISPUTE	3
IV. LEVEL OF ORDINARY SKILL IN THE ART	8
V. CLAIM CONSTRUCTION	9
VI. ARGUMENT	9
A. Grounds 1A-1G and Grounds 2A-2C: Engels and Hein not prior art	9
B. Grounds 1A-1G: Engels would not have enabled a POSITA to practice the Challenged Claims	16
C. Grounds 1A-1G: Engels does not disclose the claimed superficial layer (Limitations [1g], [21], and [24])	27
D. Grounds 2A-2C: GMW14400 is not prior art	34
E. Grounds 2A-2C: There is no motivation to combine	37
1. GMW14400 does not drive “market demand” and is not directed to POSITA at issue here	37
2. Technical considerations teach away from the combination	38
3. A POSITA would not think the properties of Hein could be obtained by combining with the microstructure of Takagi	42

F.	Grounds 2A-2C: There would have been no reasonable expectation of success in achieving Petitioner’s proposed combination with just reasonable experimentation.....	44
1.	The science at issue here is complex and unpredictable.....	45
2.	A POSITA would lack the expertise to reasonably succeed in combining the prior art to obtain the Challenged Claims	50
3.	It would not be “obvious to try” mixing and matching various alleged prior art parameters Dr. Miles speculates.....	51
4.	The alleged combination cannot be obtained using just reasonable experimentation.	56
G.	Petitioner’s Other Grounds.....	57
1.	Grounds 1B: Claims 12/15/28, 13/16/29, 19, 23, and 25	57
2.	Grounds 1B, 1C, and 1D and Ground 2B and 2C	58
3.	Grounds 1E and 1F	59
4.	Grounds 1G	60
H.	Grounds 1A-1G and Grounds 2A-2C: Secondary Considerations demonstrate the non-obviousness of the Challenged Claims	60

TABLE OF AUTHORITIES

	<u>Page(s)</u>
Cases	
<i>Acceleration Bay, LLC v. Activision Blizzard Inc.</i> , 908 F.3d 765 (Fed. Cir. 2018)	35
<i>Adang v. Fischhoff</i> , 286 F.3d 1346 (Fed. Cir. 2002)	27
<i>Amgen, Inc. v. Chugai Pharm. Co., Ltd.</i> , 927 F.2d 1200 (Fed. Cir. 1991)	19
<i>In re Antor Media Corp.</i> , 689 F.3d 1282 (Fed. Cir. 2012)	16
<i>Arctic Cat Inc. v. Polaris Indus., Inc.</i> , 795 F. App'x 827 (Fed. Cir. 2019)	42
<i>Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.</i> , 776 F.2d 281 (Fed. Cir. 1985)	17
<i>Bard Peripheral Vascular, Inc. v. W.L. Gore & Assocs., Inc.</i> , 586 F. Supp. 2d 1083 (D. Ariz. 2008)	17, 18
<i>Bayer Schering Pharma AG v. Barr Lab'ys, Inc.</i> , 575 F.3d 1341 (Fed. Cir. 2009)	54, 55, 56
<i>Blue Calypso, LLC v. Groupon, Inc.</i> , 815 F.3d 1331 (Fed. Cir. 2016)	35
<i>Burroughs Wellcome Co. v. Barr Lab'ys., Inc.</i> , 40 F.3d 1223 (Fed. Cir. 1994)	9
<i>E.I. du Pont de Nemours & Co. v. Unifrax I LLC</i> , 921 F.3d 1060 (Fed. Cir. 2019)	9, 15
<i>Elan Pharms., Inc. v. Mayo Found. for Med. Educ. & Rsch.</i> , 346 F.3d 1051 (Fed. Cir. 2003)	16
<i>Ens Labs Ltd. v. Unstoppable Domains Inc.</i> , IPR2024-00872, Paper 8 (PTAB Nov. 22, 2024).....	35
<i>Envirologix Inc. v. Ionian Techs., Inc.</i> , IPR2018-00405, Paper 12 (PTAB July 30, 2018).....	36
<i>Fleming v. Escort Inc.</i> , 774 F.3d 1371 (Fed. Cir. 2014)	9, 16
<i>Genetics Inst., LLC v. Novartis Vaccines & Diagnostics, Inc.</i> , 655 F.3d 1291 (Fed. Cir. 2011)	57, 58

<i>In re Hillis</i> , 484 F. App'x 491 (Fed. Cir. 2012)	18
<i>In re Hoeksema</i> , 399 F.2d 269 (C.C.P.A. 1968)	16, 17
<i>HTC Corp. v. Cellular Commc 'ns Equip., LLC</i> , 877 F.3d 1361 (Fed. Cir. 2017)	32
<i>Kinetic Concepts, Inc. v. Smith & Nephew, Inc.</i> , 688 F.3d 1342 (Fed. Cir. 2012)	42
<i>KSR Int'l Co. v. Teleflex Inc.</i> , 550 U.S. 398 (2007)	54
<i>In re Kumar</i> , 418 F.3d 1361 (Fed. Cir. 2005)	17
<i>LinkedIn Corp. v. eBuddy Techs. B.V.</i> , IPR2022-00165, Paper 40 (PTAB June 30, 2023)	34
<i>Merck & Co., Inc. v. Teva Pharms. USA, Inc.</i> , 395 F.3d 1364 (Fed. Cir. 2005)	60
<i>Microsoft Corp. v. Throughputer, Inc.</i> , IPR2022-01566, Paper 13 (PTAB May 31, 2023)	35
<i>Raytheon Techs. Corp. v. Gen. Elec. Co.</i> , 993 F.3d 1374 (Fed. Cir. 2021)	16, 17
<i>Samsung Elecs. Co., Ltd. v. Infobridge Pte. Ltd.</i> , 929 F.3d 1363 (Fed. Cir. 2019)	35
<i>Sanofi-Synthelabo v. Apotex, Inc.</i> , 550 F.3d 1075 (Fed. Cir. 2008)	46
<i>Slip Track Sys., Inc. v. Metal-Lite, Inc.</i> , 304 F.3d 1256 (Fed. Cir. 2002)	15
<i>In re Soni</i> , 54 F.3d 746 (Fed. Cir. 1995)	61
<i>In re Wands</i> , 858 F.2d 731 (Fed. Cir. 1988)	18, 19
<i>WBIP, LLC v. Kohler Co.</i> , 829 F.3d 1317 (Fed. Cir. 2016)	61

TABLE OF ABBREVIATIONS

Abbreviation	Term
'602 Patent	U.S. Patent No. 10,961,602 (Ex-1001)
'683 Patent	U.S. Patent No. 9,708,683
'683 Patent IPR	IPR2019-01275 (Ex-1031)
Challenged Claims	Claims 1-30 of U.S. Patent No. 10,961,602
Fig.	Figure
IPR	<i>inter partes</i> review
ITC Investigation	<i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC)
Patent Owner	ArcelorMittal
Pet.	Petition, Paper 1
Petitioner	POSCO Co., Ltd.
POSITA	person[s] of ordinary skill in the art
RPI	Real Party-In-Interest

TABLE OF EXHIBITS

Exhibit Number	Description
2001	File History of U.S. Patent No. 10,961,602
2002	Order No. 7 (Procedural Order), <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC), filed April 17, 2024
2003	Excerpted Respondents' Expert Report Regarding Invalidity, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC), filed April 17, 2024
2004	Excerpted Complainant's Expert Report Rebuttal Report Regarding Validity, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC), filed April 17, 2024
2005	Excerpted Complainant's Pre-Hearing Brief, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC), filed April 17, 2024
2006	Excerpted Respondents' Pre-Hearing Brief, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC), filed April 17, 2024
2007	Excerpted Complainant's Opening Demonstrative Slides, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC), filed April 17, 2024
2008	Excerpted Respondents' Opening Demonstrative Slides, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC), filed April 17, 2024

Exhibit Number	Description
2009	Evidentiary Hearing Transcript, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC)
2010	Deposition of Ronald Kefferstein, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC)
2011	ArcelorMittal “TAV” Research Report
2012	Respondents’ Corrected Pre-Hearing Brief, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC)
2013	Declaration of Dr. Dierk Raabe
2014	Curriculum Vitae of Dr. Dierk Raabe
2015	Springer, H., Kostka, A., Payton, E. J., Raabe, D., Kaysser-Pyzalla, A., & Eggeler, G. (2011). On the formation and growth of intermetallic phases during interdiffusion between low-carbon steel and aluminum alloys. <i>Acta Materialia</i> , 59(4), 1586–1600.
2016	Lemmens, B., Springer, H., Duarte, M. J., De Graeve, I., De Strycker, J., Raabe, D., & Verbeken, K. (2016). Atom probe tomography of intermetallic phases and interfaces formed in dissimilar joining between Al Alloys and Steel. <i>Materials Characterization</i> , 120, 268–272.
2017	Lemmens, B., Springer, H., De Graeve, I., De Strycker, J., Raabe, D., & Verbeken, K. (2017). Effect of silicon on the microstructure and growth kinetics of intermetallic phases formed during hot-dip aluminizing of Ferritic Steel. <i>Surface and Coatings Technology</i> , 319, 104–109.
2018	Lemmens, B., Springer, H., Peeters, M., De Graeve, I., De Strycker, J., Raabe, D., & Verbeken, K. (2018). Deformation induced degradation of hot-dip aluminized steel. <i>Materials Science and Engineering: A</i> , 710, 385–391.

Exhibit Number	Description
2019	Springer, H., Kostka, A., dos Santos, J. F., & Raabe, D. (2011). Influence of intermetallic phases and Kirkendall-porosity on the mechanical properties of joints between steel and aluminium alloys. <i>Materials Science and Engineering: A</i> , 528(13–14), 4630–4642.
2020	Joint Technology Stipulation, <i>Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same</i> , Inv. No. 337-TA-1402 (ITC)
2021	Li, Y., Chen, Y., & Li, S. (2021). Phase transformation testing and modeling for hot stamping of boron steel considering the effect of the prior austenite deformation. <i>Materials Science and Engineering: A</i> , 821, 141447.
2022	Çavuşoğlu, O., Çavuşoğlu, O., Yılmazoğlu, A. G., Üzel, U., Aydın, H., & Güral, A. (2020). Microstructural features and mechanical properties of 22mnb5 hot stamping steel in different heat treatment conditions. <i>Journal of Materials Research and Technology</i> , 9(5), 10901–10908.
2023	Turetta, A., Bruschi, S., & Ghiotti, A. (2006). Investigation of 22MNB5 formability in Hot Stamping Operations. <i>Journal of Materials Processing Technology</i> , 177(1–3), 396–400.
2024	Bariani, P. F., Bruschi, S., Ghiotti, A., & Turetta, A. (2008). Testing formability in the hot stamping of HSS. <i>CIRP Annals</i> , 57(1), 265–268.
2025	Kucera, V., Cabibbo, M., Prusa, F., Fojt, J., Petr-Soini, J., Pilvousek, T., Kolarikova, M., & Vojtech, D. (2021). Phase composition of Al-Si coating from the initial state to the hot-stamped condition. <i>Materials</i> , 14(5), 1125.

I. INTRODUCTION

The Petition challenges the claims of the '602 patent based on eleven different grounds involving two primary references. Petitioner's challenges fail for multiple independent reasons.

The '602 patent was conceived and reduced to practice before the earliest alleged public availability of Engels and Hein.¹ All grounds use either Engels or Hein, and thus, the grounds cannot prove that the claims are unpatentable.

In addition, Grounds 1A-1G also fail because they rely on Engels, a reference that would not have enabled a POSITA to practice the Challenged Claims. Separately, Petitioner has not shown that Engels discloses the claimed superficial layer or the claimed mean iron or mean aluminum relationship recited in the claims.

As to Petitioner's obviousness grounds, Petitioner fails to show that a POSITA would have been motivated to combine separate references or that there would have been a reasonable expectation of success. Petitioner repeatedly oversimplifies the field of hot stamping claiming that the relationship between self-selected and isolated parameters was well-known. The hot-stamping process, however, involves a complex interplay among several parameters whose relationship is still being studied today. Many of Petitioner's proposed rationales are based on

¹ As to Grounds 2A-2C, Petitioner also has not shown that GMW14400 was publicly available before the invention or priority date of the '602 patent.

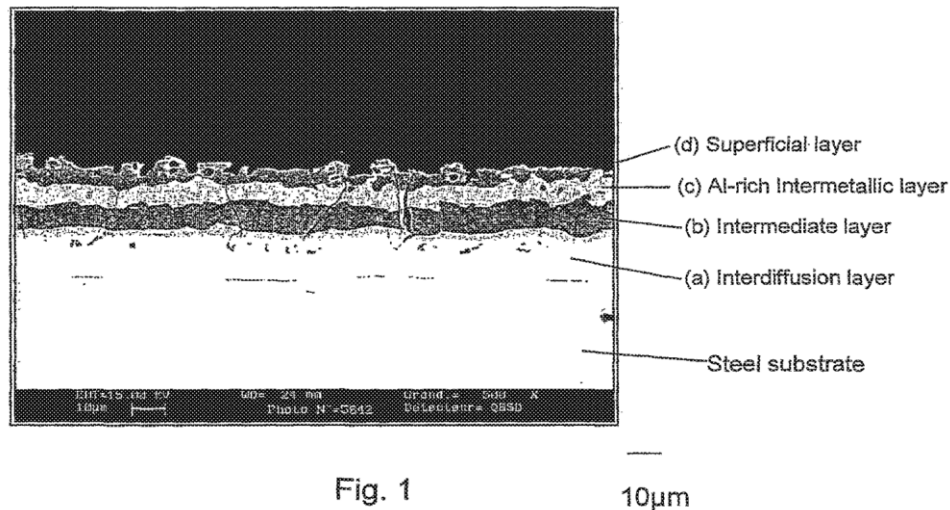
ipse dixit reasoning that was directly contradicted by RPI's expert during the parallel ITC Investigation, which addressed the '602 Patent and involved the same references. Moreover, Petitioner also ignores the recited level of skill and that the state of art teaches away from many of Petitioner's proposed rationales for combining references. For the reasons explained below, the Petition fails to establish that any of the Challenged Claims are unpatentable.

II. SUMMARY OF THE '602 PATENT

The '602 Patent relates to “[c]oated steel strips, coated stamped products and methods.” Ex-1001, Title. The '602 Patent recognizes that “the use of pre-coated steels in hot-stamping processes for the shaping of parts has become important, especially in the automotive industry.” Ex-1001, 1:37-39. However, problems could occur due to “rollers [that] may become fouled” during the hot-stamping process leading to “maintenance of the rollers” and causing productivity to decrease. Ex-1001, 1:66-2:2. The '602 Patent also recognized that there was a need for parts with “very high mechanical resistance,” and “a substantial resistance to shocks, fatigue, abrasion and wear, while retaining a good resistance to corrosion as well as a good capacity for welding, painting and gluing.” Ex-1001, 2:3-23, 11:33-39.

The '602 Patent innovated and enabled a way to obtain, in a repeatable, consistent, and robust manner, a beneficial coating microstructure with the above qualities. Ex-1001, 14:59-18:24. Specifically, as the '602 Patent claims reflect, the

inventors created a carefully designed microstructure for hot-stamped aluminum alloy coatings on martensitic steel that required exacting phase transformation, lamellar structure, and intermetallic layering. Figure 1 is an embodiment of the invention and displays an example the beneficial and required coating microstructure.



Ex-1001, Figure 1.

III. SUMMARY OF THE DISPUTE

The '602 Patent invention claims aluminum alloy coated, press-hardened (i.e., hot stamped) steel products wherein the internal microstructure of the coating is designed to meet certain specific, delineated phase transformation, lamellar, and compositional requirements. *See generally* Ex-1001. As the '602 Patent teaches, a coating microstructure of this specific design is not the natural byproduct of merely hot stamping aluminum alloy coated steel. Rather, the compositional requirements of the base steel and coating, and the hot-stamping parameters (e.g., heating curves,

dwelt and hold parameters, and press and quenching standards) must all be carefully designed and aligned to yield a product with the required particular microstructural features, all of which result in a coating that is so thin that it is only half as thick as a human hair.

As such, it is undisputed that, to obtain the Challenged Claims, a POSITA would need to design, *inter alia*, the hot stamping heating curves, dwelt and hold parameters, and press and quenching standards, along with criteria for the mass and composition of aluminum alloy and base steel used, which would then result in diffusion kinetics that yield the specific microstructural design of phase transformation layers called for in the claims. As described below, in reaching the invention, the '602 Patent inventors did just that through *years* of research.

Here, the Petitioner states that a POSITA would “have had an undergraduate degree in materials science, manufacturing engineering, mechanical engineering, or equivalent knowledge, training, or experience, with two years of experience working in metallurgy.” Pet., 6. That is, per the Petition, a POSITA is a technician working in metallurgy generally, but a POSITA would not necessarily have *any experience at all* with hot stamping, with aluminum alloy coatings, with diffusion kinetics in such coatings, with controlling intermetallic phase transformation (much less in such coatings), or in controlling or obtaining any of the microstructural features required by the Challenged Claims. Ex-2009, 940:14-941:4.

Nevertheless, according to Petitioner and RPI, such POSITA, i.e., any generalist in metallurgy, would be able to readily identify in the prior art those values for parameters, materials, and manufacturing specifications necessary to obtain the highly specific microstructural coating formation called for in the Challenged Claims (or to recreate and enable similar microstructures from pictures printed in alleged prior art). *See generally* Petition. According to Petitioner and RPI, no prior experience is needed in designing manufacturing processes to control and obtain microstructural intermetallic phase transformation layers in coatings that are so tiny that it literally takes a scanning electron microscope to see them. According to Petitioner and RPI, this is something any POSITA in metallurgy can reasonably do.

Petitioner's position here is, however, cut from whole pseudoscientific cloth. As Patent Owner's expert Professor Dierk Raabe explains, the subspeciality of metallurgy at issue in the Challenged Claims—the design and control at the microscopic, molecular level of diffusion kinetics in aluminum alloys to create specific intermetallic lamellar structures by phase transformation—is one of the most exacting, challenging, and unpredictable subspecialties in metallurgy. *See generally* Ex-2013. It is highly complex, involving multiple interrelated variables that yield unpredictable and non-linear results and interactions. It is a field that involves decades of intense research at the highest levels, research that continues even today. As shown below, it is not surprising that the inventors here—all more

experienced than Petitioner's generalist POSITA—spent *years* researching and experimenting before coming to the invention of the '602 Patent.

Dr. Raabe is a globally recognized authority and leader in steel metallurgy, microstructure, characterization, and phase transformations, with a particular focus on steel-aluminum interactions, intermetallic phase formation, and diffusion kinetics. Dr. Raabe is Managing Director at the Max Planck Institute for Sustainable Materials (formerly Max Planck Institute for Iron Research, the world's largest research organization dedicated to the study of steels) in Düsseldorf, Germany. Dr. Raabe holds professorships at RWTH Aachen and KU Leuven and holds a doctorate and habilitation in Physical Metallurgy and Metal Physics, both *summa cum laude* by RWTH Aachen University. Dr. Raabe is a member of the German National Academy Leopoldina, the US National Academy of Engineering, and recipient of the Gottfried Wilhelm Leibniz Prize and two ERC Advanced Grants.

Dr. Raabe's research includes extensive investigation into the interplay between microstructural phenomena and mechanical performance of metallic systems, in particular in steels, multiphase alloys, and metal-matrix systems (such as at issue here). As a global leader in microstructural science in metallic materials, Dr. Raabe has authored hundreds of peer-reviewed articles, and his work has been publicly cited over 100,000 times, resulting in his achieving an h-index of 182.

Relevant to this matter, Dr. Raabe's extensive research, including in *Nature*, *Science*, *Acta Materialia*, and related top-tier journals, demonstrates his profound expertise in steel-aluminum joining, interdiffusion mechanisms and intermetallic formation, and the role of alloying elements, including in martensitic and press-hardened steels, coatings, and steel design. Dr. Raabe is one of the world's preeminent scientist and expert on the subspecialties at issue in the '602 Patents.

For Petitioner's part, Petitioner relies on its expert Dr. Miles's opinion based on his view that POSITAs in metallurgy could readily and reasonably serve as microstructural architects, simply picking and combining microstructural design features from prior art to author manufacturing processes that obtain the Challenged Claims. Dr. Miles opines on what would be "obvious" to those POSITAs concerning designing means of obtaining intermetallic phase transformations of particular lamellar and compositional requirements at a microscopic level, and on how POSITAs would have a reasonable "chance of success" at designing such with just limited "reasonable experimentation." *See generally* Ex-1003.

But Dr. Miles's opinions here appear to be based on essentially naked fiat. While Dr. Miles is no doubt an accomplished metallurgist in the areas of his published articles and patents, nowhere does Dr. Miles set forth any basis to opine on the control of intermetallic phase transformation to yield specified lamellar

designs (or on the underlying diffusion kinetics, much less in aluminum alloy coatings).

At bottom, the question here is whether Dr. Miles's *ipse dixit* is correct that POSITA metallurgists could simply combine various microstructural features found in different alleged prior art coating embodiments to yield the Challenged Claims (or to recreate and enable coatings based on SEM images in alleged prior art). For the reasons summarized below and stated by Dr. Raabe, Dr. Miles is wrong—the technical challenges and science here are much more complex and unpredictable than Dr. Miles unsupported opinions. *See, e.g.*, Ex-2023 (“The main reason of [hot stamping’s] restricted application in the industry lies however in the lack of basic knowledge about mechanical and microstructural characteristics.”). Indeed, even RPI’s expert disagrees with Dr. Miles’s view of the art. Ex. 2009, 961:4-24. Accordingly, the Petition fails to establish that any of the Challenged Claims are unpatentable.

IV. LEVEL OF ORDINARY SKILL IN THE ART

Solely for this Response, Patent Owner does not challenge Petitioner’s definition of a POSITA.

V. CLAIM CONSTRUCTION

Solely for this Response, Patent Owner agrees with Petitioner that the plain and ordinary meaning of “superficial layer” is “a surface layer.” See Pet., 18-19 (citing Ex-1031, 22-24; Ex-1003, 46).

VI. ARGUMENT

A. Grounds 1A-1G and Grounds 2A-2C: Engels and Hein not prior art

Grounds 1A-1G relies on Engels and Grounds 2A-2C relies on Hein. But Engels and Hein are not prior art because the inventors conceived and reduced to practice the invention before the earliest possible alleged public availability date of either Engels or Hein.

Conception is “the formation in the mind of the inventor[s], of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.” *Burroughs Wellcome Co. v. Barr Lab’ys., Inc.*, 40 F.3d 1223, 1227-28 (Fed. Cir. 1994). “[E]vidence [of conception] is evaluated under ‘the rule of reason,’ whereby ‘all pertinent evidence is examined in order to determine whether the inventor’s story is credible.’” *Fleming v. Escort Inc.*, 774 F.3d 1371, 1377 (Fed. Cir. 2014). Moreover, the “case law does not require that evidence have a source independent of the inventors on every aspect of conception and reduction to practice; ‘such a standard is the antithesis of the rule of reason.’” *E.I. du Pont de Nemours & Co. v. Unifrax I LLC*, 921 F.3d 1060, 1077 (Fed. Cir. 2019).

Here, the '602 Patent inventors conceived and reduced to practice their invention by December 2005. As Dr. Pascal Drillet, one of the inventors, explained, ArcelorMittal developed USIBOR 1500P, which is an aluminum-silicon precoated boron steel, in the late 1990s. Ex-2009, 103:1-24, 116:18-20. USIBOR, however, was not a commercial success due to the difficulty of processing the coated steel, and thus, very few vehicle parts were made using USIBOR. *Id.*; *see also id.*, 172:7-10. Wanting to make USIBOR more successful and to increase sales, at the end of 2003/early 2004, the inventors—Dr. Drillet, Ronald Kefferstein, and Dominique Spehner—were tasked with increasing the car makers' demand for USIBOR, including incorporating parts made from USIBOR into the passenger cage of a vehicle (i.e., “body-in-white”). *Id.*, 103:1-104:25.

As Dr. Drillet explained, the inventors faced many challenges when figuring out how to satisfy the multiple needs of the automotive industry with parts made from USIBOR. *Id.*, 108:3-109:3. Automotive parts used in the body-in-white, and particularly for safety/anti-intrusion had to be extremely strong; they had to resist deformation and any breakage during collisions. *Id.* Retaining that high strength while processing the steel and forming it into vehicle parts, however, was difficult especially since vehicle manufacturers demanded that the steel also needed to be durable, weldable, paintable, formable, and corrosion resistant. *Id.*; *see also id.*, 111:4-21, 117:22-118:17, 695:19-696:2. Additionally, vehicle manufacturers were

becoming increasingly concerned with reducing the overall weight of the vehicle, so the steel needed to be lightweight. *Id.*, 108:3-109:3.

The inventors recognized the problems that occurred when processing, i.e., hot stamping the coating. *Id.*, 110:8-111:21. For example, during hot stamping of USIBOR, the aluminum coating with base steel must be transformed together inside an oven at a very high temperature, which causes the aluminum coating to melt. If this is not done precisely with a carefully designed heating curve, the melted aluminum coating will flow off the steel sheet while in the oven and cause fouling of the furnace roller (a problem exacerbated with thicker aluminum coatings). *Id.*; see also *id.*, 117:1-21; Ex-2013 ¶¶45-46, 149-50. The heating curve is an essential and critical control step in the processing: if the transfer is done too fast, the aluminum has insufficient diffusion time to react with the base steel. This means that the melting point of the unreacted aluminum (which is only 660°C) can be reached before necessary diffusion, resulting in liquid aluminum and fouling. Ex-2013 ¶42.

Starting at the end of 2003/early 2004, the inventors began working to solve these problems. Ex-2009, 103:1-104:25, 119:16-120:2. Dr. Drillet worked in press-hardened steels and researched blanks. *Id.*, 101:21-102:5, 120:3-121:6. Mr. Kefferstein oversaw the relationship between the hot stampers, the vehicle manufacturers and the ArcelorMittal R&D team. *Id.*, 119:16-120:2; Ex-2010, 12:9-

24, 13:12-18, 15:21-16:7, 16:14-20. Mr. Spehner was involved with the quality control of the precoating at the aluminizing plant. Ex-2009, 119:16-120:2. As part of this work, ArcelorMittal sent blanks made on the hot-stamping simulator to partners. *Id.*, 129:10-15. For example, in February 2004, two sets of prototype blanks were sent to Honda. *Id.*, 121:7-123:7. When tested for weldability at Honda, the 1.2 mm blank had poor weldability, whereas the 1.5 mm blank had good weldability—as Dr. Drillet testified, the microstructure of the 1.2 mm blank displayed porosity and a disturbed coating surface, including oxides at the surface. *Id.*, 122:7-123:7. As noted, there were no welding problems with the 1.5 mm blank, which had less porosity and less oxides. *Id.* From this testing, the inventors learned that heating rate affected the final microstructure. *Id.*, 123:8-19, 125:9-126:3; Ex-1001, 7:12-21.

Building on this learning from the Honda blanks, the inventors continued to investigate the processing parameters that affected the final coating microstructure. Ex-2009, 126:19-25, 127:14-130:9. Those parameters included the composition and thickness of the base steel; the precoating composition, thickness, and homogeneity; the size and type of oven; the heating time, heating rate, heating range, and dew point in the oven; and the transfer time, cooling rate, and exit temperature from the die during the quenching process. *Id.* Because ArcelorMittal did not have the ability to hot stamp USIBOR in a typical manufacturing line, to further investigate these

parameters and their effects on the final coating microstructure, the inventors had to teach the hot stampers about these process parameters and the critical process windows. *Id.*, 129:10-131:12, 169:19-22.

Through this work, the inventors discovered not only the target final coating microstructure that would achieve the vehicle manufacturers' desired steel properties but also the processing parameters and process windows required to achieve that microstructure. In November 2005, ArcelorMittal worked with the hot stamper Magna on a B-pillar prototype that was made from precoated USIBOR with a 1.6 mm thickness. *Id.*, 130:10-134:8; Ex-2011; *see also* Ex-2010, 15:21-16:7, 16:14-20, 19:19-23. As with other hot stampers, the inventors provided Magna with instructions on the processing parameters and processing window to use when hot stamping the USIBOR B-pillar prototype; Magna was experiencing breakage based on the processing instructions received from ArcelorMittal and asked ArcelorMittal to address the issue. Ex-2009, 130:10-134:8, 159:10-13, 159:24-160:7, 170:11-16, 170:21-171:6; Ex-2011. The work addressing this issue is summarized in an internal ArcelorMittal "TAV" research report, which Dr. Drillet received and studied, and has a lab report date of December 14, 2005. Ex-2009, 130:10-134:8, 171:10-172:2; Ex-2011. The TAV report identifies the part as "B-pillar made of USIBOR thickness 1.6 mm." Ex-2011.

Dr. Drillet's laboratory performed tests on the part, including preparing the SEM. Ex-2009, 130:10-134:8; Ex-2011. These tests included, for example, analyzing the coating's microstructure, hardness, and thickness, as well as the heating curves required to achieve these features in a reproducible manner. Ex-2009, 130:10-134:8; Ex-2011. This testing and analysis established the processing parameters, including the upper bound of the process window, that would achieve the target four-layer coating microstructure. Ex-2009, 130:10-134:8, 160:13-162:6, 170:21-172:2; Ex-2011. This was the first time the inventors established the upper bound of the process window. Ex-2011. As Dr. Drillet testified, this was the "last part of a puzzle because the process window [wa]s quite difficult to define." Ex-2009, 171:15-20.

The ArcelorMittal "TAV" research report includes images of the coating of the Magna hot-stamped part, which were taken in Dr. Drillet's laboratory. Ex-2011. One SEM micrograph shows the four-layer microstructure and became Figure 1 of the Asserted Patents. *Id.*; Ex-1001, Fig. 1. The analysis and testing of the USIBOR B-pillar, which, again, was hot stamped by Magna at ArcelorMittal's direction, confirmed that the inventors had come up with the processing parameters and process window required to reliably and consistently hot stamp a precoated steel part that produced the desired target four-layer microstructure to obtain the product

attributes (strength, corrosion resistance, weldability, etc.) desired by the automotive manufacturers. Ex-2009, 130:10-134:8; Ex-2011.

Thus, the evidence, including the inventors' testimony and ArcelorMittal's "TAV" research report with pictures of the hot-stamped Magna part, establishes that the inventors conceived of their invention no later than December 2005. *Slip Track Sys., Inc. v. Metal-Lite, Inc.*, 304 F.3d 1256, 1263-65 (Fed. Cir. 2002) (finding inventor testimony and drawings supported conception date and indicated "that they had at that time a definite and permanent idea of the invention"); *E.I. du Pont*, 921 F.3d at 1077 (Fed. Cir. 2019).

The evidence presented at the hearing further supports an actual reduction to practice through the hot-stamped USIBOR B-pillar. As explained above, Figure 1 of the '602 Patent, which shows the claimed four-layer structure, is the SEM micrograph of the Magna hot-stamped part contained in the ArcelorMittal "TAV" research report. Ex-2009, 133:14-134:3; Ex-1001, Fig. 1; Ex-2011. Dr. Drillet testified that the testing of the part was "the last part of [the] puzzle" of the claimed invention. Ex-2009, 171:14-172:2.

Indeed, Figure 1, which comes from the ArcelorMittal "TAV" research report, is described as a preferred embodiment. Ex-1001, 3:51-52. And it clearly shows the claimed invention. Ex-1001, Fig. 1. Indeed, even RPI argued during the ITC Investigation that Figure 1/ArcelorMittal "TAV" research report practices the

claims. Ex-2009, 44:23-45:9; Ex-2012 at 31. Thus, the hot-stamped USIBOR B-pillar establishes an actual reduction to practice of the invention of the '602 Patent by December 2005. *Fleming*, 774 F.3d at 1377.

Since the '602 Patent was conceived and reduced to practice by December 2005, Engels and Hein are not prior art. Thus, Grounds 1A-1G and 2A-2C cannot render the Challenged Claims unpatentable.

B. Grounds 1A-1G: Engels would not have enabled a POSITA to practice the Challenged Claims

Prior art must be enabling to prove anticipation or obviousness. “It is well settled that prior art under 35 U.S.C. § 102(b) must sufficiently describe the claimed invention to have placed the public in possession of it.” *Elan Pharms., Inc. v. Mayo Found. for Med. Educ. & Rsch.*, 346 F.3d 1051, 1055 (Fed. Cir. 2003). As such, “[t]he disclosure in an assertedly anticipating reference must be adequate to enable possession of the desired subject matter.” *Id.* “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.” *In re Antor Media Corp.*, 689 F.3d 1282, 1290 (Fed. Cir. 2012). “It is insufficient to name or describe the desired subject matter, if it cannot be produced without undue experimentation.” *Elan*, 346 F.3d at 1055.

Thus, “[t]o render a claim obvious, the prior art, taken as a whole, must enable a skilled artisan to make and use the claimed invention.” *Raytheon Techs. Corp. v. Gen. Elec. Co.*, 993 F.3d 1374, 1380 (Fed. Cir. 2021); *see also In re Hoeksema*, 399

F.2d 269, 274 (C.C.P.A. 1968) (“[I]f the prior art of record fails to disclose or render obvious a method for making a claimed compound ... it may not be legally concluded that the compound itself is in the possession of the public.”); *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 297 (Fed. Cir. 1985) (“The test of whether a particular compound described in the prior art may have been relied upon to show that the claimed subject matter at issue would have been obvious is whether the prior art provided an enabling disclosure with respect to the disclosed prior art compound.”). “The enabling disclosure concept [for a prior art reference] is a commonsense factor in making a determination of obviousness, for if neither any item of prior art, nor the background knowledge of one with ordinary skill in the art, would enable one to arrive at an invention, that invention would not be obvious.” *Raytheon*, 993 F.3d at 1381.

“Thus when a *prima facie* case of obviousness is deemed made based on similarity to a known composition or device, rebuttal may take the form of evidence that the prior art does not enable the claimed subject matter.” *In re Kumar*, 418 F.3d 1361, 1368 (Fed. Cir. 2005). “[T]he presumption of obviousness based on close structural similarity is overcome where the prior art does not disclose or render obvious a method for making the claimed compound.” *Id.* (citation omitted).

The Federal Circuit’s decision in *Bard Peripheral Vascular, Inc. v. W.L. Gore & Associates, Inc.* is illustrative of the foregoing principles, where the Federal

Circuit found a reference did not anticipate the asserted claims because it was not enabling. 670 F.3d 1171, 1185 (Fed. Cir.), *opinion vacated in part on other grounds on reconsideration*, 682 F.3d 1003 (Fed. Cir. 2012), and *vacated in part on reh'g en banc*, 476 F. App'x 747 (Fed. Cir. 2012). In *Bard Peripheral Vascular*, the asserted claims involved a vascular graft with a specific microstructure. *Id.* at 1175-76. The prior art included a reference by Matsumoto, which, like VinFast's asserted prior art references, was considered by the Patent Office during prosecution. *Id.* at 1176. At trial, the district court found that the evidence showed Matsumoto was not enabling, and thus, substantial evidence supported the jury's verdict that the asserted claim was not anticipated by Matsumoto. *Id.* at 1184-85. As one example, one witness testified that "'you couldn't figure anything' from the Matsumoto article 'because the article itself did not define anything'" and the evidence indicated that no one could produce the claimed invention based on Matsumoto. *Id.* at 1184-85 (quoting *Bard Peripheral Vascular, Inc. v. W.L. Gore & Assocs., Inc.*, 586 F. Supp. 2d 1083, 1092 (D. Ariz. 2008)). Thus, the Federal Circuit affirmed that "Matsumoto d[id] not enable a person of ordinary skill in the art to make the invention without undue experimentation and [could not] be used as anticipatory prior art." *Id.* at 1185.

To determine whether a prior art disclosure is enabling, courts consider the *Wands* factors. *In re Hillis*, 484 F. App'x 491, 495 (Fed. Cir. 2012) (citing *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988)). These factors include the relative skill

of those in the art, the amount of direction or guidance presented, the quantity of experimentation necessary, the presence or absence of working examples, the state of the prior art, and the predictability or unpredictability of the art. *Wands*, 858 F.2d at 737. These factors are “illustrative” and not exhaustive. *Amgen, Inc. v. Chugai Pharm. Co., Ltd.*, 927 F.2d 1200, 1212-13 (Fed. Cir. 1991).

Engels addresses the issue of how to test to determine whether a part that has gone through the hot stamping process has sufficient strength (e.g., tensile strength, hardness, etc.), which is not the invention at issue in the '602 Patent. Ex-2013 ¶¶63-76; Ex-1005, Abstract, 15. Because traditional testing results in the destruction of a part, Engels proposes non-destructive testing using magnetic inductive testing to determine the strength properties of a part. Ex-2013 ¶¶63-76; Ex-1005, 12-16.

As part of its analysis into the strength properties of a hot stamped part, Engels provides a brief *and generic* overview of the hot-stamping process (which is what allows a part to achieve its strength). Ex-2013 ¶¶63-76; Ex-1005, 3. In doing so, Engels provides at a schematic level some of the parameters involved in the hot stamping process. Ex-2013 ¶¶63-76; Ex-1005, 8. For example, Engels provides an analytical simulation of the cooling behavior that occurs during a specific step of hot-stamping. Ex-2013 ¶¶63-76; Ex-1005, 9-12. But, as Dr. Raabe explains, the hot stamping process is complex with many different critical parameters, not just cooling parameters. Ex-2013 ¶¶36-47, 56-62.

Petitioner seizes upon the fact that Engels includes an “SEM micrograph of a cross-section polish of the diffusion layer” and a corresponding table that purports to identify five phases in that SEM, providing measurements for the thickness of those phases and five elements purportedly contained therein. Ex-1005, 8-9; Pet., 7-8. Critically, however, Engels does not provide any information about the parameters used *to create* what is shown in its SEM micrograph—nor does Engels provide any information about *how* that SEM micrograph was obtained. Ex-2013 ¶¶63-76, 107-11; Ex-1005, 8-9. Engels fails to include, for example, any disclosure concerning process parameters such as precoating thickness, heating time, heating rate, heating range, and more, that would be needed to enable a POSITA to reproduce the microstructure shown in the Engels SEM, much less to arrive at the inventions disclosed in the Challenged Claims. Ex-2013 ¶¶63-76, 107-11; Ex-2009, 964:9-13.

To arrive at the Challenged Claims, one would have to, among other things, design the manufacturing specifications and process parameters that would achieve the result claimed. Ex-2013 ¶¶100-15. Doing so in a field that is intensely unpredictable, and complex, would be beyond the skill of a POSITA and require undue and excessive experimentation, as explained below. *Id.* For example, Engels provides no disclosure whatsoever as to the heating curves needed to obtain the specific microstructure shown in Engels, which a POSITA could not simply intuit or create based on the SEM picture. *Id.* Simply put, Engels does not include

sufficient disclosure to allow a POSITA (even armed with general knowledge in the field) to recreate the microstructure illustrated in the article, much less to practice the Challenged Claims.

Relative skill of those in the art: According to Petitioner, a POSITA would only “have had an undergraduate degree in materials science, manufacturing engineering, mechanical engineering, or equivalent knowledge, training, or experience, with two years of experience working in metallurgy.” Pet., 6. In short, a POSITA here is an experienced technician working in some aspect of metallurgy. A POSITA is *not* a specialist in, or even experienced with, the microstructural science of aluminum alloy coated hot-stamped steel, much less able to design manufacturing processes to create the specific microstructural phase layers required in the Challenged Claims (or to recreate the microstructure shown in Engels), without, at minimum, exceptional undue experimentation. Ex-2013 ¶¶100-06.

Here, a POSITA would have to, among other things, design the heating temperatures and rates, dwell and holding times, and cooling conditions that would during hot stamping yield the specific phase transformation, lamellar structure, and intermetallic layering in an aluminum alloy coating as called for in the Challenged Claims. But a POSITA, even armed with the knowledge in the art at the time, would lack the training, knowledge, and expertise to author such hot stamping designs without undue experimentation. *Id.* Undergraduate degrees in materials science,

manufacturing engineering, or mechanical engineering generally do not require courses in microstructures of phase and intermetallic layering created by diffusion kinetics in aluminum coatings on steel during hot stamping. *Id.*

Nor would adding two years of experience working in metallurgy provide the requisite knowledge. *Id.* Petitioner did not provide any evidence that two years of work experience would be sufficient to provide a POSITA with the requisite knowledge to make Engels's disclosures enabling. For example, Petitioner did not narrow or specify the types of metallurgical experience that would allow someone to be a POSITA. For example, a steel worker at a plant whose sole job was to melt and form steel slabs would qualify as a POSITA. *Id.*; Ex-2009, 940:14-941:4. Such an individual would not, of course, have the requisite knowledge to know how to achieve a specific microstructure in a hot-stamped aluminum coating based on just seeing an image of a microstructure. Ex-2013 ¶¶100-06. Simply, a POSITA cannot just be given an image of an intermetallic phase layered microstructure in an aluminum alloy coating that is a handful of microns thick and just "make it" as would be required to enable the SEM in Engels—this grossly oversimplifies the complex (and often unpredictable) chemistry, diffusion kinetics, and manufacturing tolerances involved. *Id.* Given the POSITA's lack of meaningful knowledge in the microstructural science of aluminum alloy coated hot-stamped steel, Engels would

need to provide *substantial* guidance (which it does not) for making the claimed invention. *Id.*

The amount of direction or guidance presented and presence or absence of working examples: Engels is focused on “wear problems” that occur “during the trimming operations” of the hot stamping process. Ex-1005, 1; Ex-2013 ¶¶107-11. Thus, Engels provides a brief overview of the hot stamping process and the focuses on analyzing the mechanical properties (e.g., tensile and hardness) of a hot stamped part. Ex-1005, 1, 2-9 (overview of hot stamping), 9-16 (analyzing mechanical properties); Ex-2013 ¶¶107-11. Engels, however, does not provide any meaningful “amount of direction or guidance” on how to make a product displaying the microstructure shown in the SEM in Engels, much less how to make products that meet the limitations of the Challenged Claims.

Specifically, Engels discloses (1) a generic and basic overview of steps of the hot stamping process; (2) some generic parameters associated with hot stamping; and (3) an SEM micrograph of the diffusion layer with a table describing layer thickness and elemental percentages. Ex-1005, 3, 7-9; Ex-2013 ¶¶107-11. Engels does not, however, disclose which parameters were used in the hot stamping process to create the part depicted in the SEM micrograph. Ex-2013 ¶¶107-11.

For example, as RPI’s expert conceded, Engels does not disclose a heating rate, heating curve, or heating time. Ex-2009, 964:9-13; Ex-2013 ¶¶107-11. Before

a POSITA could make the part depicted in the SEM micrograph or practice the Challenged Claims, a POSITA would have to determine parameters, such as base steel composition, base steel thickness, precoating composition, precoating thickness, precoating homogeneity, oven size, oven type, heating time, heating rate, heating range, and the dew point. Ex-2013 ¶¶107-11, 36-43, 56-62. Indeed, Engels even recognizes that many of these parameters must be set when hot stamping a part, but it says nothing about how these parameters collectively impact the formation, relative sizing, homogeneity, thickness, Kirkendall porosity (formation of voids in the microstructure), or composition of microstructural interdiffusion phase layers. Ex-1005. There are also no working examples of how to create such microstructural phase layers reflected in Figure 5 of Engels, or anything similar to that Figure.

In sum, Engels simply does not provide any meaningful direction, guidance, or examples showing how to create the microstructural phase layers reflected in its Figure 5. Ex-2013 ¶¶107-11. As such, to create what is reflected in Figure 5, a POSITA would be on their own to design and determine these parameters. But, given their lack of meaningful knowledge about the microstructural science of aluminum alloy coated hot-stamped steel, they would not succeed. *Id.* Simply put, the technician that Petitioner identifies as a POSITA would not be able to rise to the role of a microstructurally competent specification architect and designer to obtain

the patented inventions armed with just their own experience and the disclosure (or lack thereof) in Engels.

The state of the art and the predictability or unpredictability of the art:

The state of the art also would not help a POSITA succeed in creating what is disclosed in Figure 5. As RPI's expert succinctly stated, the state of the art did not show a relationship between the parameters and how each of them impacts the development of specific required attributes in microstructural phase layers in aluminum alloy (i.e., the formation of the coating):

I think it's not clear that how each one of those parameters affect the formation of the coating, because there hasn't been a good description in any document I've seen, other than to say that it has an influence, how that influence imposes itself, how those process conditions impose themselves in terms of forming a microstructure in the coating.

Because we've seen that it's possible to form coatings which don't have that microstructure.

And I think that there is according to the literature that I've seen, not a clear consensus in terms of precisely what set of conditions are required to produce that specific microstructure because we see that sometimes it occurs and sometimes it doesn't.

Ex-2009, 961:4-24. Indeed, consistent with RPI's expert's testimony, the art recognized that the hot stamping process was complex and there was a "lack of basic knowledge about mechanical and microstructural characteristics of sheets." Ex-2013 ¶¶112-14, 56-62. Thus, the state of the art showed that this art was

unpredictable and that there was a lack of knowledge about how the parameters impacted the resulting microstructure.

The quantity of experimentation: Because there was a lack of knowledge in the art, the art was unpredictable—the chemistry and diffusion kinetics at issue in practicing the Challenged Claims (or to obtain microstructures like that imaged in the SEM in Engels) are exceptionally complex. Ex-2013 ¶115. Moreover, there was no meaningful direction or guidance in Engels, and a POSITA would not have the necessary background in microstructural science of aluminum alloy coated hot-stamped steel. Thus, an extensive and undue amount of experimentation would be required to create a part with the interdiffusion phase layers reflected in Engels. *Id.* Before a POSITA could even begin to experiment, a POSITA would need to design the various required parameters and understand how those parameters impact the fouling behavior, microstructural properties, and phase transformations in an aluminum alloy that undergoes interdiffusion with steel during hot stamping. *Id.* ¶¶100-15 This is not only beyond the education, knowledge, and work experience of a POSITA, it is also beyond the knowledge of the state of the art. *Id.* Indeed, even today, the relationship among processing parameters, kinetics, and the resulting microstructural layers or phases is still being studied. *Id.* Thus, the quantity of experimentation needed to arrive at either the claimed invention (or even to create the product in the Engels SEM) would be extensive and undue. *Id.*

In sum, Engels's disclosures do not provide the necessary information for a POSITA to arrive at the claimed invention (or to create the product in the Engels SEM) without undue and excessive experimentation. *Adang v. Fischhoff*, 286 F.3d 1346, 1358 (Fed. Cir. 2002) ("However, the gaps in the disclosure of [prior art reference] amount to far more than minor details . . . Accordingly, we affirm the Board's conclusion that [prior art reference] did not enable the invention."). Thus, Engels lacks enablement.

C. Grounds 1A-1G: Engels does not disclose the claimed superficial layer (Limitations [1g], [21], and [24])

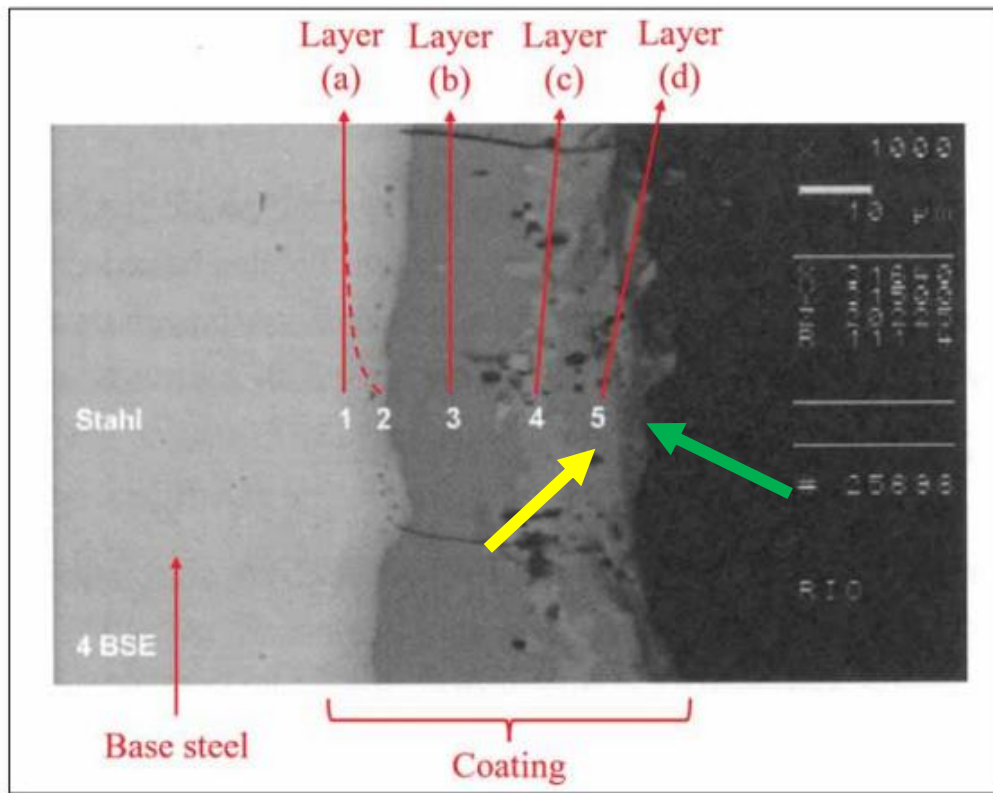
The asserted claims require a "superficial layer" with a specifically recited compositional relationship to other claimed layers. Ex-2013 ¶116. Petitioner asserts that Engels's phase 5 is the superficial layer. Pet., 17-18. However, phase 5 is not and cannot be the superficial layer because it is not in the superficial (i.e., surface) layer position in the Engels micrograph.

The plain and ordinary meaning of "superficial layer" is surface layer. Ex-2013 ¶¶117-19. Indeed, Dr. Miles equated "superficial layer" and surface. Ex-1003 ¶46. Similarly, in the '683 Patent IPR, Petitioner proposed that a POSITA "would have understood 'Superficial layer' to mean 'a surface layer.'" Ex-1031, 22-24, 33; Pet., 19.

But the alleged superficial layer in Engels—phase 5—is not at the surface. A simple visual examination of the SEM shows that there is another layer above (as in

exterior to) phase 5. Ex-2013 ¶¶120-24. In an SEM, as Dr. Miles admitted, different brightness or contrast is “reflective of the composition of the imaged material.” Ex-1003 ¶35; *see also* Pet., 21 n.3 (“Dr. Miles explains that the measurement was conducted based on the shadings in FIG. 5, which, based on Engels’ disclosure and his familiarity with imaging using backscattered electrons (BSE) in scanning electron microscopy (SEM), correspond to the different phases of the coating.”). In other words, a different brightness indicates a layer with a different composition. Ex-2013 ¶¶120-124.² In Engels, there is another layer, with a different brightness, above layer 5; as shown below, the yellow arrow on the left shows layer 5 while the green arrow on the right shows a layer above layer 5. *Id.* ¶123:

² To be clear, while a different brightness in an SEM micrograph indicates that the overall composition of the layer is different, the brightness does not indicate whether a specific element within a layer has a different composition than that same element in another layer. Ex-2013 ¶122.



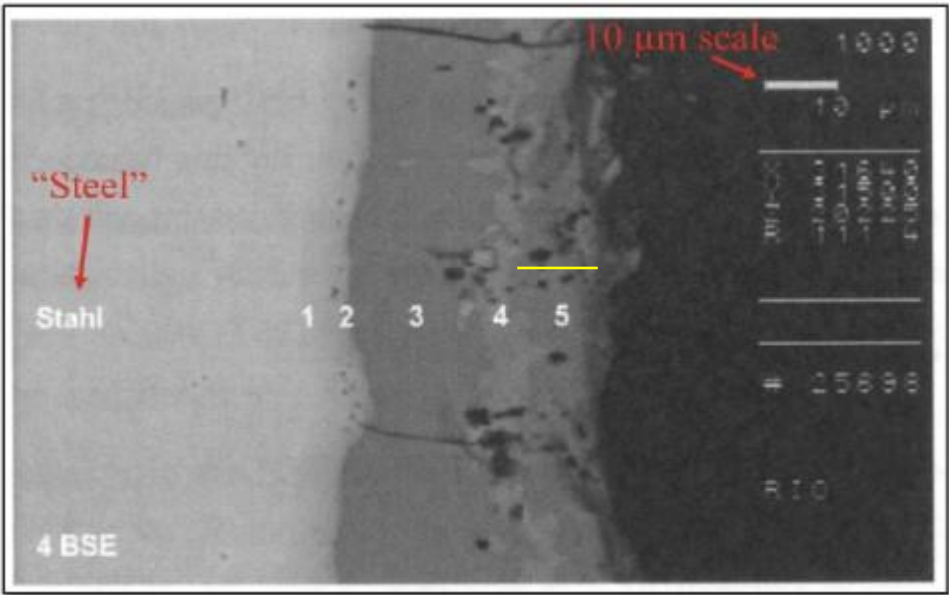
Annotated Engels FIG. 5

Ex-1003, ¶45 (adding annotations).

There is nothing in Engels that demonstrates what Engels identified as phase 5 extends to the surface. On Figure 5, Engels self-identified five phases based on being able to easily distinguish them (e.g., because of shading), and then in a corresponding table, provided the measurements for each of the identified phases. Ex-2013 ¶¶125-29. The measurement provided by Engels for phase 5 shows that it does not extend to the surface. *Id.* Engels's Table, shows the "layer thickness" in μm for each phase:

phase number	layer thickness, μm	Al	Fe	Si	Cr	Mn
		Volume-%				
1	5 – 9	7,2	89,2	1,9	0,3	1,4
2	< 1 μm	unmeasurable				
3	11 – 18	51,4	45,9	1,9	0,1	0,7
4	3 – 8	33,9	54,3	10,6	0,3	0,9
5	5 - 11	53,2	44,1	1,9	0,2	0,6

Ex-1003, ¶24; Ex-2013 ¶¶125-29. Engels shows phase 5 as having a measurement of 5-11 μm . Ex-1003, ¶24; Ex-2013 ¶¶125-29. In the below-annotated version of Figure 5, a yellow line that is 11 μm long (based on the 10 μm scale) is added. Ex-2013 ¶¶125-29. As shown, Engels’s phase 5 does not extend to the surface.



Id. Thus, Engels’s phase 5 cannot be the claimed superficial layer.

As such, it is clear that the identified layer 5 cannot be the topmost or surface layer. *Id.* ¶¶117-129. Engels’s measurements, which state layer 5 has a measurement of 5-11 μm , conclusively proves (as depicted above) that layer 5 does not reach the surface. *Id.* Petitioner also cannot claim that the scale depicted in the

SEM is inaccurate because Petitioner uses this same scale to argue that the SEM in Engels has an overall thickness of more than 30 μm . Pet., 21-22; Ex-1003 ¶¶52-53.

Merely because Engels self-identifies only five layers does not mean the image in Figure 5 consists of only five layers—it plainly does not. Ex-2013 ¶¶133-35. Engels did not state that it was attempting to identify all layers present in the SEM micrograph, but instead qualified its identification of layers to those that “can easily be distinguished.” *Id.* ¶¶133-35. As Dr. Raabe explains, Engels also would not have been concerned with the topmost layer because the goal of Engels was to assess non-destructive ways to test the strength and hardness of a hot-stamped part. *Id.* The strength and hardness of a part is primarily derived from the properties of the base steel *beneath* the coating (and thus most impacted by the layers *below* the surface layer). *Id.* The surface layer, meanwhile, has a greater impact on corrosion resistance and weldability, an issue different from what Engels was addressing. *Id.* As such, Engels would not have been preoccupied with identifying and providing measurements for the surface layer (which it did not). *Id.*

Furthermore, as additional independent reasons for why Engels does not disclose the Challenged Claims, each superficial layer limitation recites a specific mean composition relationship.³ Claim [1g] requires the superficial layer to have “a

³ The same argument would apply to claim 14, which requires the overall composition of the phase 5.

fourth mean iron composition different from the third mean iron composition.” Ex-1001, 15:11-13. Claim [21] requires the superficial layer to have “a fourth mean iron composition different from the first, second and third mean iron compositions.” Ex-1001, 16:60-62. And Claim [24] requires the superficial layer to have “a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition.” Ex-1001, 17:21-25.

Petitioner also has not shown that Engels discloses a “mean” composition. To anticipate, a reference must “expressly or inherently” disclose all the limitations of the claim. Here, as Dr. Miles recognizes, Engels does not expressly disclose a “mean” composition: “Engels discloses the ‘chemical composition’ of each phase, not explicitly a ‘mean’ composition.” Ex-1003, ¶49; Pet., 20. Dr. Miles then relies on the possibility that a POSITA “*might* sample” portions to obtain a mean composition to state that a POSITA would have understood Engels to be disclosing mean compositions. Ex-1003, ¶49; Pet., 20. The fact that something “might” happen is insufficient to show anticipation by inherency as a matter of law. *HTC Corp. v. Cellular Commc’ns Equip., LLC*, 877 F.3d 1361, 1369 (Fed. Cir. 2017) (“Inherency, however, may not be established by probabilities or possibilities.”).

Yet there is no evidence that the alleged superficial layer in Engels meets the recited mean compositional relationship. Engels only provides the “Volume-%” for

the phase numbers corresponding to the layer thicknesses provided in its table. Ex-2013 ¶¶136-43. Phase 5 in Engels has a thickness of only 5-11 μm , and, as shown above, phase 5 does not extend to the surface. Thus, when Engels provides a “Volume-%,” it is not doing it for a layer that is a surface layer, but instead provides a “Volume-%” for a 5-11 μm thick portion of the layer. *Id.*

In other words, even if the Board disagrees with Patent Owner’s argument and finds that phase 5 is the superficial layer, Engels does not provide sufficient information to determine if phase 5 has a different mean iron or aluminum composition than other layers as recited in limitations [1g], [21], and [24]. *Id.* This is because Engels only provides compositional and elemental information for the first 11 μm of what would then be phase 5. *Id.* As shown above, if the Board finds there is not a separate layer above layer 5, layer 5 would necessarily extend beyond 11 μm to the product surface. *Id.* But Engels reports no elemental composition data for the portion the coating shown in the SEM micrograph above that first 11 μm . *Id.* Thus, there is no evidence that the mean composition of purported layer 5 discloses the recited mean compositional relationship in the Challenged Claims.⁴ Therefore,

⁴ The Institution Decision suggested that the text of Engels confirmed that the layers have different compositions. Paper 11, 25-26. Engels, however, discloses only the *overall* composition of each layer. Ex-2013 ¶¶141-43. Indeed, Engels’s statement that the layers have a different composition must refer to the overall composition because specific elements in different layers have the *same* “Volume-%.” *Id.*; Ex-

Engels does not render the Challenged Claims unpatentable.⁵

D. Grounds 2A-2C: GMW14400 is not prior art

Petitioner's Ground 2 relies on GMW14400, but Petitioner did not show that GMW14400 was publicly available before the critical date. Petitioner relies on the declaration of June Ann Munford to allege GMW14400 was publicly available before the critical date. Pet., 3; Ex-1027.

To start, Ms. Munford relies on the declaration of Ms. Schuster to assert that GMW14400 was available for purchase from Accuris since December 1, 2005. Ex-1027, 5 (citing Appendix SCHUSTER01). But Ms. Schuster only states that GMW14400 was "listed in our database and available to the public for purchase online since December 1, 2005." Merely stating something is "available to the

1005, 9 (e.g., "Si" or "Cr"). The Challenged Claims require a specific element within each layer to have a different value (e.g., "iron" or "aluminum"). Ex-2013 ¶¶141-43. Engels's statement that the five phases differ in chemical composition does not disclose whether the specific iron and aluminum compositions in Engels's layers anticipate the claims as it only addresses the overall composition of the layer. *Id.*

⁵ Although Petitioner asserts that Engels also renders obvious the Challenged Claims, Petitioner's obviousness arguments relate to different aspects of the claims. *E.g.*, Pet., 24 (alleged obviousness of overall layer thickness). As it relates to the limitations of the claims described above, Petitioner only states that "Engels discloses or renders obvious" these limitations but does not actually set forth any explanation of how these limitations are rendered obvious in view of Engels. Pet., 17-21. Petitioner's assertions are insufficient to show these limitations are obviousness. *LinkedIn Corp. v. eBuddy Techs. B.V.*, IPR2022-00165, Paper 40 at 33 (PTAB June 30, 2023).

public” is insufficient to show public availability. *See Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1349 (Fed. Cir. 2016). Instead, Petitioner needed to, but did not, show that an interested POSITA would have been able to locate GMW14400. *Samsung Elecs. Co., Ltd. v. Infobridge Pte. Ltd.*, 929 F.3d 1363, 1372 (Fed. Cir. 2019); *Acceleration Bay, LLC v. Activision Blizzard Inc.*, 908 F.3d 765, 772-73 (Fed. Cir. 2018). Petitioner never identified any basis why a POSITA would have known to look at Accuris at all at the time.

The Institution Decision stated that “Information Handling Services” or “Accuris” had GMW14400. But respectfully, that is inapposite to Petitioner’s burden to show that an interested POSITA would have found GMW14400. It is not evident that a POSITA (as defined here as an experience technician) would search for automobile standards intended for GM’s contract manufacturers. Petitioner identifies no theory why a POSITA would have been motivated to do so.

Ms. Munford also relies on three websites from Internet Archive, but, again, Petitioner never identifies any basis as to why a POSITA would have known about the hyperlinks behind these websites. *Ens Labs Ltd. v. Unstoppable Domains Inc.*, IPR2024-00872, Paper 8 at 19-20 (PTAB Nov. 22, 2024); *Microsoft Corp. v. Throughtputer, Inc.*, IPR2022-01566, Paper 13 at 11-12 (PTAB May 31, 2023). The Institution Decision believed Petitioner had identified a theory where a POSITA would have known about these websites they allegedly “provide[d] information for

aerospace engineers.” But Petitioner has not identified any theory why a POSITA would be looking to aerospace engineering resources regarding the subject matter of this invention—use of high-strength steel in automobiles. Whether aerospace engineers would have known about Accuris is irrelevant to whether a POSITA would have known about Accuris.

Similarly, Dr. Miles’s assertion that the purpose of GMW14400 is to inform steel makers of the requirements of steel to be used in the GMW14400 does not show why a POSITA in this case would have known about this website. A POSITA here is not someone who designs hot stamping process parameters and is not an architect of processes to manufacture aluminum alloy coatings for steel, but instead is analogous to a technician who implements already crafted processes. Ex-2013 ¶¶34-35, 101-104; Ex-2009, 940:14-941:4. Whether steel companies are informed of GMW14400 does not indicate whether a POSITA would have known about GMW14400.

Lastly, Ms. Munford’s archived websites are from 2003, years before GMW14400 allegedly became publicly available in December 2005. *Envirologix Inc. v. Ionian Techs., Inc.*, IPR2018-00405, Paper 12 at 13-15 (PTAB July 30, 2018). Petitioner never identifies any basis to believe a website in 2003 would have any relevance as to what was on that website years later.

In sum, the proffered evidence does not support that a POSITA would have known about GMW14400.

E. Grounds 2A-2C: There is no motivation to combine

A POSITA would not have been motivated to combine Takagi, Hein, and GMW14400. Petitioner argues that a POSITA would have been motivated to combine Takagi, GMW14400, and Hein because of “market demand” based on GMW14400 (which identifies a thicker final coating of 35 μm) and other factors. Pet., 55-56. However, there are multiple reasons Petitioner’s reliance on GMW14400 (or other art) as a basis for a motivation to combine is misplaced.

1. GMW14400 does not drive “market demand” and is not directed to POSITA at issue here

As an initial matter, GMW14400 would not have created and driven a general “market demand” towards the criteria in its specification. Ex-2013 ¶¶145-146. GMW14400 is a “worldwide engineering standards” document that identifies requirements for “low carbon, heat-treatable boron steel” to be used in future parts for General Motors vehicles. Ex-1026, 1; Ex-2013 ¶¶97-99; Ex-1003, ¶140. But in the automotive world, carmakers such as General Motors obtain their parts from Tier 1 suppliers under contracts with those suppliers. Ex-2009, 83:14-22, Ex-2013 ¶¶145-46. Tier 1 suppliers are the companies contracted to hot stamp and produce parts for carmakers *based on the carmaker’s designs*. Ex-2009, 83:14-22, Ex-2013 ¶¶145-46. Thus, the intended audience for GMW14400 are Tier 1 suppliers under

contract with GM to produce GM-designed parts, and the individuals at those Tier 1 suppliers who design the hot-stamping processes to manufacture those parts. Ex-2013 ¶¶145-46.

As explained above, however, here, a POSITA, would have been an experienced technician working in some aspect of metallurgy, *not* someone who has risen to the highly specialized role of designing hot-stamping processing procedures for aluminum alloy coated steel (much less specifically for GM). Ex-2013 ¶¶34-35, 101-04; Ex-2009, 940:14-941:4. Thus, a POSITA would not have been motivated by GMW14400 because GMW14400 was directed to and intended for a very different (and very specific) audience. Ex-2013 ¶¶144-45. Petitioner has not set forth any evidence that a POSITA specifically would have been motivated by GMW14400. By contrast, Patent Owner's expert Dr. Raabe *has* conducted such research, and over many years. Ex-2013 ¶¶3-15. And, as Dr. Raabe explains, a POSITA would not have been motivated by GMW14400 to try to combine Takagi and Hein (and, as described below, doing so would have been beyond a POSITA's skill without exceptional undue experimentation).

2. Technical considerations teach away from the combination

In addition, there are many manufacturing related reasons why one would not have been motivated to obtain a post-hot stamping coating thickness of greater than 35 μm as required by Petitioner's proffered combination. Ex-2013 ¶¶147-58.

Achieving a post-hot stamping coating thickness of more than 35 μm means that more pre-coating must be used on the base steel before the hot stamping process begins. *Id.* ¶148. Using more pre-coating would, of course, increase manufacturing costs. *Id.* But more critically, applying more pre-coating to a base steel would create significant issues and problems during the manufacturing process. *Id.* ¶¶149-58. For example, pre-coating is applied to a base steel using a hot-dip process. *Id.* ¶149. To obtain a thicker pre-coating, the requirements for the precoating aluminum alloy immersion bath for the base steel would need to be more exacting, which in turn would lead to longer manufacturing times, potential waste (product outside of specification), and reduced output. *Id.* During the heating step of the hot-stamping process, the increase in aluminum coating also leads to an excessive transfer of liquid to the production equipment, causing fouling in the hot stamping line and related manufacturing surfaces. *Id.* ¶¶149-50; Ex-2009, 116:21-117:19; Ex-1001, 1:65-2:2. Fouling would lead to equipment problems, cause equipment to degrade faster, and eventually require production lines to stop operation to facilitate repairs, leading again to longer manufacturing times, reduced output, and increased costs. Ex-2013 ¶150; Ex-1001, 1:65-2:2.

As another problem, the more coating that is applied, the higher probability that the coating will not be applied evenly across the base steel. Ex-2013 ¶151. When the coating is not applied evenly, the resulting diffusion layers will not form

properly, which can impair, for example, weldability. *Id.* An increase in AlSi coating also increases thermal insulation. *Id.* ¶152. Using more coating means that the heating step will be less efficient, which can require additional heating curve adjustments resulting in, among other things, the use of increased temperatures and longer heating times. *Id.* This would also increase cost and manufacturing times. *Id.* ¶154. As another issue, an increase in coating means the interdiffusion phase layers will be thicker and more pronounced. *Id.* ¶153. However, unless the microstructure is properly designed as set forth in the Challenged Claims, thicker interdiffusion phase layers will lead to issues with formability because there is an increased likelihood that the part's surface coating will crack or have other issues during the forming step. *Id.* As noted above, thicker coatings require more time for interdiffusion between the aluminum and steel, increasing the fouling risk. *Id.* ¶¶149-50.

In sum, for multiple reasons, the conventional wisdom when the Challenged Claims were invented was that increasing the thickness of the aluminum alloy coating was not commercially desirable. *Id.* ¶155. Petitioner and its expert Dr. Miles oversimplify this very complex field, arguing by fiat that it would be obvious that “more is better.” But the opposite is true—what was conventionally thought at the time was that more was *not* better. *Id.* It was not until the inventors set forth their specific microstructural design and teachings in the '602 Patent that a

microstructural design for phase layers in aluminum alloy coating was created and enabled that would facilitate high weldability, high paintability, as well as avoid cracking and formation failure. *Id.*

Although a general POSITA would not have been involved with the *design* of the hot-stamping process or the design of microstructural phase layers in aluminum alloy coatings for the reasons explained above, a POSITA would have been well-aware of the problems caused by using additional amounts of pre-coating. *Id.* ¶156. For example, a technician or operator on a hot-stamping line would be well-aware of production problems caused by fouling of the equipment and the other issues described (as these issues are parallel to slag formation that occurs at multiple stages of metallurgical processing). *Id.* Thus, a POSITA would have been aware of the reasons that taught away from trying to achieve a thicker steel coating (such as trying to achieve the 35 µm threshold for aluminum alloy coatings suggested in GMW14400). *Id.*

In light of all the issues above, it is not surprising that GMW14400 itself makes clear that its specification does not prescribe a mandatory set of requirements. *Id.* ¶157; Ex-1026, 7 n.1 (stating additional demands can be specified). Petitioner's reliance on GMW14400 as a basis for a motivation to combine is unavailing. There is no factual support to suggest that POSITA would have been motivated to combine Takagi and Hein, with or without GMW14400.

3. A POSITA would not think the properties of Hein could be obtained by combining with the microstructure of Takagi.

To avoid this, Petitioner also asserts that a POSITA would have been motivated to the combination by Hein's disclosure concerning the mechanical properties (e.g., the strength) of the resulting hot stamped part in Hein. Pet., 56 (Hein "provide[s] benefits including high tensile strength and yield strength, a lack of springback, and a 'highly adherent' coating with 'good corrosion properties.'"). But this motivation assumes that Takagi's properties are inferior to Hein's properties. Ex-2013 ¶159. Petitioner, however, did not provide any evidence about how the properties of the product in Takagi compare to that in Hein, and whether Takagi results in a superior or inferior product to Hein. *Id.*; Pet., 56; Ex-1003, ¶145.⁶ See also *Arctic Cat Inc. v. Polaris Indus., Inc.*, 795 F. App'x 827, 833 (Fed. Cir. 2019) ("Arctic Cat's case was doomed when it failed to prove the premise it offered for combining Sundahl with Suzuki."); *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1369 (Fed. Cir. 2012) ("Because each device independently operates

⁶ In the hot stamping process, martensitic transformation occurs during the final forming and quenching steps. Ex-2013 ¶¶43, 160; Ex-1003, ¶31. To the extent a POSITA was motivated by these attributes of Hein, a POSITA would have looked to the factors that influence these parameters (total cycle time, stamping, and cooling), Ex-1019, 2, and would not have been motivated to use Hein's other processing parameters.

effectively, a [POSITA], who was merely seeking to create a better device . . . would have no reason to combine the features of both devices into a single device.”)

Ignoring this, Petitioners allege a motivation to combine Takagi with Hein based on Hein’s description of “an alloyed layer” illustrated in Hein Figure 4, which it states was “highly adherent” and “with good corrosion properties.” Pet., 56; Ex-2013 ¶¶159-61; Ex-1019, 3. But Hein does not specify the processing parameters for how the “alloyed layer” depicted in Figure 4 was obtained. Ex-2013 ¶161; Ex-1019, 2-3. Thus, it is not clear what processing parameters a POSITA would even be able to adopt from Hein. *Id.*

Regardless, “corrosion resistance” is not some independent feature separable from the layered microstructure of the aluminum alloy coating—corrosion resistance is a feature that results *from* the microstructure. *Id.* ¶¶162-63. A POSITA could not just combine the (undefined) processing parameters that yielded Hein Figure 4 with the properties of Takagi (with a different layered microstructure than Hein Figure 4) and expect to obtain the *same* corrosion resistant properties. *Id.* One cannot say “I like the aerodynamics of one plane and the physical form of another, so I will just combine them”—the attribute, whether aerodynamics or corrosion resistance, is derived from and depends on *the form* and thus cannot be separated or “mixed and matched” as Petitioner proposes here. *Id.* If a POSITA wants to obtain the corrosion resistance reflected in Hein Figure 4, they need to replicate the microstructure shown

in that figure (although Hein does not disclose how to do so). *Id.* A POSITA cannot get the corrosion resistance stated in Hein using the microstructure disclosed in Takagi. Thus, to the extent a POSITA is motivated by Hein's description of a corrosion resistance layer, a POSITA would have been motivated to use the microstructure depicted in Hein Figure 4 and not some different structure such as Takagi. *Id.* ¶164.

* * *

In sum, there would not have been a motivation to combine Takagi, GMW14400, and Hein. *Id.* ¶165.

F. Grounds 2A-2C: There would have been no reasonable expectation of success in achieving Petitioner's proposed combination with just reasonable experimentation

Notwithstanding that there would not be a motivation to combine, for example Takagi, Hein, and GMW14400, to the extent someone still wanted to obtain a post-hot stamping aluminum alloy coating thickness greater than 35 μm , a POSITA would have had no reasonable expectation of success to achieve that combination with just reasonable experimentation. To take the multi-layered microstructure shown in Takagi and replicate it in a thicker coating form—while still maintaining the intermetallic phase layering and structure in Takagi—would require substantial expertise, experience, and extensive experimentation. *Id.* ¶166. Even Petitioner's

expert agrees that “trial and error” would be “require[d],” Ex-1003, ¶151, albeit severely underestimating the scope of such efforts. Ex-2013 ¶166-81.

1. The science at issue here is complex and unpredictable

Obtaining specific phase layering and controlled formation and coalescence of intermetallic materials from steel diffusing into aluminum alloy is exceedingly complex and unpredictable. *Id.* ¶167. The task here is not simply, as Petitioner seems to presume, taking Takagi’s microstructure and “upsizing” it to make it “bigger” (i.e., thicker). *Id.* Designing and controlling microstructure via diffusion kinetics to form intermetallic phase layers is *not* like baking a muffin—you don’t just add more batter to the pan and get the same muffin, just taller. *Id.*

The flaw in Petitioner’s conclusory *ipse dixit* is that it presupposes that the various microstructural attributes (like intermetallic phase layering) and hot stamping parameters (like heating curves) can simply be combined as one might combine the ingredients at a salad bar to obtain the desired combination. *E.g.*, Ex-1003, ¶151. According to Petitioner’s flawed logic, because there are a “finite number of possible experimental values” for compositions and various hot stamping parameters, the result called for in the Challenged Claims could be supposedly achieved by “trial and error” with mere “routine experimentation.” *Id.* But this is belied by the fact that there is not only an enormous range of options within each variable—e.g., an untold number of options to set heating curves alone—but that the

interaction between those variables can be unpredictable. Ex-2013 ¶168. Petitioner overlooks that the allegedly “finite” number of ways to combine compositional elements, precoating thickness, various heating curve options, holding times, and cooling parameters is very, very, very large and the relationship among these variables and the hot-stamped microstructure was unpredictable and still be researched. *Id.* ¶169. *Cf. Sanofi-Synthelabo v. Apotex, Inc.*, 550 F.3d 1075, 1088 (Fed. Cir. 2008) (“Only with hindsight knowledge that the dextrorotatory enantiomer has highly desirable properties, can Apotex argue that it would have been obvious to select this particular racemate and undertake its arduous separation.”). Indeed, Petitioner does not identify the number of constituent options in all the parameters required to form the alleged combination or calculate the product of each multiplied against each other. Dr. Miles just concludes by fiat that the options are “finite” and thus identifiable by “trial and error.” Ex-1003, ¶151. To indulge Dr. Miles’s logic would render every patent ever issued supposedly obvious, as every invention ever made combines the “finite” resources known to mankind in a way that would be discoverable with unlimited trial and error.

Designing hot stamping parameters that manipulate diffusion kinetics to yield a particular multi-layered intermetallic microstructure in an aluminum alloy is neither a one or two-dimensional exercise nor depends entirely on predictable result effective parameters. *Id.* ¶¶170-72. This is not like boiling water where the amount

of heat applied or volume of water heated yields predicable, calculable results as to when the water will boil. Here, as RPI's own expert has testified, "it's not clear [] how each one of those parameters [heating curves, holding, and quenching parameters] affect the formation of the coating...." Ex-2009 (Brown), 961:4-24. As RPI's expert testified *after reviewing every reference raised here by Petitioners*: "[T]here is according to the literature that I've seen, not a clear consensus in terms of precisely what set of conditions are required to produce that specific microstructure because we see that sometimes it occurs and sometimes it doesn't." *Id.* As RPI's expert explained: "there hasn't been a good description in any document I've seen, ... [as to] how those process conditions [heating curves, holding, and quenching parameters] impose themselves in terms of forming a microstructure in the coating." *Id.*

The view of RPI's expert is confirmed by the very references Petitioner relies on now. As Takagi itself stated at the time: "The mechanism of formation of the layered structure is not fully evident." EX-1016, ¶19. Here, as Dr. Raabe explains, not a single variable—not elemental compositions, not thickness, not heating curves, not temperatures nor rates, not holding times, nor quenching parameters—was itself known to give rise to the multi-layered intermetallic microstructure required by the Challenged Claims. Ex-2013 ¶172. Rather, the desired microstructure was the product of the complex interaction of these multiple factors, many of which

themselves yield unpredictable results as detailed below. *Id.* This is why it took the inventors themselves *years* of extensive research to come to the inventions in the Challenged Claims. *Id.*; *supra* Section VI.A. And the inventors here were substantially *more* experienced and skilled in this field of coating and microstructure design than a POSITA.

As Dr. Raabe explains, even a single variable, like the heating curve, can itself be exceedingly complex and subject to immense variation. Ex-2013 ¶173. Heating need not be linear or constant—heating can be accelerated, decelerated, or held steady for any period throughout the heating stage, resulting in enormous optionality and variation. *Id.* ¶174. Heating curves in hot stamping typically are not linear (defined by two points and heating rate), or even a simple curve, but typically constitute a complex series of variable adjustments over the heating period. *Id.* And, while such adjustments and variables affect kinetics generally, it was not known how such adjustments affected or could be modulated to create the multi-layered intermetallic microstructure required by the Challenged Claims. *Id.*

This wide, broad range of just heating curve options alone, combined with other variables noted above like variation in coating thickness, results in a sea of hot stamping parameter design options—but without any guidance in the art at the time as to how the multi-layered intermetallic microstructure required by the Challenged Claims might be obtained or maintained at different coating thicknesses. A POSITA

tasked with, for example, combining the microstructure shown in Takagi with a thicker aluminum alloy coating (e.g., Hein or the parameters listed in GMW14400) would not have a reasonable likelihood of success. As Dr. Raabe explains, whatever impact the above variables may have on diffusion kinetics is altered when material thickness is altered. *Id.* ¶175. Whatever parameters give rise to, for example, a four-layered intermetallic microstructure yielding a 25 µm coating, will not result in the same microstructure in a thicker or thinner coating. *Id.*

Rather, to increase the thickness of the coating while maintaining the same targeted microstructure (albeit enlarged), the specification designer must redesign the other parameters to again achieve the targeted microstructure under different diffusion kinetics in a different material thickness. *Id.* ¶176. And, as noted above, at the time the Challenged Claims were invented, there was no understanding in the field as to how exactly these variables could be modulated to achieve that result. *Id.*; Ex-2009, 961:4-24. At best, Petitioner's combination serves as an "invitation to experiment," which in no way suggests any reasonable expectation of success in that experiment, absent undue experimentation (e.g., plugging and chugging through countless variations of parameters in hopes of happening upon the Challenged Claims). *Id.* ¶177.

2. A POSITA would lack the expertise to reasonably succeed in combining the prior art to obtain the Challenged Claims

This lack of reasonable expectation of success is heightened because, as detailed above, the POSITA here—an experienced technician—would not be expected to have any experience designing hot stamping parameters to obtain particular multi-layered intermetallic phases in aluminum alloy via diffusion kinetics. *Id.* ¶178. To do so here, a POSITA would need to make significant adjustments to the process in light of the issues outlined above, such that it would require much more than just trivial adjustments to a hot stamping process (and beyond their experience). *Id.* Thus, Petitioner is simply incorrect that adjustments to Takagi were “within the skill” of a POSITA and “would have been achievable with a reasonable expectation of success.” *Id.*

In sum, there is no evidence that a POSITA would have had a reasonable expectation of success in modifying Takagi with Hein or GMW14400, *without impacting the other properties of Takagi*. *Id.* ¶179. Indeed, as just one example—as noted above, additional coating reduces heating efficiency and alters diffusion kinetics, implicating required changes to the heating curve. *Id.* This impacts the formation of layers, including individual layers within the interdiffusion layers, including requiring greater individual layer thicknesses (as is readily apparent if the overall thickness needs to be greater than 35 μm , then the individual layers must also be thicker). *Id.* There is no evidence about how a longer formation time required

for thicker coatings and layers impacts the elemental composition of these layers (or the correlative formation of intermetallic compounds). *Id.* Dr. Miles does not address (but appears to assume) that the elemental composition of each layer and the relationships of the elemental composition among the layers will stay the same. *Id.* This is not so. *Id.*

As heating time increases, and the layers grow thicker, more diffusion occurs and the elemental composition of each layer changes. *Id.* ¶180; *see also* Ex-2009, 961:4-24. Similarly, the diffusion kinetics affected by changes in the heating curve implicated in attempting a thicker coating can affect the coalescence of, or give rise to the degradation of, the desired phase layers. *Id.* There is thus no evidence that a POSITA would have had a reasonable expectation of success in modifying Takagi with GMW14400, *without altering the other properties of Takagi*. *Id.* Dr. Miles put forth no evidence other than his fiat that a POSITA would have any reasonable expectation of success in altering one variable of Takagi (thickness) while keeping the other characteristics static—this is exceedingly complicated and onerous to achieve. *Id.*

3. It would not be “obvious to try” mixing and matching various alleged prior art parameters Dr. Miles speculates.

Dr. Miles, however, opines that the alleged combination “would have entailed nothing more than applying Hein’s and GMW14400’s known techniques and parameters to Takagi to obtain a predictable result.” Ex-1003, ¶145. But this is just

Dr. Miles's *ipse dixit*, contradicted by the state of the art, contradicted by RPI's own expert, and simply wrong. Ex-2013 ¶181; Ex-2009, 961:4-24. Forming a specific intermetallic layered microstructure by diffusion kinetics during hot stamping is a complex process and the relationships between and among the various parameters is neither straightforward nor predictable. Ex-2013 ¶181. Petitioner's attempt to argue that certain parameters would have been obvious to try or to combine improperly looks at parameters in isolation without considering their impact on other hot stamping parameters and variables affecting microstructural development, and without considering the level of skill and knowledge in the field.

For example, Petitioner asserts that there was a supposed known "direct correlation" between pre-coating thickness and post-coating thickness. Ex-1003, ¶146. But this is true only at superficial and extremely general level—the more pre-coating material one starts with, the more post-hot-stamped coating there will be. But Petitioner's argument fails when Petitioner tries to impose a specific relationship between the pre-coating and post-hot-stamped coating thickness. Specifically, Petitioner asserts that the art recognized that there was generally a 50% increase in the post-hot-stamped coating thickness. *Id.* ¶¶142, 146. This is wrong. As Dr. Raabe explains, the post-hot-stamped coating thickness is going to be impacted by many parameters during the heating process prior to hot stamping, including heating temperature, heating time, heating rate, oven size, and more. Ex-2013 ¶¶36-43, 56-

62. Indeed, Petitioner's support for its proposition makes clear that its characterization of a 50% increase is an observation specific to the process described in that reference, under the specific heating conditions used there. Ex-1025, 5:1-20 ("The alloying, through interdiffusion, leads to an increased thickness of the layer which, *for the treatment specified above*, generally corresponds to a 50% increase." (emphasis added)). *Id.* ¶182.

Moreover, the general notion that more pre-coating material leads to more post-processing coating says nothing about *how* more pre-coating impacts diffusion kinetics and the formation of microstructural layering during the diffusion process. *Id.* It is not possible to have a "50%" increase in the post-coating, without impacting the other properties of the final hot stamped coating—but Petitioner and Dr. Miles have not shown what the relationship is among these variables. *Id.* Petitioner makes the same error when it comes to pre-coating composition—varying the Al% and Si% in the pre-coating will impact the heating process, the formation of layers, the growth of the layers, the diffusion kinetics, the Kirkendall effect (the formation of voids in microstructural layers), the composition of the layers, and the characteristics of the final coating. *Id.* ¶183. The same is true of the base steel, varying the elements in the base steel will also impact the diffusion kinetics. *Id.* But again, neither Petitioner nor Dr. Miles put forth evidence of how those interdependent relationships operate (or how a POSITA would know how to control them).

In sum, Petitioner just assumes that various hot-stamping parameters in the prior art are a smorgasbord of variables that would be “obvious to try.” For example, Petitioner asserts that it would have been “obvious to try” and combine: the pre-coating thickness of 25 μm /side as stated in Hein, the pre-coating thickness range of 20 to 33 μm stated in GMW14400, the 90 Al% AlSi pre-coating composition stated in Hein, the 85-96% Al% AlSi coating in GMW1400, the base steel composition in GMW14000, and/or Hein’s USIBOR 1500 base steel. Pet., 56-57. But an invention is only obvious under the “obvious to try” doctrine when “there are a finite number of identified, *predictable solutions*, a person of ordinary skill in the art has good reason to pursue the known options within his or her technical grasp.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 402 (2007) (emphasis added). “A finding of obviousness would not obtain where what was ‘obvious to try’ was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.” *Bayer Schering Pharma AG v. Barr Lab’ys, Inc.*, 575 F.3d 1341, 1347 (Fed. Cir. 2009) (internal quotations and citation omitted). As such, where, as in this case, there is evidence that variables interacted in an unpredictable or unexpected way, a combination can be nonobvious. *KSR*, 550 U.S. at 421.

The parameters associated with hot stamping do not have a predictable relationship and there are not just a “small or easily traversed” number of possibilities. *Bayer*, 575 F.3d at 1347. RPI’s own expert admitted that it was not known how the parameters at issue gave rise to the microstructural properties at issue here. Ex-2009, 961:4-24. As Dr. Raabe explained, hot stamping is a highly complex field, with many parameters that impact one another. Ex-2013 ¶¶36-43, 56-62. Indeed, research still exists today about the impact of various parameters on the hot stamping process and on the development and properties of microstructural layering in aluminum alloy coatings. *Id.*

Thus, a POSITA would not have had a “high confidence” (Ex-1003, ¶150) that the proposed modification would be successful. Contrary to Dr. Miles’s assertion, changing the pre-coating to a thickness of 25 μm is not a “small modification” compared to the 10-20 μm range disclosed by Takagi. At that scale, a difference of 5-15 μm is significant. Ex-2013 ¶184. To go from a pre-coating thickness of 10 μm to 25 μm would more than double the volume of coating material, giving rise to downchain impacts on diffusion kinetics, microstructural layer formation, and the resulting properties of the hot stamped part. *Id.* ¶¶36-43, 56-62, 184. As explained above, there are many reasons why a POSITA would not have had any reasonable expectation of success that they could double the volume of aluminum alloy coating while maintaining (or improving) the attributes and benefits

inherent in Takagi. *Id.* ¶184. Yet, while a POSITA may not have been able to obtain the Challenged Claims from the prior art as Dr. Miles assumes, a POSITA likely *would have* recognized that complexity and unpredictability at issue—a POSITA would not have thought that they could “obviously try” just mixing and matching aspects from different alleged prior art as Dr. Miles presumes. *Id.*

4. The alleged combination cannot be obtained using just reasonable experimentation.

There is nothing routine about the experimentation required to obtain the Challenged Claims. *Id.* ¶185. Although Petitioner asserts a POSITA would have “arrived at various coatings with layers having various thicknesses and compositions,” Petitioner’s argument is essentially that POSITA should “vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result.” *Bayer*, 575 F.3d at 1347. An invention is not obvious when a POSITA would need to do the inventing his or herself by varying all the parameters and trying all possible choices because the relationship among all the variables was not known and the art did not provide guidance about how parameters impact one another or impact the resulting attributes of the hot stamped part. *Id.*; Ex-2013 ¶¶36-43, 56-62, 185; Ex-2009, 961:4-24. For the reasons discussed above, given the complexity, unpredictability, specialized knowledge and experience required, still developing understanding in the field of the underlying kinetics, and generalist level

of ordinary skill a POSITA would have, the alleged combination could not be obtained by POSITA through mere routine experimentation alone. Ex-2013 ¶185.

* * *

In light of the above, there would not have been any reasonable expectation of success for a POSITA to achieve the Challenged Claims by combining Takagi, GMW14400, and Hein in any way.

G. Petitioner's Other Grounds

1. Grounds 1B: Claims 12/15/28, 13/16/29, 19, 23, and 25

Each of these claims require a specific overall composition (claims 12/15/28, 13/16/29), a specific percentage of iron (claim 19), a specific relationship among iron (claim 23), or a specific relationship among aluminum (claim 25). Petitioner concedes that the sole reference Engels does *not* expressly disclose the recited limitations.

Nevertheless, Petitioner argues that the recited limitations would have been obvious for two reasons: (1) the '602 Patent does not describe any criticality or unexpected results from the specifically recited limitations and (2) a POSITA would have been motivated the recited compositional element with a reasonable expectation of success. Pet., 27-32. As to (1), Petitioner is simply wrong on the law—the specification does not need to provide a showing of criticality or unexpected results. *See Genetics Inst., LLC v. Novartis Vaccines & Diagnostics*,

Inc., 655 F.3d 1291, 1307 (Fed. Cir. 2011) (“The dissent would require either an express prediction of unexpected properties in the patent specification or a showing of the inventors’ contemporaneous knowledge of such properties before the PTO or any court could consider such probative evidence. Our precedent contains no such requirement.” (citing cases)). As explained, small differences in any one parameter can have a significant impact on diffusion kinetics, the formation of layers, and the microstructure. *See supra* VI.F; Ex-2013 ¶¶36-43, 56-62, 144-85; Ex-2009, 961:4-24. A POSITA also would not have had a reasonable expectation of success. Ex-2013 ¶¶36-43, 56-62, 144-85.

2. Grounds 1B, 1C, and 1D and Ground 2B and 2C

For these grounds, Petitioner alleges that there would have been a motivation to combine based on “benefits” provided by the secondary references, without showing that the secondary references actually provide a benefit over the primary reference. Thus, there is no motivation to combine Engels and Cornette (Ground 1B), Engels and Laurent (Ground 1C), Engels and Nishibata (Ground 1D), Takagi, Hein, GMW14000, and Laurent (Ground 2B), and Takagi, Hein, GMW14400, and Nishibata (Ground 2C).

According to Petitioner, a POSITA would have been motivated to look at these secondary references because of various “benefits” discussed in them. Pet., 35 (Cornette has parameters that provide “good results in terms of weldability,

corrosion resistance, and mechanical strength”), 41 (Laurent’s components “improve performance”), 42 (Nishibata’s elements “can improve properties of steel”). But these are all relative terms and Petitioner makes no effort to compare the alleged benefits in any of these references to what is disclosed in the primary references. Thus, for example, there is no evidence that the benefits described in Cornette, Laurent, or Nishibata are superior to the attributes of Engels. And even with these references, there are indications that would teach away from using them, such as Cornette, which expressly states that mechanical properties are not guaranteed. Ex-2013 ¶186. A POSITA also would not have had a reasonable expectation of success for the reasons explained above. *See supra* VI.E and VI.F; Ex-2013 ¶¶36-43, 56-62, 144-85.

3. Grounds 1E and 1F

There is also no motivation to combine Engels, Cornette, Nishibata (Ground 1E) or Engels, Cornette, and Laurent (Ground 1F). *See supra* VI.E, VI.F., VI.G. The problem is also compounded by trying to combine disclosures from three *different* references, making it even more so that a POSITA also would not have had a reasonable expectation of success for the reasons explained above. *Id.*; Ex-2013 ¶187.

4. Grounds 1G

There is no motivation to combine Engels and Takagi. Petitioner appears to base its motivation on Takagi's description of "advantages" of certain characteristics. Again, like all of other Petitioner's combination, there is no evidence that Takagi's advantages are superior to Engel's microstructure; thus, there is no evidence that a POSITA would have been motivated to combine Engels and Takagi. Ex-2013 ¶186. There also would not have been a reasonable expectation of success, because as explained, this would not be a simple "optimization" or routine experimentation but would instead take undue and excessive experimentation. Ex-2013 ¶186.

H. Grounds 1A-1G and Grounds 2A-2C: Secondary Considerations demonstrate the non-obviousness of the Challenged Claims

Secondary considerations, such as commercial success, long-felt need and praise, and unexpected results also show that it would not have been obvious to combine the references in Petitioner's Grounds. "Commercial success is relevant because the law presumes an idea would successfully have been brought to market sooner, in response to market forces, had the idea been obvious to persons skilled in the art." *Merck & Co., Inc. v. Teva Pharms. USA, Inc.*, 395 F.3d 1364, 1376 (Fed. Cir. 2005). For unexpected results, "[t]he basic principle behind this rule is straightforward—that which would have been surprising to a person of ordinary skill in a particular art would not have been obvious. The principle applies most often to

the less predictable fields, such as chemistry, where minor changes in a product or process may yield substantially different results.” *In re Soni*, 54 F.3d 746, 750 (Fed. Cir. 1995). “Evidence of a long felt but unresolved need tends to show non-obviousness because it is reasonable to infer that the need would have not persisted had the solution been obvious.” *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1332 (Fed. Cir. 2016).

As explained above, before the invention of the Asserted Patents, USIBOR was not a commercial success. It was Dr. Drillet and his co-inventors who were tasked with developing innovations that could increase USIBOR’s commercial viability because only “very small volumes” were being sold before 2004. Ex-2009, 172:7-10. After the invention, USIBOR sales increased significantly (as it serves as a base-steel component in practicing the Challenged Claims). *Id.*, 147:22-148:6, 1066:22-1067:20, 716:1-14. Now, USIBOR (and DUCTIBOR) is a “very significant business success,” with more than half a million tons sold in North America alone between ArcelorMittal and its licensees in 2023. *Id.*, 89:9-14. The commercial success tied to the Asserted Patents is further reflected in the fact that they are widely licensed. *Id.*, 85:13-15. There was also a long-felt need and praise for the invention. In the industry, there was a need for high-strength steel that displayed better weldability, paintability, and better corrosion resistance. *Id.*, 1067:21-1068:8, 108:3-109:3, 461:21-463:3. There were also unexpected results as

the prior art had not achieved a hot stamped steel product that displayed at least the same qualities sought after in the art—i.e., better weldability, paintability, and better corrosion resistance. *Id.*, 1068:9-16, 147:22-148:6.

As demonstrated by the timeline—the invention and subsequent sales of USIBOR—there is a nexus between the secondary considerations and Challenged Claims. As Dr. Drillet explained, the sales of USIBOR were minimal before the invention, Dr. Drillet was specifically tasked with coming up with innovations to improve sales, and that sales in fact improved drastically after the invention. *Id.*, 147:22-148:6, 1066:22-1067:20. Thus, secondary considerations also show that the Challenged Claims are not unpatentable.

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Respectfully Submitted,

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CERTIFICATION UNDER 37 C.F.R. § 42.24(d)

Under the provisions of 37 C.F.R. § 42.24(d), the undersigned attorney hereby certifies that this document complies with the type-volume limitations of 37 C.F.R. § 42.24(b). The word count of the foregoing Patent Owner's Response is 13,899, according to the word count tool in Microsoft Word.

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CERTIFICATE OF SERVICE

The undersigned certifies service pursuant to 37 C.F.R. § 42.120 of a copy of this Patent Owner's Response and supporting materials upon Petitioner by email on June 10, 2025, to the following email addresses of record:

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