IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Pascal DRILLET et al.	
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Title:	Coated Steel Strips, Coated Stamped Products and Methods	

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PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT NO. 10,961,602 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42

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EXHIBITS

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EX-1002	Excerpts from the Prosecution History of the '602 Patent ("the Prosecution History")
EX-1003	Declaration of Dr. Michael Miles
EX-1004	Curriculum Vitae of Dr. Michael Miles
EX-1005	Engels et al., "Controlling and Monitoring of the Hot-Stamping Process of Boron-Alloyed Heat-Treated Steels" (2006) ("Engels")
EX-1006	Translation Certificate of Michael L. Magee
EX-1007	Excerpt from "New Developments in Sheet Metal Forming" (2006)
EX-1008	Declaration of Prof. Mathias Liewald
EX-1009	Declaration of Christoph Wohlstein
EX-1010	"Engels" and "Hein," in English and German, provided by the German National Library
EX-1011	[Reserved]
EX-1012	[Reserved]
EX-1013	[Reserved]
EX-1014	Cornette et al., "High Strength Steels for Automotive Safety Parts," SAE Technical Paper Series 2001-01-0078 (2001) ("Cornette")

EX-1015	Declaration of Mel DeSart
EX-1016	U.S. Patent Application Publication No. 2004/0009366 ("Takagi")
EX-1017	Japanese Patent No. JP3738754
EX-1018	Translation and Certificate of Translation for portions of EX-1017
EX-1019	Hein et al., "Hot Stamping of USIBOR 1500 P: Part and Process Analysis Based on Numerical Simulation" (2006) ("Hein")
EX-1020	Hein et al., "Pressharten von USIBOR 1500 P: Simulationsbasierte Bauteil- und Prozessanalyse" (2006)
EX-1021	Vaissiere et al., "Development of Pre-Coated Boron Steel for Applications on PSA Peugeot Citroën and RENAULT Bodies in White," SAE Technical Paper Series 2002-01-2048, reprinted from the Proceedings of the 2002 SAE International Body Engineering Conference and Automotive & Transportation Technology Conference (2002) ("Vaissiere")
EX-1022	Declaration of June Ann Munford - #1
EX-1023	U.S. Patent No. 6,296,805 ("Laurent")
EX-1024	French Patent Publication No. FR2833504
EX-1025	Translation of EX-1024 and Certificate of Accuracy
EX-1026	GMW14400 material specification ("GMW14400")
EX-1027	Declaration of June Ann Munford - #2
EX-1028	U.S. Patent No. 9,708,683 ("the '683 Patent")

EX-1029	Final Written Decision for IPR2019-01275, corresponding to EX-1028
EX-1030	Record of Oral Hearing for IPR2019-01275
EX-1031	Petition for IPR2019-01275
EX-1032	Somani et al., "Dimensional Changes and Microstructural Evolution in a B-bearing Steel in the Simulated Forming and Quenching Process," ISIJ International, Vol. 41 (2001) ("Somani")
EX-1033	Japanese Patent Publication JP2004244704
EX-1034	Translation of EX-1033 and Certification of Accuracy
EX-1035	WO Patent Application Publication No. WO02/103073
EX-1036	European Publication No. EP1865086
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EX-1038	Winkel, "Quenches for press hardening steel plate in the car industry" (2004)
EX-1039	Translation of EX-1038 and Certification of Accuracy
EX-1040	[Reserved]
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EX-1046	[Reserved]
EX-1047	Eriksson et al., "Testing and evaluation of material data for analysis of forming and hardening of boron steel components," Modelling Simul. Mater. Sci. Eng. 10 277 (2002)
EX-1048	[Reserved]
EX-1049	WO Patent Application Publication No. 2004/106573
EX-1050	Translation of EX-1049 and Declaration of Accuracy ("Nishibata")
EX-1051	Ahindra Ghosh, "Secondary Steelmaking, Principles and Applications" (2001)
EX-1052	U.S. Patent Publication No. 2004/0238080

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LISTING OF CLAIMS

Claim 1	
[1pre]	A precoated steel product comprising:
[1a]	a strip of base steel having a first side and a second side; and
[1b]	a coating on at least one of the first side of the strip of base steel and the second side of the strip of base steel,
[1c]	wherein the coating results from interdiffusion between the base steel, and an aluminum or aluminum alloy pre-coating,
[1d]	and wherein the coating includes, proceeding from the base steel outwards: (a) an interdiffusion layer having a first mean iron composition,
[1e]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1f]	(c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third mean iron composition being higher than the second mean iron composition; and
[1g]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1h]	wherein the coating has a thickness greater than 30 micrometers.
Claim 2	
[2]	The precoated steel product as recited in claim 1 wherein the layers (c) and (d) are quasi continuous by occupying at least 90% of a level corresponding to each of the layers (c) and (d) and wherein less than 10% of layer (c) is present at an extreme surface of the product.
Claim 3	
[3]	The precoated steel product as recited in claim 1 wherein the base steel includes the following components by weight based on total weight: 0.15%<carbon<0.5%; 0.5%<manganese<3%; 0.1%<silicon<0.5%; 0.01%<chromium<1%; titanium<0.2%; aluminum<0.1%;

	phosphorus<0.1%; sulfur<0.05%; 0.0005%<boron<0.08%; and further comprises iron and impurities inherent in processing.
Claim 4	
[4]	The precoated steel product as recited in claim 1 wherein the base steel comprises the following components by weight based on total weight: 0.20%<carbon<0.5%; 0.8%<manganese<1.5%; 0.1%<silicon<0.35%; 0.01%<chromium<1%; titanium<0.1%; aluminum<0.1%; phosphorus<0.05%; sulfur<0.03%; 0.0005%<boron<0.01%; and further comprises iron and impurities inherent in processing.
Claim 5	
[5]	The precoated steel product as recited in claim 1 wherein the base steel comprises 20 ppm or less of sulfur.
Claim 6	
[6]	The precoated steel product as recited in claim 2 wherein the base steel comprises 20 ppm or less of sulfur.
Claim 7	
[7]	The precoated steel product as recited in claim 1 wherein a ratio of titanium to nitrogen in the base steel in weight % is in excess of 3.42.
Claim 8	
[8]	The precoated steel product as recited in claim 2 wherein a ratio of titanium to nitrogen in the base steel in weight % is in excess of 3.42.
Claim 9	
[9]	The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 15 micrometers.
Claim 10	
[10]	The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 10 micrometers.

Claim 11	
[11]	The precoated steel product as recited in claim 1 wherein the interdiffusion layer comprises the following components by weight based on total weight: 86 to 95% Fe, 4 to10% Al, and 0 to 5% Si.
Claim 12	
[12]	The precoated steel product as recited in claim 1 wherein the intermediate layer comprises the following components by weight based on total weight: 39 to 47% Fe, 53 to 61% Al, and 0 to 2% Si.
Claim 13	
[13]	The precoated steel product as recited in claim 1 wherein the intermetallic layer comprises the following components by weight based on total weight: 62 to 67% Fe, 30 to 34% Al, and 2 to 6% Si.
Claim 14	
[14]	The precoated steel product as recited in claim 1 wherein the superficial layer comprises the following components by weight based on total weight: 39 to 47% Fe, 53 to 61% Al, and 0 to 2% Si.
Claim 15	
[15]	The precoated steel product as recited in claim 11 wherein the intermediate layer comprises the following components by weight based on total weight: 39 to 47% Fe, 53 to 61% Al, and 0 to 2% Si.
Claim 16	
[16]	The precoated steel product as recited in claim 15 wherein the intermetallic layer comprises the following components by weight based on total weight: 62 to 67% Fe, 30 to 34% Al, and 2 to 6% Si.
Claim 17	
[17]	The precoated steel product as recited in claim 16 wherein the superficial layer comprises the following components by weight based on total weight: 39 to 47% Fe, 53 to 61% Al, and 0 to 2% Si.

Claim 18	
[18]	The precoated steel product as recited in claim 1 wherein the interdiffusion layer has a thickness of from 1 micron to 15 microns.
Claim 19	
[19]	The precoated steel product as recited in claim 1 wherein the first mean iron composition is 90 percent, the second mean iron composition is 43 percent, the third mean iron composition is 63 percent and the fourth mean iron composition is 45 percent.
Claim 20	
[20]	The precoated steel product as recited in claim 1 wherein the fourth mean iron composition is lower than the third mean iron composition.
Claim 21	
[21]	A precoated steel product comprising: a strip of base steel having a first side and a second side; and a coating on at least one of the first side of the strip of base steel and the second side of the strip of base steel, wherein the coating results from interdiffusion between the base steel, and an aluminum or aluminum alloy pre-coating, and wherein the coating includes, proceeding from the base steel outwards: (a) an interdiffusion layer having a first mean iron composition, (b) an intermediate layer having a second mean iron composition different from the first mean iron composition, (c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third mean iron concentration being higher than the second mean iron composition, and (d) a superficial layer having a fourth mean iron composition different from the first, second and third mean iron compositions, wherein the coating has a thickness greater than 30 micrometers.

Claim 22	
[22]	The precoated steel product as recited in claim 21 wherein the fourth mean iron composition is lower than the third mean iron composition.
Claim 23	
[23]	The precoated steel product as recited in claim 22 wherein the fourth mean iron composition is higher than the second mean iron composition.
Claim 24	
[24]	A precoated steel product comprising: a strip of base steel having a first side and a second side; and a coating on at least one of the first side of the strip of base steel and the second side of the strip of base steel, wherein the coating results from interdiffusion between the base steel, and an aluminum or aluminum alloy pre-coating, and wherein the coating includes, proceeding from the base steel outwards: (a) an interdiffusion layer having a first mean aluminum composition, (b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition, (c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and (d) a superficial layer having 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; wherein the coating has a thickness greater than 30 micrometers.

Claim 25	
[25]	The precoated steel product as recited in claim 24 wherein the fourth mean aluminum composition is less than the second mean aluminum composition.
Claim 26	
[26]	The precoated steel product as recited in claim 24 wherein the layer (a) has a thickness less than 15 micrometers.
Claim 27	
[27]	The precoated steel product as recited in claim 24 wherein the interdiffusion layer comprises the following components by weight based on total weight: 86 to 95% Fe, 4 to 10% Al, and 0 to 5% Si.
Claim 28	
[28]	The precoated steel product as recited in claim 24 wherein the intermediate layer comprises the following components by weight based on total weight: 39 to 47% Fe, 53 to 61% Al, and 0 to 2% Si.
Claim 29	
[29]	The precoated steel product as recited in claim 24 wherein the intermetallic layer comprises the following components by weight based on total weight: 62 to 67% Fe, 30 to 34% Al, and 2 to 6% Si.
Claim 30	
[30]	The precoated steel product as recited in claim 24 wherein the superficial layer comprises the following components by weight based on total weight: 39 to 47% Fe, 53 to 61% Al, and 0 to 2% Si.

POSCO Co., Ltd. petitions for *Inter Partes* Review ("IPR") of claims 1-30 ("the Challenged Claims") of U.S. Patent No. 10,961,602 ("the '602 patent").

I. REQUIREMENTS FOR IPR

A. Grounds for Standing

Petitioner certifies that the '602 Patent is available for IPR. Petitioner is not barred or estopped from requesting review of the Challenged Claims on the below-identified grounds.

B. Challenge and Relief Requested

Petitioner requests IPR of the Challenged Claims on the grounds in the table below. Additional explanation is provided in EX-1003, Declaration of Dr. Miles. EX-1003, 1-16.

Ground	Claims	Basis
1A-102	**1, 9-11, 14, 18, 20-22, 24, 26-27, 30**	§102 – Engels
1A-103	**1-2, 9-30**	§103 – Engels
1B	**2, 5-6**	§103 – Engels, Cornette
1C	**3-4, 7-8**	§103 – Engels, Laurent
1D	**3-6**	§103 – Engels, Nishibata
1E	**6**	§103 – Engels, Cornette, Nishibata
1F	**8**	§103 – Engels, Cornette, Laurent
1G	**11-17, 19, 23, 25, 27-30**	§103 – Engels, Takagi
2A	**1-30**	§103 – Takagi, Hein, GMW14400
2B	**3-4, 7-8**	§103 – Takagi, Hein, GMW14400,

Ground	Claims	Basis
		Laurent
2C	**3-6**	§103 – Takagi, Hein, GMW14400, Nishibata

Although priority entitlement is not conceded, the earliest claimed priority date of the ’602 Patent is 10/30/2006. EX-1001, 1:6-14. Each reference qualifies as prior art:

Engels and Hein qualify as prior art under 35 U.S.C. §102(a). These documents are printed publications that were available as of 5/9/2006 based on public distribution at the “New Developments in Sheet Metal Forming” conference. EX-1008. Prof. Liewald explains how these documents were printed beforehand in the collected conference proceedings “New Developments in Sheet Metal Forming” (*see* EX-1007) and distributed to conference attendees without restriction. EX-1008. The conference was publicly advertised and open to any interested researchers. *Id*. Engels and Hein also were catalogued and publicly available at the German National Library no later than 8/1/2006. EX-1009.

Cornette qualifies as prior art under §102(b). As explained in the Declaration of Mel DeSart (reproduced from IPR2019-01275), Cornette was publicly available at the Engineering Library at the University of Washington “within a few weeks of March 13, 2001.” EX-1015.

Laurent qualifies as prior art under §102(b). Laurent is a U.S. Patent with a

publication date of 10/2/2001. EX-1023.

GMW14400 qualifies as prior art under §102(a). As June Munford explains, and as supported by Shannon Schuster, GMW14400 was publicly available no later than 12/1/2005. EX-1027. GMW14400 would have been easily located using the search features provided on its distribution website, the IHS Standards Store. *Id*.

Nishibata qualifies as prior art under §102(b). Nishibata is a WO Patent Publication with a publication date of 12/9/2004. EX-1050.

C. Claim Construction

Because the evidence and the prior art's description of the claimed elements are similar to those of the '602 Patent's specification, no formal claim constructions are necessary in this proceeding.[1] For this petition, Petitioner applies prior art in a manner consistent with Patent Owner's allegations of infringement in co-pending litigation.

II. THE '602 PATENT

A. Summary

The '602 Patent describes manufacturing methods and structures associated

[1] Petitioner is not conceding that each claim satisfies all statutory requirements, such as §§101 and 112, nor is Petitioner waiving any arguments concerning claim scope or grounds that can only be raised in litigation.

with a "coating" formed by hot-stamping pre-coated steel blanks. EX-1003, 17. The '602 Patent acknowledges that these coatings and their manufacture were already "important, especially in the automotive industry." EX-1001, 1:38-39. As the Background describes, processing to obtain a coating typically included "[p]re-coating of a steel sheet[], by hot dipping; [t]rimming or cutting for obtaining blanks; [h]eating the blanks in order to obtain alloying of the steel substrate with the pre-coating, as well as the austenitizing of the steel; and [h]ot forming followed by rapid cooling of the part in order to obtain predominantly martensitic structures." EX-1001, 1:41-47.

Starting with this well-established process, the '602 Patent alleges several improvements. First, the '602 Patent emphasizes "importan[ce]" of "control of the homogeneity of the pre-coating thickness over the entire sheet" by "monitor[ing] continuously" the pre-coating thickness. EX-1001, 2:54-57, 4:65. However, the '602 Patent does not claim any pre-coating or homogeneity thereof. EX-1003, 18.

The '602 Patent further notes (i) certain process parameters that are linked to the manufacture of "fully homogeneous martensitic structure[s]" and (ii) advantages of "reduction of sulfur below a critical value." EX-1001, 2:64-3:7. But both low sulfur amounts and "fully martensitic" products were recognized in the art. For example, Takagi, Vaissiere, and Somani each discuss how hot-stamping is tuned to obtain martensitic structures. EX-1016, [0028]; EX-1021, 3, 6; EX-1032,

8; EX-1003, 19.

Finally, the ’602 Patent describes that “particularly good weldability [] is associated with a special succession of coating layers on the parts.” EX-1001, 2:60-63. An example coating, which includes four layers, is described for “Example 2” and illustrated in FIG. 1. EX-1001, 12:30-61; EX-1003, 20.

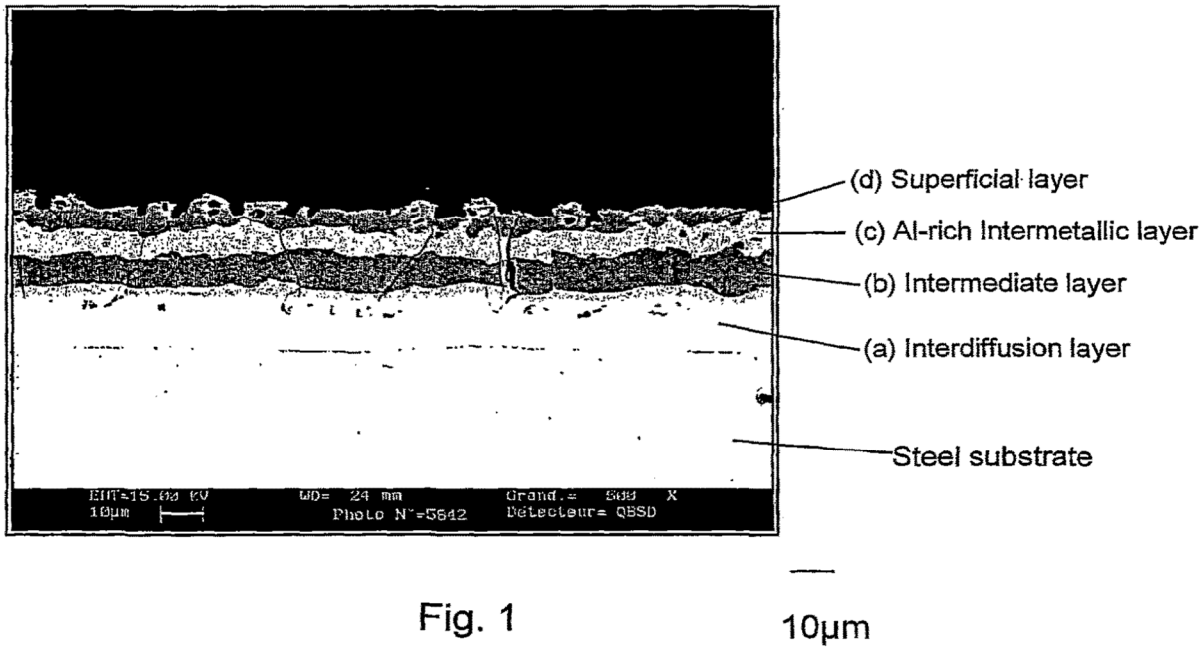


Fig. 1

But, even if these coating layers were “special,” they were not new. This Petition presents two independent sets of grounds that anticipate and/or render obvious the claimed coating layers.

B. Prosecution History

The only reference applied in a rejection during prosecution of the ’602 Patent was Laurent. EX-1002, 30-34. The allowance relied on the art’s alleged lack of teaching of layers having the recited iron compositions and total thickness. EX-

1002, 11. The two primary references relied on in this Petition – Engels and Takagi – disclose the recited iron compositions, and Engels discloses the recited thickness greater than 30 micrometers, thereby teaching the features that justified allowance. EX-1003, 21.

C. Level of Ordinary Skill

A person having ordinary skill in the art ("POSITA") at the time of the alleged invention 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. EX-1003, 15.

III. GROUNDS 1A-102 and 1A-103: Claims 1, 9-11, 14, 18, 20-22, 24, 26-27, and 30 are anticipated by Engels, and claims 1-2 and 9-30 are obvious over Engels

A. Engels

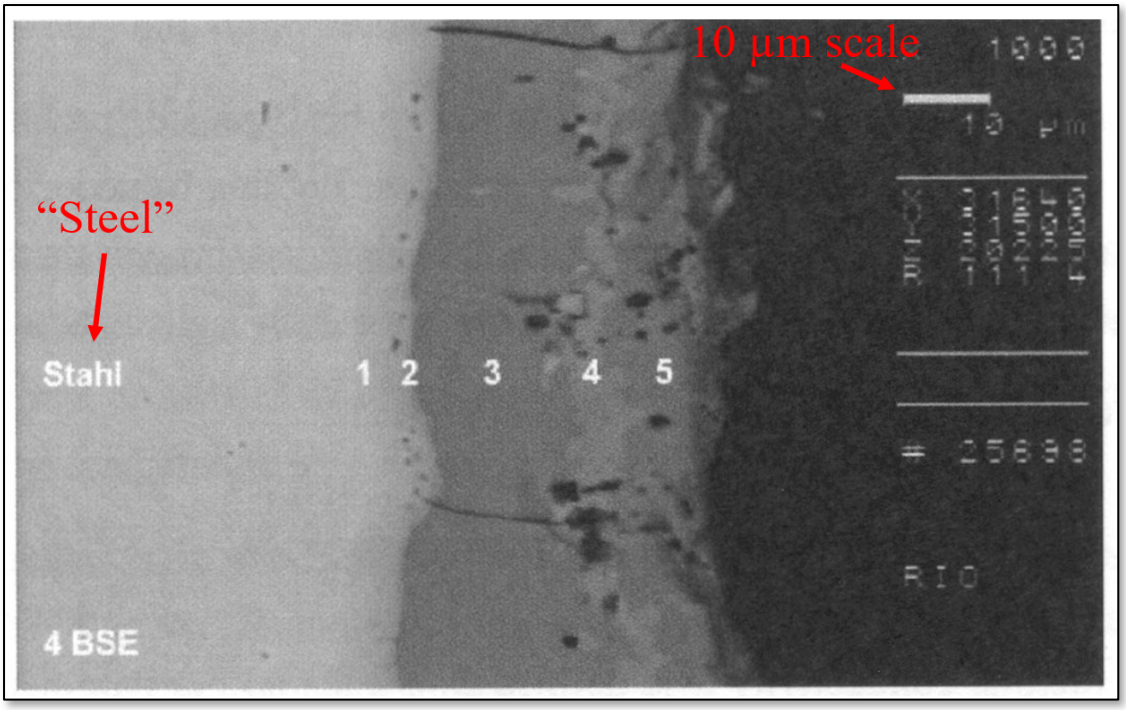
Entitled "*Controlling and Monitoring of the Hot-Stamping Process of Boron-Alloyed Heat-Treated Steels*," Engels provides an overview of hot-stamping as applied to "boron-alloyed steels." EX-1005, 136. Engels notes that "blanks" having an "Al-Si-coating" (i.e., pre-coating) are "austenitized at temperatures between 900 ˚C and 950 ˚C," "stamped," and "systematically cooled down under pressure" (i.e., quenched). EX-1005, 137; EX-1003, 22-23. As a result, a "diffusion layer" (coating) forms, and Engels recognizes that "it is crucial to look for a correctly shaped diffusion layer with regard to layer thickness, porosity and

roughness, as this layer will decisively impact the corrosion and welding properties of the hot stamped parts." EX-1005, 142. Among "parameters which have to be taken into account when setting the temperature profile" are "heating rate," "total processing time," "maximum austenitizing temperature," and "material thickness." *Id*.

Engels' FIG. 5 shows a "cross-section polish of the diffusion layer of a hot-dip aluminum coated boron steel." EX-1005, 142. "Five phases which differ in their layer thickness and chemical composition can easily be distinguished." *Id*. These phases and their compositions and thicknesses are shown in Engels' FIG. 5 and a corresponding table (reproduced below). EX-1005, 143; EX-1003, 24.

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	< 1µm	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

Engels' Table



Annotated Engels' FIG. 5

Several aspects of Engels' FIG. 5 and Table bear special comment. First, a scale at the top-right shows a length of 10 µm, permitting the calculation of exact thicknesses from the image itself. EX-1003, 25. Second, the annotation "Stahl" is German for "steel;" this portion of the image depicts the base steel underlying the coating. EX-1006; EX-1003, 25.

Third, although Engels' Table lists "Volume-%," this is a translation error and would have been recognized as such by a POSITA. The German version of Engels describes the compositions as "Masse-%," which, as described in EX-1006, is correctly and unambiguously translated as "Mass-%," not "Volume-%." EX-1006; EX-1010, 22. Further, as Dr. Miles explains, the concept of a "Volume-%" for distinct elements in a homogenous compound is not well-defined, and "Mass-

%" (or, equivalently, weight-%) was and remains by far the most common composition metric among steel researchers. EX-1003, 26. "Volume-%," by contrast, is an essentially unknown and unused metric in steel research. *Id*. Accordingly, this Petition treats the compositions in Engels' Table as percentages by mass or, equivalently, weight, as they would have been understood by a POSITA. *Id.*

B. Analysis of Claims

[1pre]:

1. The preamble is non-limiting

The preamble of claim 1 ("*a precoated steel product*") is not limiting. The '602 Patent explicitly defines the term "product" as "a stamped blank," such that the preamble is equivalent to "a precoated steel stamped blank." EX-1001, 14:56.

As a rule, "a preamble generally is not limiting when the claim body describes a structurally complete invention []." *Catalina Mark. Intern. v. Coolsavings.com*, 289 F.3d 801, 809 (Fed. Cir. 2002). Here, the claim body describes a structurally complete apparatus including a "*strip of base steel*" and a "*coating*" having four recited layers, without requiring any reference to the preamble.

Although several exceptions have been recognized, none applies in this case. For example, "clear reliance on the preamble during prosecution to distinguish the

claimed invention from the prior art transforms the preamble into a claim limitation." *Catalina*, 289 F.3d at 808. This reliance is lacking in the prosecution history of the '602 Patent. *See* §II.B. Also lacking is dependence on the preamble for antecedent basis.

Moreover, even if some portion of the preamble is limiting, at least the implicit "stamped" is not limiting. This claim element represents at most a product-by-process element that, absent "structural and functional differences" over prior art imparted by the process, carries no patentable weight. *Amgen v. F. Hoffmann-La Roche*, 580 F.3d 1340, 1370 (Fed. Cir. 2009). Although the '602 Patent describes how characteristics of the coating depend on **temperature** treatment parameters such as "cooling rate" and "heating rate" (*see, e.g.*, EX-1001, 5:63, 11:13), the '602 Patent is silent as to any structural difference imparted by "stamp[ing]."

2. Collateral estoppel requires a holding that the preamble is non-limiting

The question of whether this preamble is limiting was already answered during IPR proceedings for the '683 Patent (a parent to the '602 Patent), in which claim 1 recited "[a] coated steel stamped product." EX-1028, 15:21. In the Final Written Decision, the Board found the preamble non-limiting. EX-1029, 13-15. As reasoning, the Board noted that the preamble failed to provide antecedent basis to the body of claim 1, a condition that also applies here. *Id.*, 13. The Board also

found that "Patent Owner has not identified any structural feature that differentiates a stamped versus unstamped steel product," noting that the Specification "attributes the recited four-layer structure to an alliation (i.e., alloying) reaction that occurs 'during the heat treatment **immediately preceding hot stamping**.'" *Id*., 16. Patent Owner's counsel did not disagree with this characterization. *See* EX-1030, 36:10-12. The Board also found that the preamble did not relate to any "important characteristic[] of the claimed invention" but, rather, only to "conventional" subject matter, weighing **against** the preamble having patentable weight. *Id*., 14-15. The same reasoning applies here.

Given similarities between this preamble and that of the '683 Patent, the Board's prior finding is conclusive and should be applied here. "It is well established that collateral estoppel applies to IPR proceedings." *Google LLC v. Hammond Dev. Int'l*, 54 F.4th 1377, 1381 (Fed. Cir. 2022). In addition, "[i]t is well established that patent claims need not be identical for collateral estoppel to apply." *Id*. Rather, "it is the identity of the *issues* that were litigated that determines whether collateral estoppel should apply." *Ohio Willow Wood Co. v. Alps S., LLC*, 735 F.3d 1333, 1342 (Fed. Cir. 2014). Notably, collateral estoppel applies not only to issues of invalidity but also to issues of claim interpretation. *See Papst Licensing GMBH & Co. KG v. Samsung Elecs. Am., Inc.*, 924 F.3d 1243, 1252 (Fed. Cir. 2019); *Nestle USA, Inc. v. Steuben Foods, Inc.*, 884 F.3d 1350, 1352 (Fed. Cir.

2018). The case for collateral estoppel is strengthened here because the present IPR is a case of **mutual** issue preclusion, because POSCO and ArcelorMittal were also adverse in the '683 Patent's IPR.

Finally, USPTO rules dictate estoppel, as ArcelorMittal "is precluded from taking action inconsistent with the adverse judgment" in the '683 Patent's IPR. 37 CFR § 42.73(d)(3). Estoppel applies to all issues that were resolved against ArcelorMittal in the '683 Patent's IPR and that overlap with this proceeding.

3. Engels teaches the preamble

Even if the entirety of "precoated steel product" or "precoated steel stamped blank" is limiting, Engels' FIG. 5 depicts a precoated steel stamped blank. EX-1003, 27. For example, Engels' FIG. 5 shows a "diffusion layer" (coating) on underlying "boron steel" ("Stahl") that has undergone hot-stamping. EX-1005, 142-143.

On whether the part of Engels' FIG. 5 is "stamped," Engels (entitled "Controlling and Monitoring of the **Hot-Stamping** Process of Boron-Alloyed Heat-Treated Steels"[2]) describes essentially continuous processes in which parts are transferred directly from a furnace (in which austenitization and coating formation occur) into a die to be stamped (or "formed") and quenched. EX-1005, 137-138. As Dr. Miles notes, in the field of steel metallurgy, these steps were and

[2] All emphasis is added except where indicated otherwise.

are understood as portions of a single, unified process referred to, as a whole, as "hot stamping." EX-1003, 28. Indeed, as described by Engels, the "[t]ransfer time t_T between furnace and die" is a factor in determining the mechanical and surface properties of the resulting part, and other art notes that "[t]he transfer time between the furnace and the die has to be reduced as much as possible," e.g., to "less than ten seconds." EX-1005, 141; EX-1019, 167. As Dr. Miles explains, in view of this continuous, unified process that includes immediate transfer to a die for stamping, a POSITA would have understood Engels' FIG. 5 to illustrate a part that has undergone the entirety of that process, including stamping: to depict a part that has undergone only a portion of the process (e.g., furnace treatment without forming in a die) would have been viewed as much less illustrative and relevant. EX-1003, 29. This is particularly true in view of the context of Engels' FIG. 5, which discusses how the forming and quenching process causes "structural change" in the part. EX-1005, 143. A POSITA "would have naturally understood Engels' FIG. 5 to depict a hot stamped part that has undergone those structural changes as part of the unified hot-stamping process, not a part whose processing has been arbitrarily arrested mid-way through." EX-1003, 29-31.

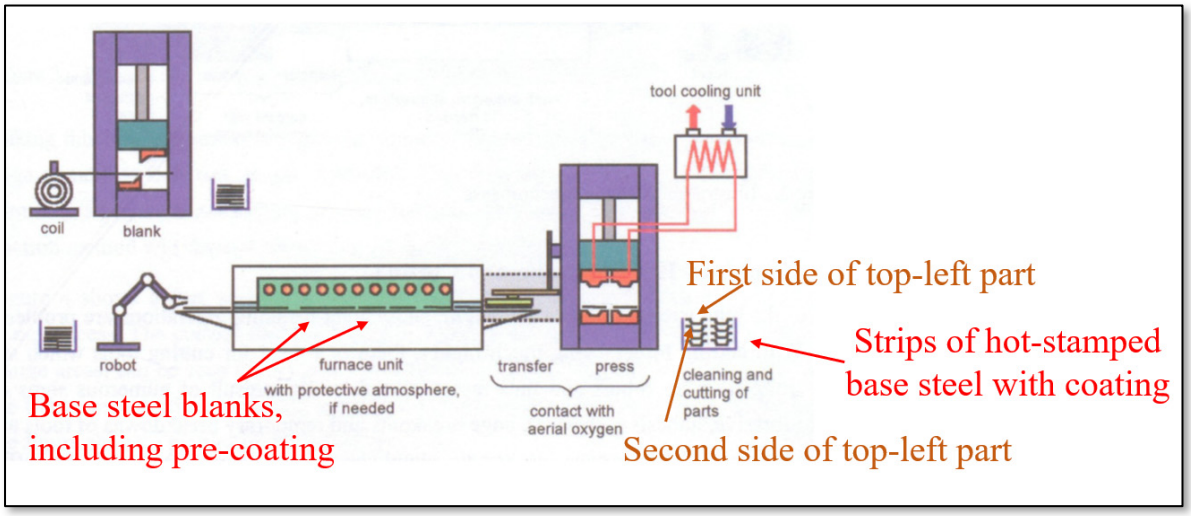
Engels also discloses both the stamping of a "blank" (EX-1005, FIG. 1, 143) and the use of an "Al-Si" pre-coating (EX-1005, 137-138, 141-142). EX-1003, 32.

Accordingly, a POSITA would have understood that Engels discloses or

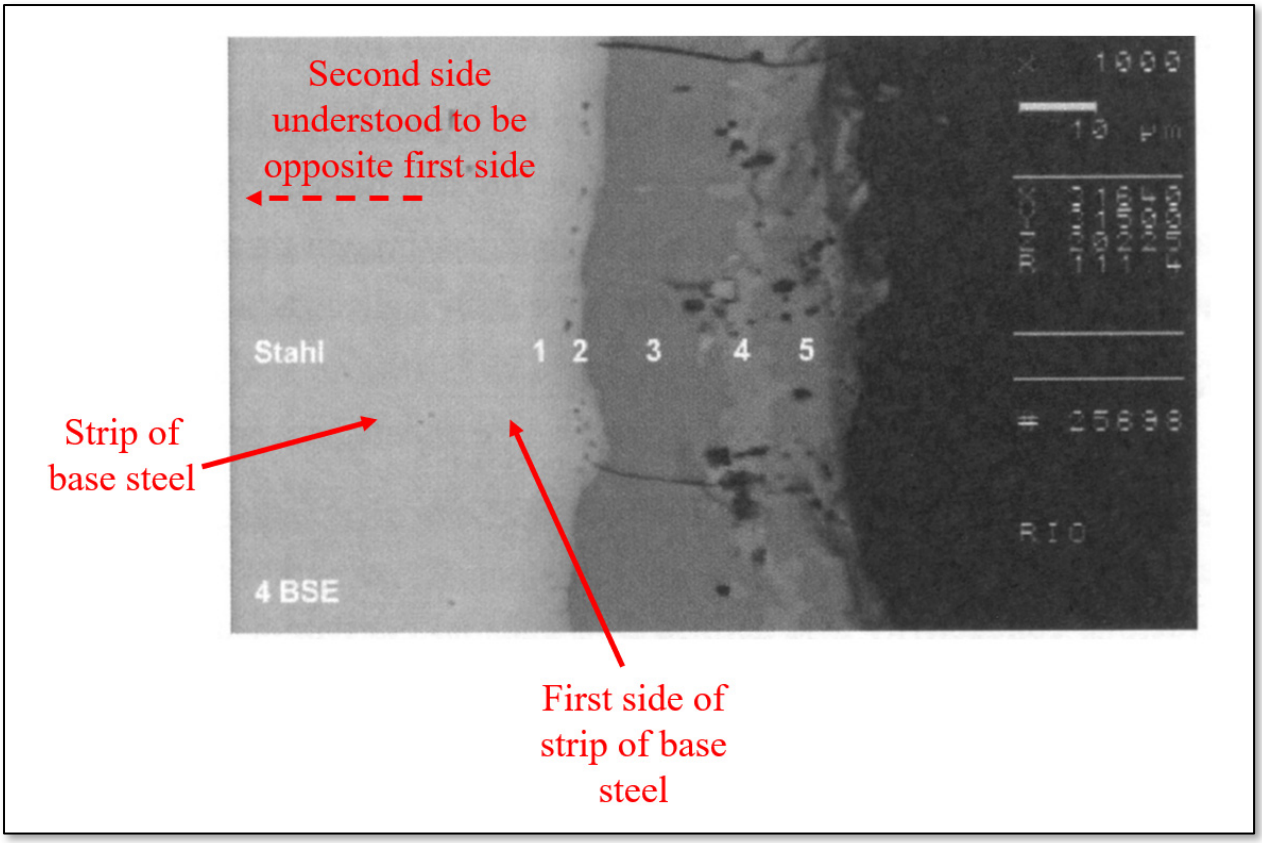
renders obvious a "precoated steel product." EX-1003, 30-32.

[1a]:

Engels discloses or renders obvious a strip of base steel having a first side and a second side. EX-1003, 33. Engels describes blanks (which a POSITA would have understood as being strips of base steel with a pre-coating. EX-1003, 33) having first sides and second sides, as shown in annotated Engels' FIG. 1 below. EX-1005, 137. The strips of base steel are austenitized and formed to produce hot-stamped parts having the same base steel with first and second sides. EX-1003, 33. A strip of base steel and one of its sides (immediately underlying phase 1) are shown in Engels' FIG. 5; a POSITA would have understood that there would be a second side opposite the labeled first side. EX-1003, 33.



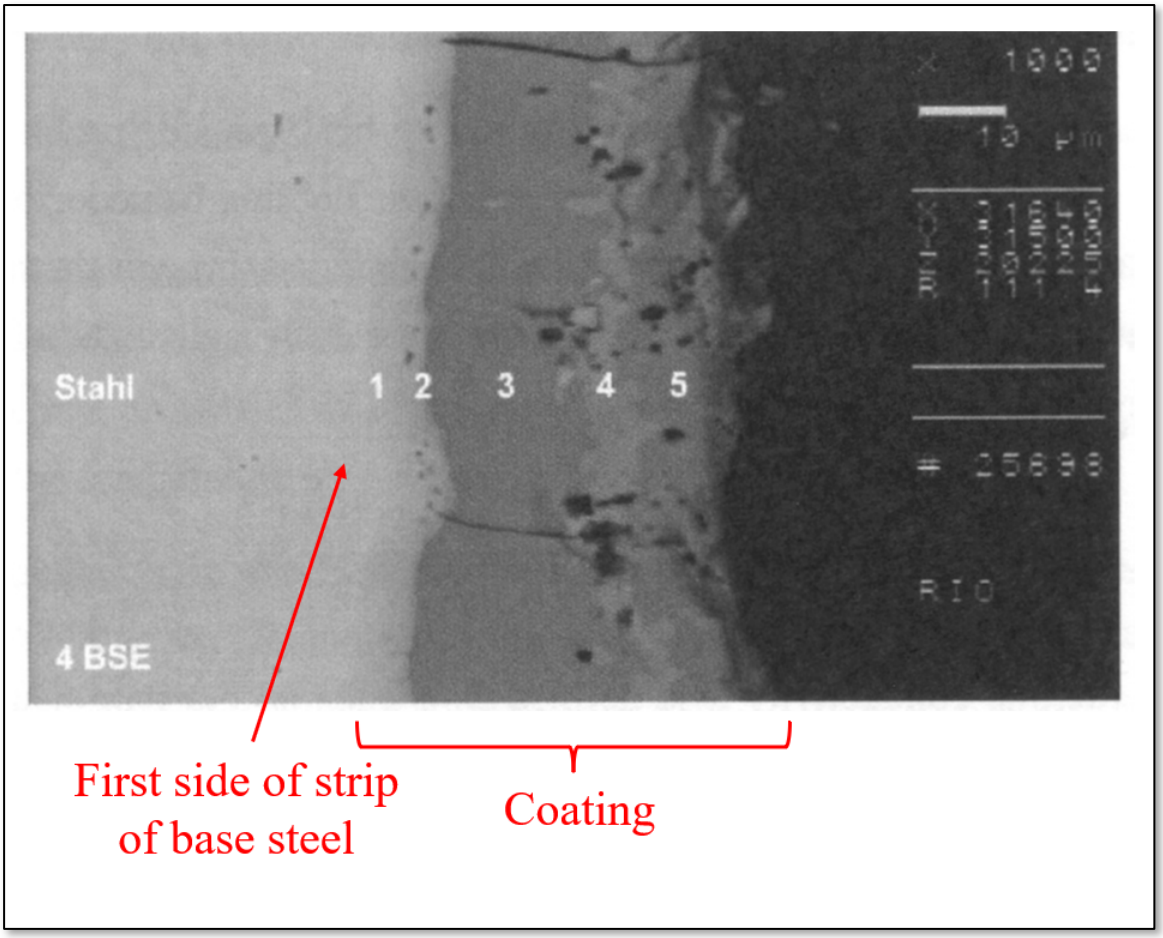
Annotated Engels' FIG. 1



Annotated Engels' FIG. 5

[1b]:

Engels discloses or renders obvious a coating on the first side of the strip of base steel. EX-1003, 34-35. The coating is a "diffusion layer" having five phases, as shown in annotated Engels' FIG. 5 below. EX-1005, 142-143.



Annotated Engels' FIG. 5

[1c]:

Engels discloses or renders obvious that the coating results from interdiffusion between the base steel and an aluminum or aluminum alloy pre-coating. Engels' "diffusion layer" (coating) is formed by heat treatment of "hot-dip aluminum coated boron steels." EX-1005, 141-142. "Hot-dip" refers to a process in which a base steel is dipped in a bath of aluminum or aluminum-silicon to form an aluminum or aluminum-silicon pre-coating. EX-1003, 42. A POSITA would have understood Engels to describe specifically an aluminum-silicon pre-coating,

based on the descriptions of "an Al-Si-coating" and an "22MnB5+AS diffusion layer," where "AS" would have been understood as referring to "aluminum-silicon." EX-1003, 42; EX-1005, 138, 141.

Engels' thermal treatment (e.g., "heating rate," "total processing time," and "austenitizing temperature," such as "temperatures between 900 °C and 950 °C") causes "diffusion" between the material(s) of the pre-coating and the base steel. EX-1005, 136, 142; EX-1003, 43. As a result, Engels' coating includes various phases composed of varying degrees of iron, aluminum, and silicon. EX-1005, 143. Based on these compositions and Engels' use of the term "diffusion," a POSITA would have understood that the coating was formed by interdiffusion between the iron of the base steel and the aluminum and silicon of the "AS" or "Al-Si" pre-coating. EX-1003, 43.

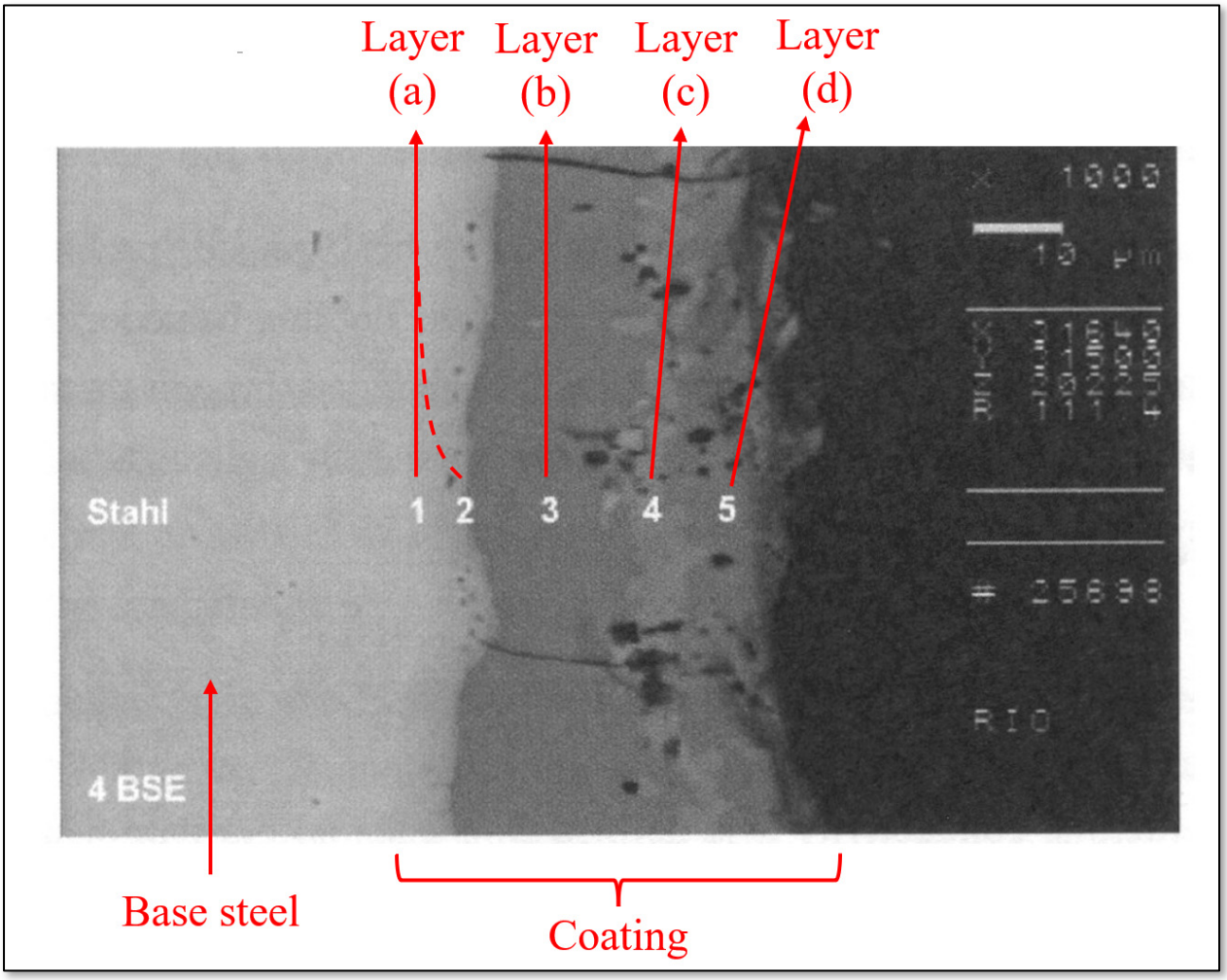
[1d]-[1g]:

Engels discloses or renders obvious [1d]-[1g]. EX-1003, 44. Engels' coating includes "five phases which differ in their layer thickness and chemical composition." EX-1005, 142. As shown in Engels' FIG. 5, each of phases 1 or 1+2 and 3-5 constitutes a layer and satisfies the claimed layers and iron compositions according to the following mappings:

- **Phase 1 or 1+2** teaches **layer (a) (the "interdiffusion layer")**. As shown in FIG. 5, phase 1 is arranged directly on the underlying steel. EX-1003, 44.

- **Phase 3** teaches **layer (b) (the "intermediate layer")**.
- **Phase 4** teaches **layer (c) (the "intermetallic layer")**.
- **Phase 5** teaches **layer (d) (the "superficial layer")**.

These phases are included in the coating ("diffusion layer") and "proceed[] from the base steel outwards." EX-1003, 45.



Annotated Engels' FIG. 5

The '602 Patent does not describe that the names of the layers (i.e., "interdiffusion," "intermediate," "intermetallic," and "superficial") denote any

particular characteristics of the layers. However, phases 1 (or 1+2), 3, 4, and 5 satisfy the meanings of each of those terms as proposed by Petitioner during IPR proceedings for the ’683 Patent. EX-1031, 22-24; EX-1003, 46.

Further, claim 1 does not recite that the layers must be adjacent to one another, such that arrangement of phase 2 at least partially between phase 1 and phase 3 is no impediment to the mapping of phase 1 to layer (a) and phase 3 to layer (b). EX-1003, 47. To the extent Patent Owner disputes this mapping, Dr. Miles notes that phase 2 (described by Engels as being very thin and as having an “unmeasurable” composition) would be understood as forming a sub-layer of an overall layer composed of both phases 1 and 2, the overall/composite layer having a composition similar to that provided for phase 1 and a thickness the same as or similar to the disclosed thickness of phase 1 (e.g., within 1 μm of the phase 1 thickness, a thickness difference that would not change the below discussion). EX-1003, 36-39, 47. This interpretation is consistent with the ’602 Patent’s description that, in one example, layer (a) “is itself composed of two sub-layers.” EX-1001, 12:46; EX-1003, 40-41. All arguments provided herein that rely on associating Engels’ phase 1 with layer (a) apply equally to this composite layer of phases 1 and 2, and that alternative mapping should be understood as being included in the discussions below.

Engels discloses or renders obvious that layers (a), (b), (c), and (d) have the

recited mean iron compositions. EX-1003, 48. Engels' Table provides elemental compositions for each of phases 1 and 3-5, which correspond to layers (a)-(d), respectively. Each of these layers has a different iron composition from one another, and phase 4 (corresponding to layer (c)), has a mean iron composition greater than the mean iron composition of phase 3 (corresponding to layer (b)).

Differing Fe compositions

	phase number	layer thickness, µm	Al	Fe	Si	Cr	Mn
			~~Volume-%~~ Mass-%				
Layer (a)	1	5 – 9	7,2	89,2	1,9	0,3	1,4
[Layer (a)]	2	< 1µm	unmeasurable				
Layer (b)	3	11 – 18	51,4	45,9	1,9	0,1	0,7
Layer (c)	4	3 – 8	33,9	54,3	10,6	0,3	0,9
Layer (d)	5	5 - 11	53,2	44,1	1,9	0,2	0,6

Fe% (layer (c)) > Fe% (layer (b))

Annotated Engels' Table

Engels discloses the "chemical composition" of each phase, not explicitly a "mean" composition. However, as explained by Dr. Miles, a POSITA would have understood that, in the field of steel metallurgy, a disclosure of a composition for a material, phase, or layer implicitly is, and would have been understood as, a disclosure of a **mean** composition of the material, phase, or layer. EX-1003, 49. He describes that, "a researcher might sample several representative portions of a material and average the corresponding compositions to obtain values representative of a mean composition of the material." EX-1003, 49. Absent a

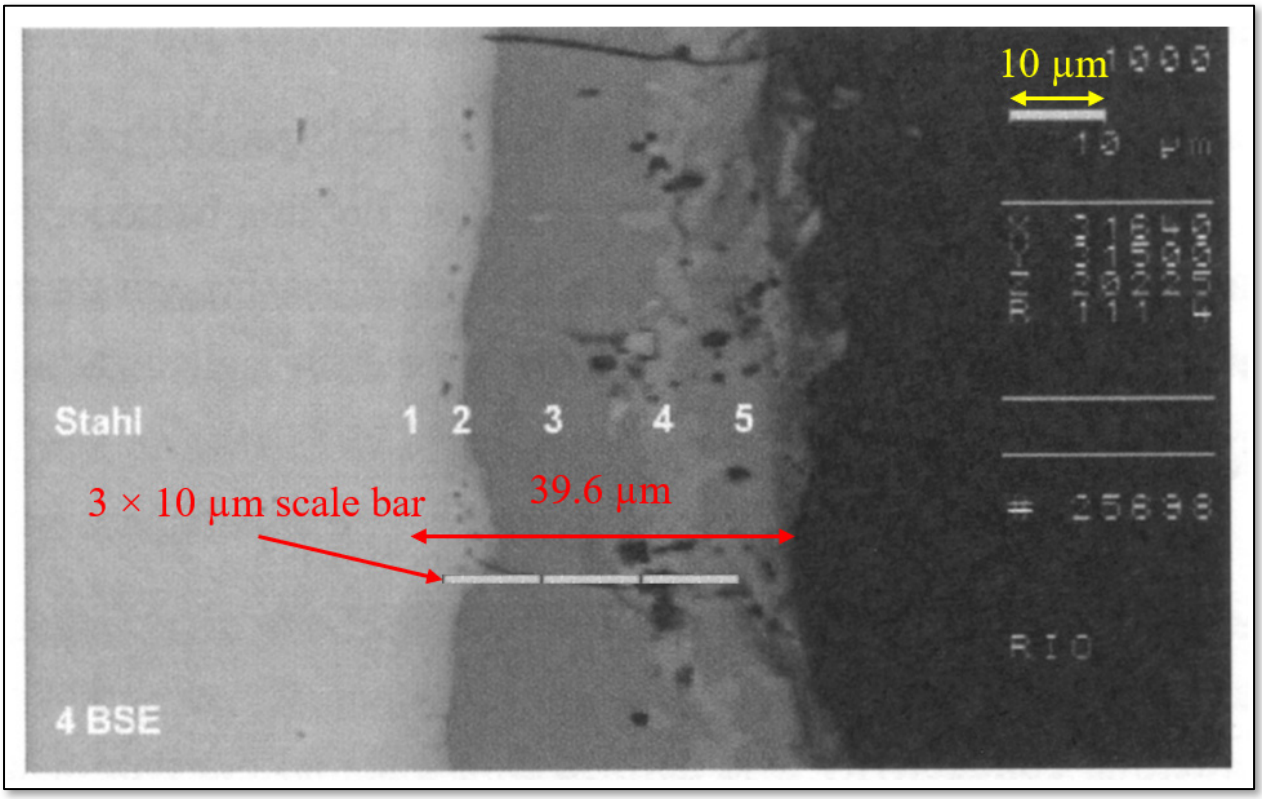
statement or suggestion otherwise – which Engels does not include – a POSITA would have understood Engels' disclosures of compositions to be disclosures of **mean** compositions, thereby satisfying this claim element. *Id.*, 50. Indeed, Dr. Miles notes that "'mean' composition is by far the most common way to report a composition and would have been the most accessible measure of a layer's composition for a POSITA seeking to apply Engels' teachings to hot-stamped steel." EX-1003, 51.

[1h]:

Engels' coating has a thickness greater than 30 micrometers. Dr. Miles conducted a direct measurement[3] in Engels' FIG. 5 (shown below) based on the included 10 µm scale. EX-1003, 52-53. This measurement shows a thickness of **39.6 µm**, well beyond the recited 30 µm threshold. This disclosure, in combination with the other teachings of Engels discussed above, is sufficient to anticipate claim 1. *Id*. "It is [] an elementary principle of patent law that when, as by a recitation of ranges or otherwise, a claim covers several compositions, the claim is 'anticipated'

[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. EX-1003, 35.

if one of them is in the prior art." *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 782 (Fed. Cir. 1985).



Annotated Engels' FIG. 5

Alternatively, Engels renders obvious that the coating has a thickness greater than 30 µm based on the thickness ranges in Engels' Table. EX-1003, 54. Many combinations of the disclosed ranges result in a total coating thickness greater than 30 µm. For example, assuming that each phase has a value in the middle of the disclosed range (7 µm for phase 1, 14.5 µm for phase 3, 5.5 µm for phase 4, and 8 µm for phase 5), and neglecting any thickness of phase 2 in the case of the phase 1 mapping, results in a coating thickness of **35 µm**. Even assuming that each phase

has a value one-third of the way through its disclosed range (toward the lower end) results in a coating thickness of **31.3 µm**, again satisfying this claim element. Any marginal thickness contributed by phase 2 would not substantively alter this reasoning in the case where layer (a) is mapped to phases 1+2. EX-1003, 54.

Generally, Engels' Table is equivalent to a disclosure of ranges of total coating thickness from 24 µm (assuming each phase has its lowest-disclosed thickness) to 46 µm (assuming each phase has its highest-disclosed thickness). This range overlaps the claimed range of "greater than 30 micrometers," rendering the claimed range obvious. A presumption of obviousness applies "[w]here a claimed range overlaps with a range disclosed in the prior art." *Ormco Corp. v. Align Tech., Inc.*, 463 F.3d 1299, 1311 (Fed. Cir. 2006). This presumption can be overcome if the "prior art teaches away from the claimed range, or the claimed range produces new and unexpected results." *Id*. Here, Engels does not teach away from the claimed range, and, indeed, discloses a specific value within the claimed range. EX-1003, 55. In addition, the '602 Patent does not assert that the claimed range of "greater than 30 micrometers" is associated with any unexpected results relative to the range disclosed by Engels. Although the range is described as "a preferred embodiment," the '602 Patent fails to discuss any particular effects, results, or criticality associated with the range, and does not describe any unexpected results relative to the ranges disclosed by Engels. EX-1001, 6:46-47;

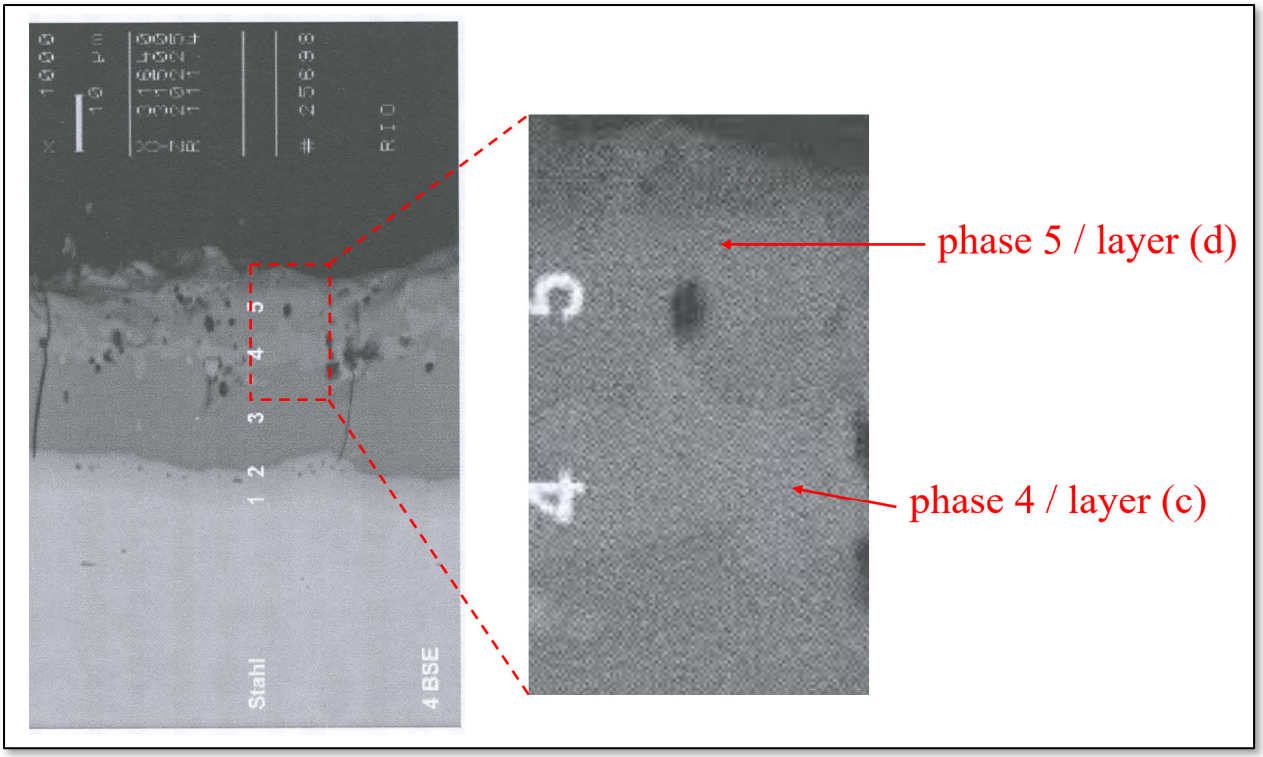
EX-1003, 55-56.

Moreover, it would have been obvious to try varying and experimenting with the coating thickness based on Engels' disclosure that "it is crucial to look for a correctly shaped diffusion layer with regard to **layer thickness** [] as this layer will decisively impact the corrosion and welding properties of the hot stamped parts." EX-1005, 142; EX-1003, 57-59.

[2]:

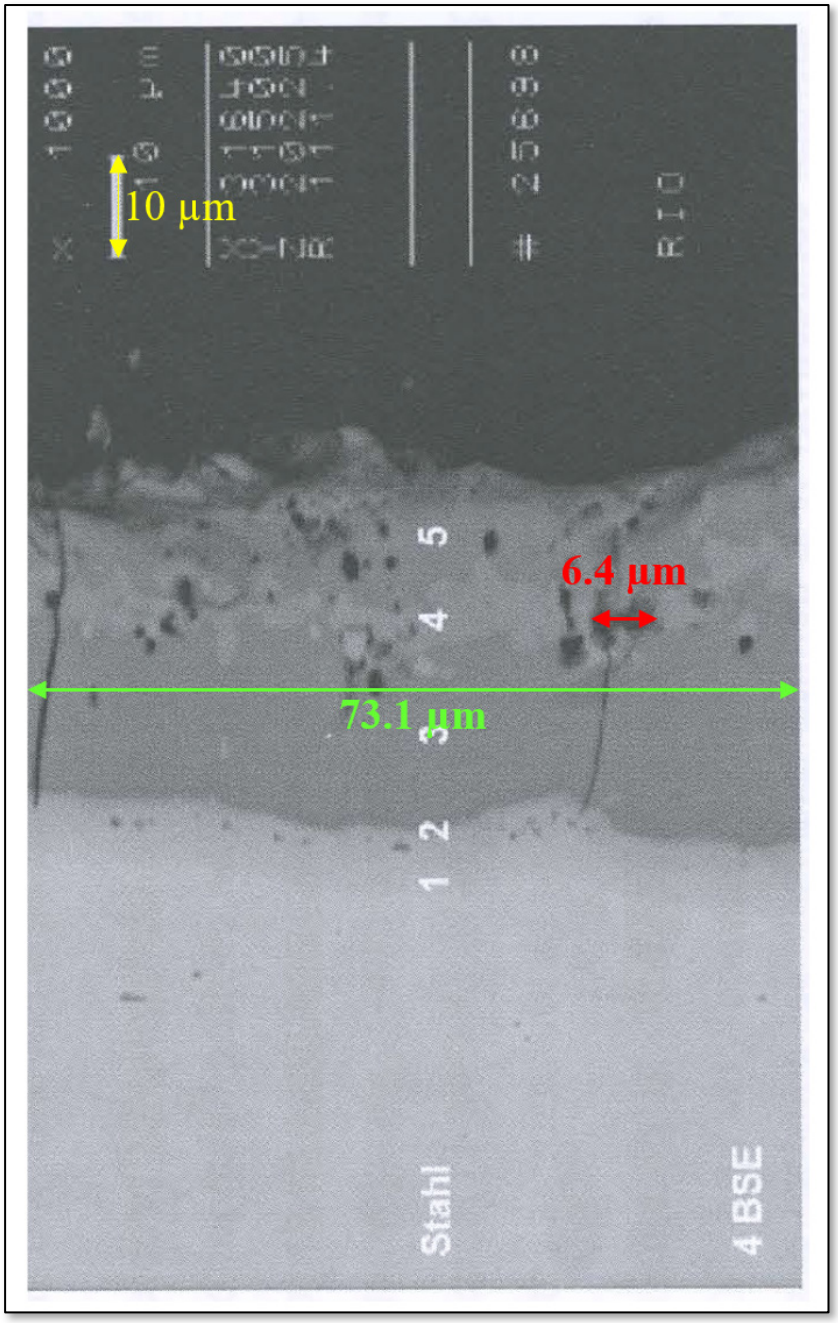
Engels renders obvious claim 2. EX-1003, 60-63. For "*less than 10% of layer (c) is present at an extreme surface of the product*," Engels' FIG. 5 shows that essentially none of phase 4 (corresponding to layer (c)) is present at the extreme surface of Engels' coating. EX-1005, FIG. 5; EX-1003, 60.

With respect to "*the layers (c) and (d) are quasi continuous by occupying at least 90% of a level corresponding to each of the layers (c) and (d)*," Engels' FIG. 5 illustrates that each of phases 4 and 5 extends continuously or essentially continuously, e.g., as illustrated in the segment of FIG. 5 enlarged below. Claim 2 merely refers to "a level corresponding to each of the layers" and, thus, the enlarged segment of FIG. 5 demonstrates "a level" of phases 4 and 5 that satisfies claim 2. EX-1003, 61.



Annotated Engels' FIG. 5 (enlarged view)

Even across the entire SEM image in FIG. 5 above, phases 4 and 5 extend continuously or essentially continuously across the **entire image** (as shown below), except perhaps for one segment of phase 4 indicated in red below. EX-1003, 62. A POSITA would have considered the layer to be continuous or essentially continuous (or quasi continuous) despite this pore. *Id*. To the extent that this pore is considered to make the layer discontinuous, the indicated segment occupies only about 9% of the total width of FIG. 5, such that phase 4 is "quasi-continuous." *Id*.



Annotated Engels' FIG. 5

[9]-[10]:

Engels discloses or renders obvious that layer (a) has a thickness of less than 15 or 10 micrometers. EX-1003, 64. As disclosed in Engels' Table, phase 1 or 1+2 (corresponding to layer (a)) has a thickness in a range from **5-9 µm**, such that all

thicknesses satisfy both "less than 15 micrometers" and "less than 10 micrometers." EX-1005, 143. This is confirmed by Dr. Miles' direct measurement in Engels' FIG. 5. EX-1003, 65. Any marginal thickness contributed by phase 2 would not substantively alter this reasoning in the case where layer (a) is mapped to phases 1+2. *Id.*, 64-65.

[11]:

As discussed at [1d], the interdiffusion layer is mapped to Engels phase 1. Phase 1 has weight composition **89.2% Fe, 7.2% Al**, and **1.9% Si**. EX-1005, 143. *See* §III.A and EX-1003, 26 for interpretation of composition values in Engels' Table as weight percentages. As described by Dr. Miles, a POSITA would have understood Engels' percentages to be percentages "based on total weight," as implied by the additional disclosure of Cr and Mn content. EX-1003, 66-67.

[12]:

As discussed at [1e], the intermediate layer is mapped to Engels phase 3. Phase 3 has weight composition, by total weight, of **45.9% Fe, 51.4% Al**, and **1.9% Si**. EX-1005, 143; EX-1003, 68. *See* [11] for this interpretation of Engels' Table.

The Fe% and Si% of Engels phase 3 satisfy the ranges of claim 12, while the Al% is slightly outside of the claimed range (**51.4%** compared to **53-61%**). However, it is well established that a claimed amount that does not overlap with,

but is close to, a prior art amount, is obvious absent evidence of unexpected results or teaching-away. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775 (Fed. Cir. 1985); *Haynes Intern., Inc. v. Jessop Steel Co.*, 8 F.3d 1573 (Fed. Cir. 1993); *In re Becket*, 88 F.2d 684 (C.C.P.A. 1937).

Here, the '602 Patent describes no criticality or unexpected results for a range of 53-61% Al compared to 51.4% Al. And Dr. Miles discusses why a POSITA would have been motivated to modify the Al% with a reasonable expectation of success. EX-1003, 69-71. Thus, the composition of Engels' phase 3 renders obvious the claimed composition. EX-1003, 68-72.

[13]:

Engels' phase 4 (mapped to the intermetallic layer; *see* [1f]) has weight %, by total weight, of **54.3% Fe, 33.9% Al,** and **10.6% Si**. EX-1005, 143; EX-1003, 73.

Of these values, the Al% is within the claimed range, while the Fe% and the Si% are outside, but close to, their claimed ranges. For similar reasons to those discussed for [12] here and by Dr. Miles, absent a showing of criticality or unexpected results, the values taught by Engels render obvious the claimed ranges. EX-1003, 74-76. The '602 Patent fails to describe a "difference in kind and not of degree" resulting from an Fe% of 62% compared to 54.3%, or from a Si% of 6% compared to 10.6%, for a single layer in a four-layer coating. And Dr. Miles

discusses why a POSITA would have been motivated to modify the Al% with a reasonable expectation of success. EX-1003, 74-76. Accordingly, Engels renders obvious the claimed composition. EX-1003, 77.

[14]:

As discussed at [1g], the superficial layer is mapped to Engels phase 5. Phase 5 has weight composition, by total weight, of **44.1% Fe, 53.2% Al**, and **1.9% Si**. EX-1003, 78.

[15]: See [12] above.

[16]: See [13] above.

[17]: See [14] above.

[18]:

As disclosed in Engels' Table, phase 1 (corresponding to the interdiffusion layer) has a thickness in a range from **5-9 µm**, such that all thicknesses satisfy the recited range. EX-1005, 143. Any marginal thickness contributed by phase 2 would not substantively alter this reasoning in the case where layer (a) is mapped to phases 1+2. EX-1003, 79; *see also* [10] above.

[19]:

Engels renders obvious that layers (a)-(d) have mean iron compositions of 90%, 43%, 63%, and 45%, respectively. EX-1003, 80. Engels' Table discloses Fe% for the corresponding phases of **89.2%, 45.9%, 54.3%,** and **44.1%**. For

similar reasons to those discussed for [12] and by Dr. Miles, absent a showing of criticality or unexpected results, the values taught by Engels render obvious the claimed values. EX-1003, 69-76, 80. The ’602 Patent fails to describe a “difference in kind and not of degree” associated with the differences between claim 19’s Fe% and Engels’.

[20]:

Engels discloses or renders obvious that the mean iron composition for layer (d) is lower than the mean iron composition for layer (c). Engels’ Table discloses Fe% of **44.1%** and **54.3%** for these respective values, where phase 4 corresponds to layer (c) and phase 5 corresponds to layer (d). EX-1005, 143; *see* [1f]-[1g]; EX-1003, 81.

[21]:

See claim 1 above. Claim 21 is identical to claim 1 except for additionally reciting that the fourth mean iron composition is different from the first and second mean iron compositions. This element is disclosed in Engels’ Table. EX-1005, 143; EX-1003, 82.

[22]: See [20] above.

[23]:

Engels renders obvious that the fourth mean iron composition (of layer (d)) is higher than the second mean iron composition (of layer (b)). EX-1003, 83.

Engels' Table discloses values of **44.1%** (phase 5) and **45.9%** (phase 3) for these mean iron compositions, respectively. EX-1005, 143.

For similar reasons to those discussed for [12], and as discussed by Dr. Miles, absent a showing of criticality or unexpected results, the values taught by Engels render obvious the claimed relationship. EX-1003, 69-76, 84. For example, a 1% increase in Engels' phase 3 Fe% and a 1% decrease in Engels' phase 5 Fe% would result in layers satisfying claim 23, and this modification would have been obvious. EX-1003, 84.

[24]:

See claim 1 above. Claim 24 is identical to claim 1 except that (i) mean **aluminum** compositions are recited instead of mean iron compositions, (ii) the fourth mean Al% is "different from the first, second and third mean" Al%, and (iii) "the second mean aluminum composition [is] greater than the third mean aluminum composition." These elements are disclosed in Engels' Table. EX-1003, 85.

Differing Al compositions

	phase number	layer thickness, µm	Al	Fe	Si	Cr	Mn
			~~Volume-%~~ Mass-%				
Layer (a)	1	5 – 9	7,2	89,2	1,9	0,3	1,4
[Layer (a)]	2	< 1µm	unmeasurable				
Layer (b)	3	11 – 18	51,4	45,9	1,9	0,1	0,7
Layer (c)	4	3 – 8	33,9	54,3	10,6	0,3	0,9
Layer (d)	5	5 – 11	53,2	44,1	1,9	0,2	0,6

Al% (layer (b)) > Al% (layer (c))

Annotated Engels' Table

[25]:

Engels' Table discloses that the fourth Al% is **53.2%**, while the second Al% is **51.4%**. EX-1005, 143; EX-1003, 86.

For similar reasons to those discussed for [12] and [23], absent a showing of criticality or unexpected results, the values taught by Engels render obvious the claimed relationship. EX-1003, 69-76, 87. For example, a 1% increase in Engels' phase 3 Al% and a 1% decrease in Engels' phase 5 Al% would result in layers satisfying claim 25, and this modification would have been obvious. EX-1003, 87.

[26]: See [9] above. EX-1003, 88.

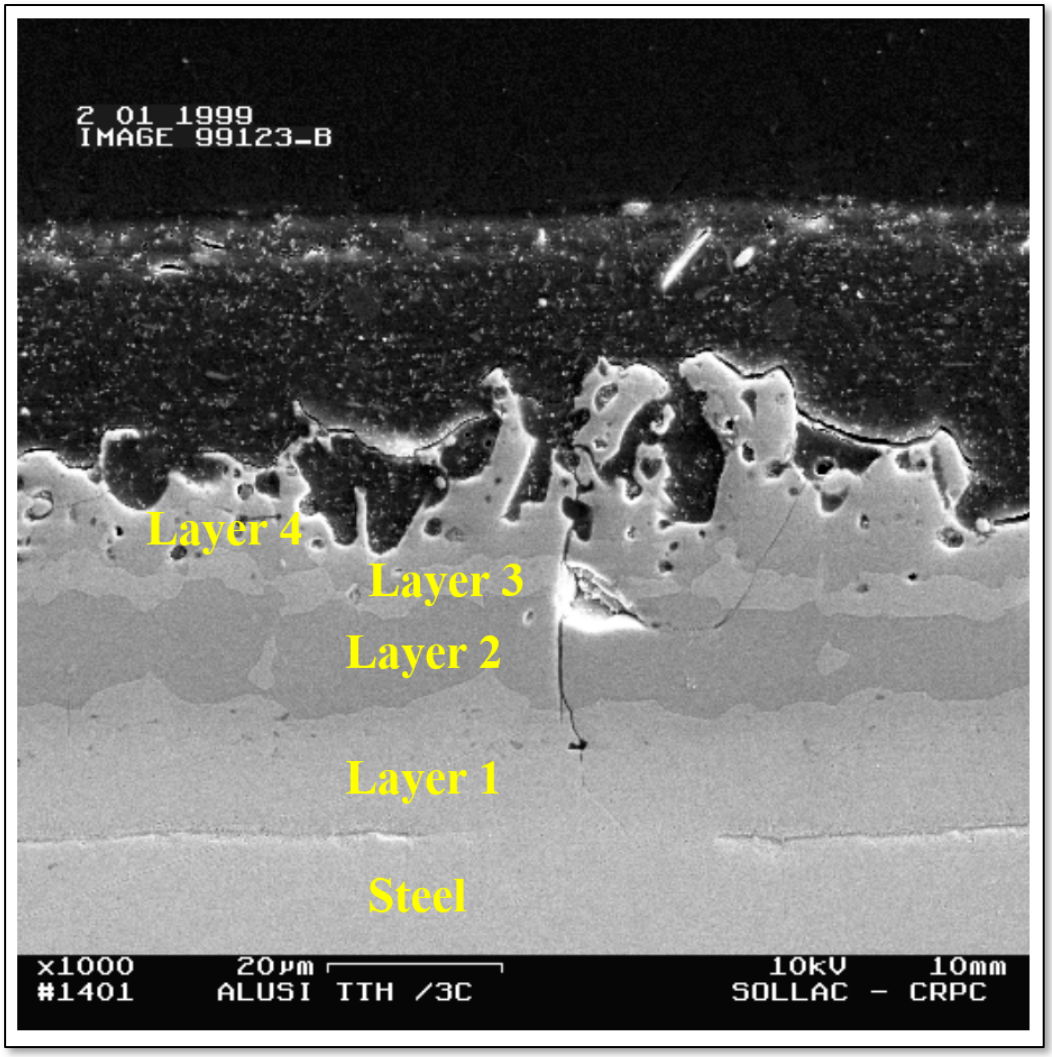
[27]-[30]: See [11]-[14] above. EX-1003, 89.

IV. GROUND 1B: Claims 2 and 5-6 are obvious over Engels in view of Cornette

A. Cornette

Cornette ("High Strength Steels for Automotive Safety Parts") describes

"mechanical testing and different design solutions associated with" certain steel grades. EX-1014, 3; EX-1003, 90. "A specific part of [Cornette] deals with a ultra high tensile strength pre-coated boron steel for hot forming." *Id*. Specifically, Cornette uses "USIBOR 1500" steel in hot-stamping (or "hot forming"). *Id*., 9. A "hot dipped" aluminum-silicon pre-coating with average thickness 25 µm is applied to the steel, and the pre-coated steel is heated at "generally 900˚C [for] 5 minutes" and hot-stamped to obtain, based on an "alloying reaction between substrate [] and the coating," an "Fe-Al-Si layer [] at the steel surface" that is "typically about 40 µm." *Id*., 9. Cornette's FIG. 22 shows the coating (a "multiphase alloy layer"), in which four distinct layers are visible. *Id*. As Dr. Miles explains, these four layers constitute the Fe-Al-Si coating, with a base steel region underneath. EX-1003, 91. In IPR proceedings for the '683 Patent, in a finding that holds here as discussed in §III.B.1, it was found that these layers and the underlying steel form a "stamped product." EX-1029, 32-35.



Annotated Cornette's FIG. 22

B. Combination of Engels and Cornette

It would have been obvious to apply Cornette's process-related disclosure to Engels to obtain a coating having layer compositions at least similar to those described by Engels, with the layer thicknesses described by Cornette. EX-1003, 92. Engels describes hot-stamping with heat treatment generally at "temperatures between 900 ˚C and 950 ˚C," and a POSITA would have understood general ranges of other process parameters (e.g., austenitization time, a specific

austenitization temperature, and pre-coating thickness) based on general knowledge in the art. EX-1003, 92.

To identify specific numerical values of process parameters, a POSITA would have been motivated to consider values used in similar prior art processes such as that of Cornette. EX-1003, 93. It would have been obvious to a POSITA to follow or be generally guided by Cornette's teachings when experimenting with hot-stamping processes, e.g., by using the disclosed "USIBOR 1500" steel (which is referenced by Engels) and/or by performing a 900˚C austenitization for five minutes using a 25 μm pre-coating. EX-1014, 9-10; EX-1003, 93-94 (a comparison of Engels' 22MnB5 steel and USIBOR 1500 steel).

A POSITA would have been further motivated by Cornette's reporting that these parameters provide good results in terms of weldability, corrosion resistance, and mechanical strength. EX-1003, 95; EX-1014, 10. "[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill." *KSR*, 550 U.S. at 417.

A POSITA would have had a reasonable expectation of success in making the combination. As Dr. Miles notes, "the process parameters noted by Cornette would all have been readily available to a steel metallurgist working on hot-

stamping." EX-1003, 96. And the coatings disclosed by Engels and Cornette are similar: each includes four primary layers identifiable using electron microscopy, and each is approximately 40 µm thick (*see* [1h] above). *Id*. Moreover, Engels' disclosure of using temperatures "between 900 ˚C and 950 ˚C" suggests that Engels' FIG. 5 coating was processed under conditions generally similar to those of Cornette. *Id.*

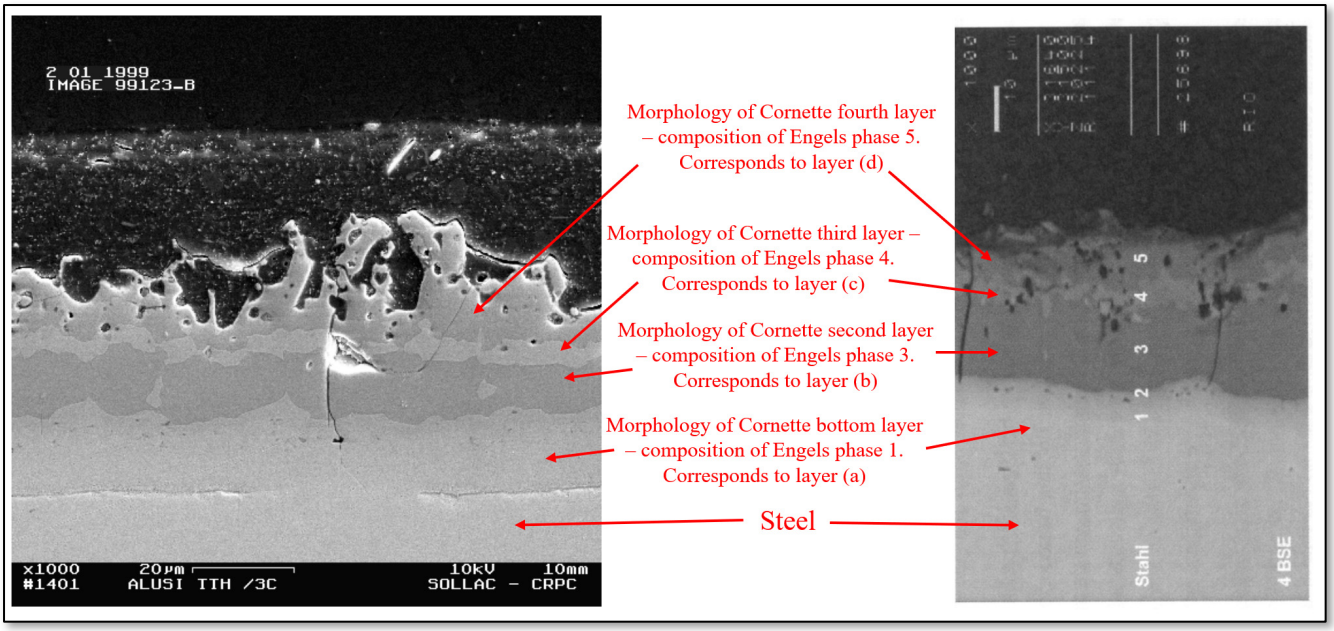
And Engels describes that "heating rate," "total processing time," "maximum austenitizing temperature," and "material thickness" are process parameters that can be tuned to achieve a "correctly shaped diffusion layer." EX-1005, 142; EX-1003, 97.

Accordingly, it would have been obvious to apply Cornette's teachings to obtain a "**modified Engels coating**" in which the four layers have the thicknesses and morphologies described by Cornette, and compositions like Engels, as shown below. Guided by Cornette's teachings, a POSITA would have adjusted the hot-stamping process to arrive at such a layer as a matter of design choice and routine experimentation, and as an example of a layer that it would have been obvious to try manufacturing and testing, given that there are only a finite number of options for the thicknesses of four layers in the four-primary-layer, approximately 40 µm coating disclosed by both Engels and Cornette. EX-1003, 98-99.

As Dr. Miles discusses, it would have been obvious to arrive at the recited

coatings in view of the lack of novel process parameters disclosed by the ’602 Patent. He discusses how the process parameters of the ’602 Patent (e.g., pre-coating thicknesses, heating rates, temperatures, hold times, and cooling rates) are each disclosed by the prior art. EX-1003, 152-153. For example, the ’602 Patent’s heating rate range of 4-12˚C/s was known as evidenced by Takagi and several other references. EX-1016, [0026] (1-10˚C/s), [0037] (8˚C/s); EX-1035, 57:1 (5-10˚C/s); EX-1039, FIG. 2 (5.2 °C/s and 8°C/s); EX-1003, 153. This and other parameter ranges described by the ’602 Patent were general in view of the prior art, and it would have been well within the skill of a POSITA to arrive at the claimed coatings as a result of routine experimentation within the conditions of the prior art. EX-1003, 153.

Notably, to address claim 1, the layers of the modified coating need not have **exactly** the same compositions as those disclosed by Engels but merely satisfy the recited Fe% relationships, which would be satisfied even for moderate deviations from the Fe% in Engels’ Table. EX-1003, 100.



Modified Engels coating

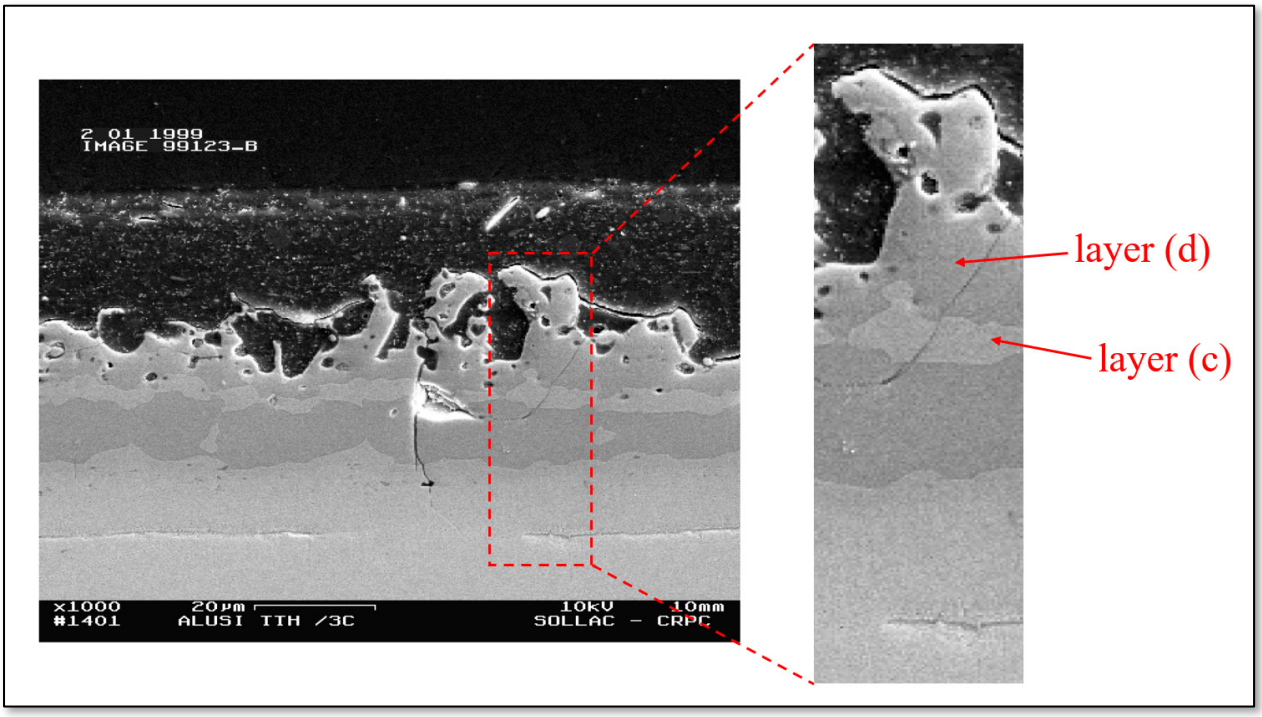
C. Analysis of Claims

[2]:

The combination of Engels and Cornette renders obvious claim 2. EX-1003, 101. For "*less than 10% of layer (c) is present at an extreme surface of the product*," Cornette's FIG. 22 shows that essentially none of layer (c) of the modified coating is present at the extreme surface of the coating. EX-1014, FIG. 22; EX-1003, 101.

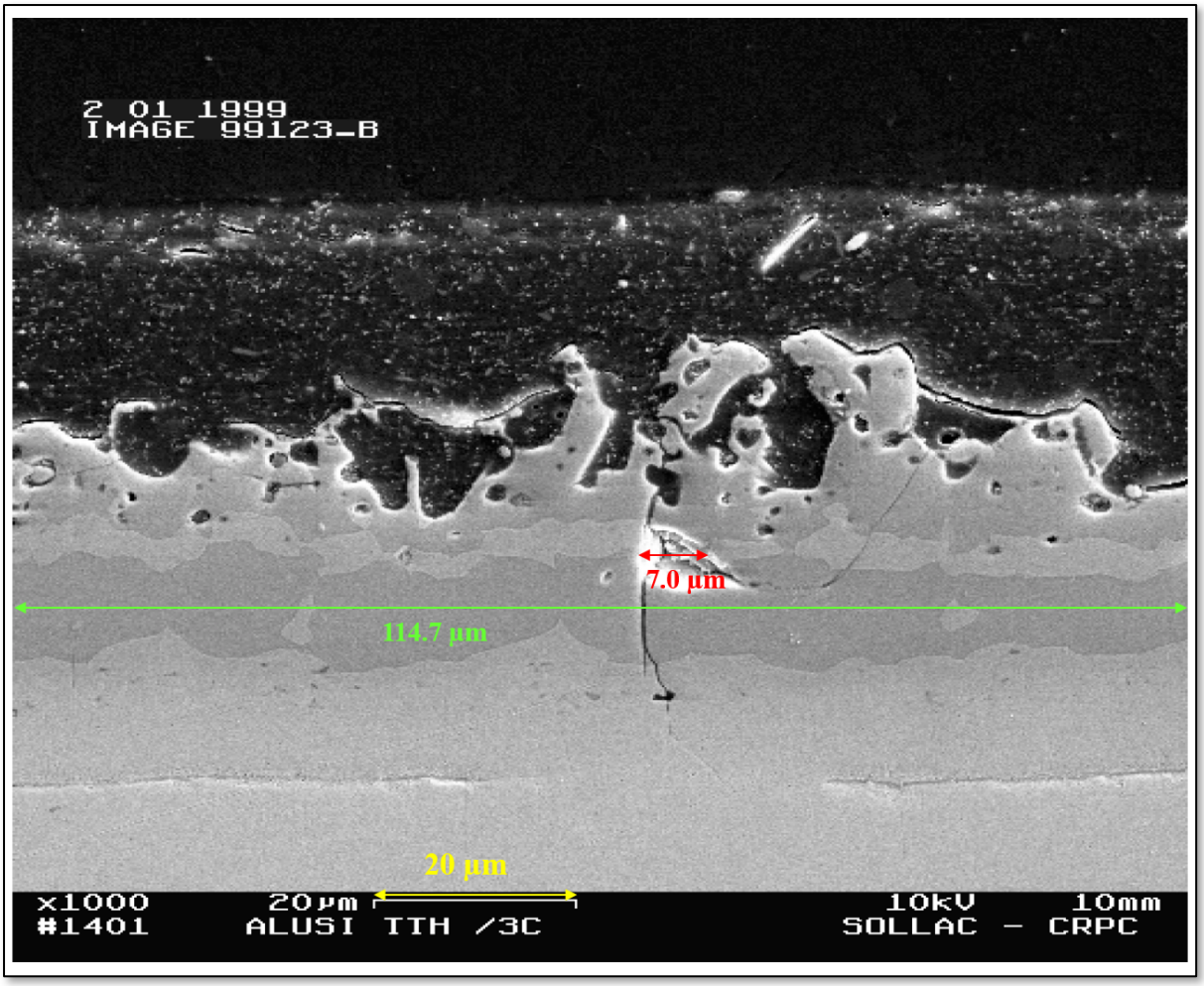
With respect to the first element of claim 2, as shown below, Cornette's uppermost two layers (mapped to (c) and (d)) extend continuously or essentially continuously, e.g., as illustrated in the segment of FIG. 22 enlarged below. Claim 2 merely refers to "a level corresponding to each of the layers" and, thus, the

enlarged segment of FIG. 22 demonstrates "a level" of layers (c) and (d) that satisfies claim 2. EX-1003, 102.



Annotated Cornette's FIG. 22 (enlarged view)

Even across the entire SEM image in FIG. 22 (as shown below), these layers extend continuously or essentially continuously across the **entire image**, except perhaps for one segment (indicated with red below). A POSITA would have considered the layer to be continuous or essentially continuous (or quasi continuous) despite this segment. EX-1003, 103. To the extent that this segment is considered to make the layer discontinuous, the segment occupies only about 6% of the total width of FIG. 22. *Id.* Therefore, layer (c) in Cornette's FIG. 22 is "quasi-continuous." Dr. Miles discusses that a correct analysis would include the red section, such that layer (c) is fully continuous across FIG. 22. *Id.*



Annotated Cornette's FIG. 22

[5]:

As discussed in §IV.B, it would have been obvious to use Cornette's USIBOR 1500 steel (also mentioned in Engels) as the base steel. EX-1003, 104. Cornette discloses that this steel has sulfur composition ≤ 0.008%, or ≤ 80 ppm. EX-1014, 9. Given this disclosure, the recited range of "20 ppm or less," which is entirely encompassed by the prior art range, is obvious. *See In re Peterson*, 315 F.3d 1325, 1329-30 (Fed. Cir. 2003).

[6]: See [2] in §§III.B and IV.C, and [5] above. [6] is obvious based on the reasoning for [5] and the analysis of either Engels' FIG. 5 or Cornette's FIG. 22 for [2]. EX-1003, 105.

V. GROUND 1C: Claims 3-4 and 7-8 are obvious over Engels in view of Laurent

A. Laurent

Laurent describes "steel sheet[s]" having compositions that "ensur[e] a very high mechanical resistance after thermal treatment." EX-1023, 1:47-62. Laurent discusses elemental components of the steel and how those components improve performance. *Id*., 4:18-33. Laurent's components "allow hardening in the stampers" and the "mechanical characteristics [] of the sheet [] allow [] a deep stamping." *Id*., 2:50, 4:30. A POSITA would have understood this disclosure to indicate that the steels of Laurent are well-suited for hot-stamping processes. EX-1003, 106.

B. Analysis of Claims

It would have been obvious to use the steel compositions of Laurent in Engels. EX-1003, 107-110. This would have constituted "mere substitution of one element [the Laurent steel] for another [the "22MnB5" steel of Engels] known in the field." *KSR*, 550 U.S. at 416; EX-1005, 135, 141, 149; EX-1003, 107. A POSITA would have been motivated by Laurent's discussion of the advantages of such a steel, including advantages of the particular elements and concentrations

noted in §VIII.A. 22MnB5 and Laurent's steel have generally similar compositions, such that the substitution of one for the other would have constituted a minor modification within the general conditions of what was already in use. EX-1003, 109.

[3]-[4]:

The "preferabl[e]" "steel composition by weight" of Laurent satisfies or renders obvious [3]-[4]. EX-1023, 1:66-2:10; EX-1003, 109-110.

[7]-[8]:

Laurent discloses "**[t]itanium, the ratio of the content of which with respect to the nitrogen content should be in excess of 3.42**, is introduced in order to prevent combining of the boron with the nitrogen, the nitrogen being combined with titanium." EX-1023, 4:25-28. EX-1003, 111.

For [8], *see* [2] in §III.B. EX-1003, 112.

VI. Ground 1D: Claims 3-6 are obvious over Engels in view of Nishibata

A. Nishibata

Nishibata describes steel compositions and process parameters for "hot forming" (i.e., hot-stamping) for automotive components. EX-1050, 1; EX-1003, 113. Nishibata describes that the inclusion of certain elements, in certain concentrations, can improve properties of the steel. For example, Nishibata discusses the benefits of certain concentrations of carbon, manganese, silicon,

chromium, titanium, aluminum, phosphorous, sulfur, and boron. EX-1050, 3-5. Based on the inclusion of these elements, "it is possible to produce hot-formed members that also have stabilized strengths and toughnesses." *Id*., 2.

B. Analysis of Claims

[3]-[6]:

It would have been obvious to use the steel compositions of Nishibata in Engels. This would have constituted "mere substitution of one element [the Nishibata steel] for another [the "22MnB5" steel of Engels] known in the field." *KSR*, 550 U.S. at 416; EX-1005, 135, 141, 149; EX-1003, 114. A POSITA would have been motivated by Nishibata's discussion of the advantages of such a steel, including that the steel provides "stabilized strengths and toughnesses." EX-1050, 2. For sulfur composition specifically, a POSITA would have been motivated by Nishibata's comment that sulfur is "effective in raising the hardening ability of the steel plate and raising the stabilizing of its strength after hardening" if included at a sufficiently low concentration. EX-1050, 4; EX-1003, 114. 22MnB5 and Nishibata's steel have generally similar compositions, such that the substitution of one for the other would have constituted a minor modification within the general conditions of what was already in use. EX-1003, 115.

Nishibata discloses base steel compositions having sulfur% of 0.002% and 0.001% (20 ppm and 10 ppm), within the range of [5]-[6]. EX-1050, Table 1; EX-

1003, 116. The sulfur% range based on Nishibata's steels in Table 1 also substantially overlaps with the claimed range, and the claimed range is also encompassed by Nishibata's sulfur range of "≤0.05%." EX-1050, 4. Nishibata's steel compositions in Table 1 and pg. 3-4 also satisfy or overlap with the compositions of [3]-[6], rendering obvious those compositions. EX-1003, 115-116; EX-1050, 3-4.

For [6], *see also* [2] in §III.B. EX-1003, 117.

In addition to the foregoing reasons, there are also other reasons why a POSITA would have been motivated to modify Engels in view of Nishibata. First, Engels and Nishibata are in the same field of endeavor as the '602 Patent (e.g., pre-coated boron steels used for automotive parts). *See* EX-1050 at 2 (disclosing that "[t]his invention provides hot-formed members which can be produced from high-strength steel plates by using a hot-forming method and which also have stabilized strengths and toughnesses, as well as a hot-forming method for producing them"); EX-1003, 117.

Second, Dr. Miles notes that "a POSITA would have recognized that mechanical properties of a steel can be improved by reducing the steel's sulfur content." EX-1003, 117. It was recognized that the inclusion of sulfur at high concentrations can deteriorate steel formability. EX-1052, [0088]. *See also* EX-1051 at 5 (discussing that, ideally, sulfur would be limited to 10 ppm in steels by

1990). Knowing this, a POSITA would have been motivated to look for a boron steel having a low sulfur content, such as the boron steels described in Nishibata (e.g., boron steels with low sulfur contents, e.g., ≤ 20 ppm). EX-1003, 117.

Third, as noted above and illustrated in more detail by Dr. Miles, the concentrations disclosed for Nishibata's steels are similar to those of Engels' 22MnB5 composition. EX-1003, 115. In light of this, a POSITA would have expected the proposed combination of Engels and Nishibata to yield predictable and successful results (e.g., a coated steel stamped product having the advantages as described by Engels and Nishibata). EX-1003, 117.

VII. Ground 1E: Claim 6 is obvious over Engels in view of Cornette and Nishibata

A. Analysis of [6]

For reasons discussed in §§IV.B and VI.B, it would have been obvious to apply Cornette's process parameters and Nishibata's base steel composition to Engels, to obtain a modified product having Nishibata's base steel and the modified coating of §IV.B. EX-1003, 118.

The coating and steel composition render obvious claim [6] for reasons discussed for [2] and [5] in §§IV.B and VI.B. EX-1003, 119.

VIII. Ground 1F: Claim 8 is obvious over Engels in view of Cornette and Laurent

A. Analysis of [8]

For reasons discussed in §§IV.B and V.B, it would have been obvious to

apply Cornette's process parameters and Laurent's base steel composition to Engels, to obtain a modified product having Laurent's base steel and the modified coating of §IV.B. EX-1003, 120.

The coating and steel composition render obvious claim [8] for reasons discussed for [2] and [7] in §§IV.B and V.B. EX-1003, 121.

IX. Ground 1G: Claims 11-17, 19, 23, 25, and 27-30 are obvious over Engels in view of Takagi

An overview of Takagi is provided in §X.A. EX-1003, 122.

A. Analysis of Claims

[11]-[17], [27]-[30]

Takagi describes that several hot-stamped coatings, including Nos. 1 and 4, provide desirable formability, corrosion resistance, and weldability. EX-1016, Table 1. Takagi associates these advantages with certain coating characteristics, including innermost layer hardness and thickness, intermediate layer Al%, and outermost layer Fe%. EX-1016, [0017]-[0025].

Dr. Miles discusses that, per his analysis, Takagi's Inner, Inter 2, Inter 3, and Outer layers correspond to Engels' phases 1, 3, 4, and 5, based on layer-by-layer comparisons of Takagi's and Engels' layers and positioning within the coatings. EX-1003, 36-37, 123-126. Thus, a POSITA would have applied Takagi's teachings to the respective layers of Engels. *Id*.

It would have been obvious to optimize the composition of Engels' phases 1,

3, 4, and/or 5 (that is, to modify one, multiple, or all of those compositions) to that of the corresponding layers of Takagi's Nos. 1 and 4 coatings, to achieve the formability, corrosion resistance, and weldability benefits. EX-1003, 127. Engels and Takagi provide a roadmap for doing so: Engels describes that properties of the coating depend on the "[t]emperature profile" (e.g., "heating rate," "total processing time," "maximum austenitizing temperature," and "material thickness"), and Takagi describes (i) how target parameters such as layer hardness and corrosion resistance depend on composition and (ii) how atomic composition can be controlled "by controlling the raised temperature of the heating and the holding time at the raised temperature." EX-1005, 141-142; EX-1016, [0019]-[0021]. Given this guidance and similarities between the layer compositions of Engels and Takagi, it would have been obvious and well within the skill of a POSITA to obtain the claimed compositions by routine experimentation, for example, by experimenting with the thermal parameters identified by Engels guided by Takagi's more-specific temperature disclosures. EX-1003, 128. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller,* 220 F.2d 454, 456 (C.C.P.A. 1955).

This modification would have constituted merely discovery of the optimum composition by routine experimentation, with a reasonable expectation of success

based on Takagi's teachings and close similarities between Takagi's and Engels' processes/coatings. EX-1003, 129. Indeed, this experimentation would have been within the general conditions already disclosed by Engels. For example, as Dr. Miles notes, the layer compositions are similar to one another. EX-1003, 129. *See also* discussion in §IV.B noting that the process parameter ranges (including heating rate) disclosed by the '602 Patent are each described in the prior art, such that it would have been obvious for a POSITA to arrive at the claimed coatings by routine experimentation within the general conditions of the prior art. EX-1003, 152-153.

The resulting modified phases 1, 3, 4, and/or 5 would satisfy or render obvious claims 11-17 and 27-30, as discussed in more detail in §X.E below. EX-1003, 123-130.

[19]:

As discussed for [13] in §IX.A, it would have been obvious to modify the composition of Engels' phase 4 to have a composition of or similar to Takagi's Inter 3 layer. EX-1003, 131. As discussed in §§III.B and X.E, Engels' phase 1, 3, and 5 compositions, in combination with Takagi's Inter 3 composition, render obvious the claimed iron compositions. EX-1003, 131.

For the reasons provided for [13] in §IX.A, it would have been obvious to modify the compositions of Engels' phases 1, 3, 4, and 5 to have compositions of

or similar to Takagi's Inner, Inter 2, Inter 3, and Outer layers, respectively. The compositions of these layers also render obvious the claimed iron compositions. *See* §X.E. EX-1003, 132.

[23]:

As discussed for [13] and [19] in §IX.A, it would have been obvious to modify the compositions of Engels' phases 3 and 5 to have compositions of or similar to Takagi's layers Inter-2 and Outer, respectively. As discussed in §X.E, Takagi's layer compositions for No. 4 satisfy the claimed iron compositions. EX-1003, 133.

[25]:

As discussed for [13] and [19] in §IX.A, it would have been obvious to modify the compositions of Engels' phases 3 and 5 to have compositions of or similar to Takagi's layers Inter-2 and Outer, respectively. As discussed in §X.E, Takagi's layer compositions for No. 4 satisfy the claimed aluminum compositions. EX-1003, 134.

X. GROUND 2A: Claims 1-30 are obvious over Takagi in view of Hein and GMW14400

A. Takagi

Takagi is directed to steel parts with "Al-Si-Fe alloy layer[s]." EX-1016, [0005]. In Takagi, "a heat resisting hot-dip aluminum-coated steel sheet containing Si in a coating layer is heated at a rate of 1-10° C./sec to a temperature in the

temperature range of 900-950° C., and held at that raised temperature for a holding time (or duration) of 2-8 minutes." *Id*., [0026]. "After the heat treatment…, the steel sheet is carried from a heating furnace to a forming press." *Id*., [0027]. "The forming operation into a desired shape is started in the temperature range of 700-800° C. After the forming operation, the shaped sheet is cooled rapidly." *Id*., [0028]. A POSITA would have understood that this is a hot-stamping process. EX-1003, 135.

Takagi describes that "[d]uring the growth of the Al-Si-Fe alloy layer by the heat treatment, mutual diffusion between Al coating and steel substrate layer produces various Al-Si-Fe ternary intermetallic compounds []. The Al-Si-Fe alloy layer formed by the heat treatment has a layered structure made up of these intermetallic compounds, and offers advantages of formability, corrosion resistance and weldability." EX-1016, [0016]. Table 1 provides manufacturing methods, compositions, and hardness values for multiple layers of coatings obtained using five different combinations of temperature and hold time. Nos. 1 and 4 in Table 1 are coatings having five distinct layers. EX-1003, 136.

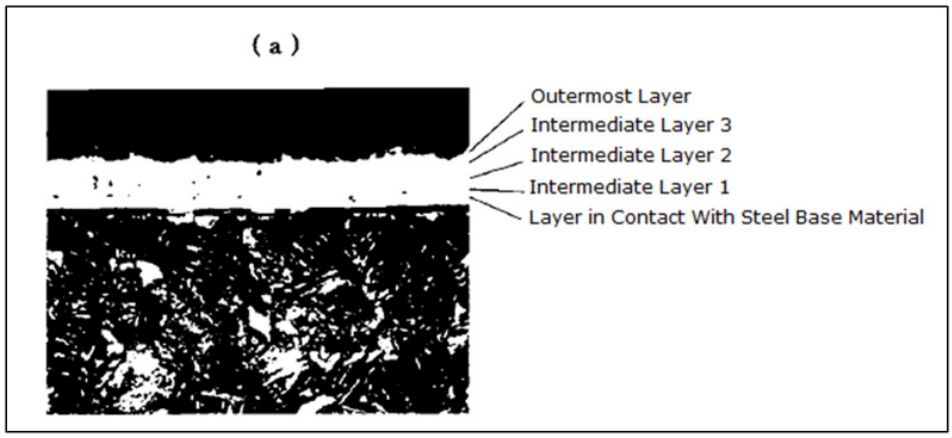
Coatings with five layers

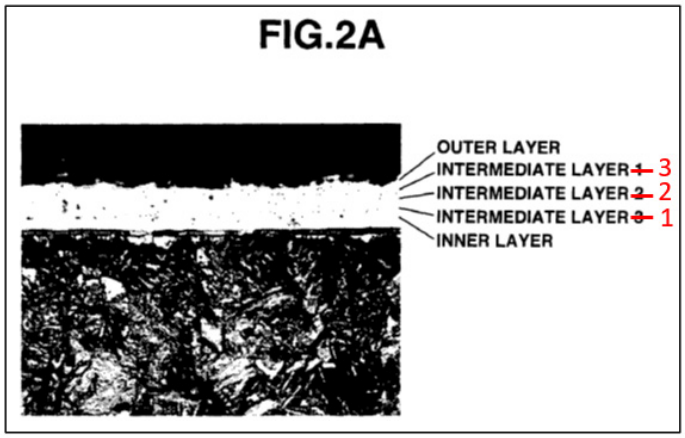
TABLE 1

No.	PRODUCTION		COATING LAYER STRUCTURE & COMPOSITION (%)						STEEL BASE HARDNESS (Hv)	COATING LAYER HARDNESS (Hv)			OXIDE WEIGHT (mg/dm²)	FORMABILITY	CORROSION RESISTANCE	WELDABILITY
	RAISED TEMPERATURE (°C)	HOLD TIME (min.)	COMPONENT & HARDNESS	INNER	INTER 1	INTER 2	INTER 3	OUTER		SOFTEST	AVERAGE	SOFTER RANGE (%)				
1	920	3	Al	7.7	31.0	48.4	31.6	54.8	450	310	415	51	300	○	○	○
			Si	2.0	3.9	1.2	5.7	0.8								
			Fe	89.6	65.9	50.1	62.0	44.5								
			Hv	310	360	750	700	800								
2	900	2	Al	27.2	48.4	31.6	—	54.9	415	380	455	22	275	×	○	○
			Si	4.1	1.2	5.7		0.8								
			Fe	67.2	50.1	61.9		44.1								
			Hv	380	760	720	—	810								
3	930	10	Al	9.4	—	—	—	11.6	400	305	385	78	550	○	×	×
			Si	1.3				1.8								
			Fe	88.4				85.7								
			Hv	305	—	—	—	410								
4	950	5	Al	6.0	27.8	51.9	30.4	47.4	440	280	400	59	385	○	○	○
			Si	1.5	4.3	0.6	5.3	2.2								
			Fe	90.7	66.7	46.8	63.1	49.8								
			Hv	280	340	720	690	800								
5	900	4	Al	3.2	54.5	33.4	—	54.5	440	300	410	56	335	○	○	○
			Si	0.4	2.5	15.3		6.8								
			Fe	94.3	42.7	51.4		38.4								
			Hv	300	740	700	—	810								

Annotated Takagi's Table 1

In Table 1, layers Inner, Inter 1, Inter 2, Inter 3, and Outer are arranged from the base steel outwards. EX-1003, 137. Takagi FIG. 2A erroneously shows the opposite order for intermediate layers 1-3. FIG. 2(a) of the original Japanese patent filing, JP3738754, shows the correct order, which accords with the order presented in Table 1. EX-1018; EX-1003, 137. The drawing from the JP filing, along with a corrected version of the US drawing, are shown below.





Top: translation of FIG. 2(a) of JP3738754
Bottom: corrected FIG. 2A of Takagi

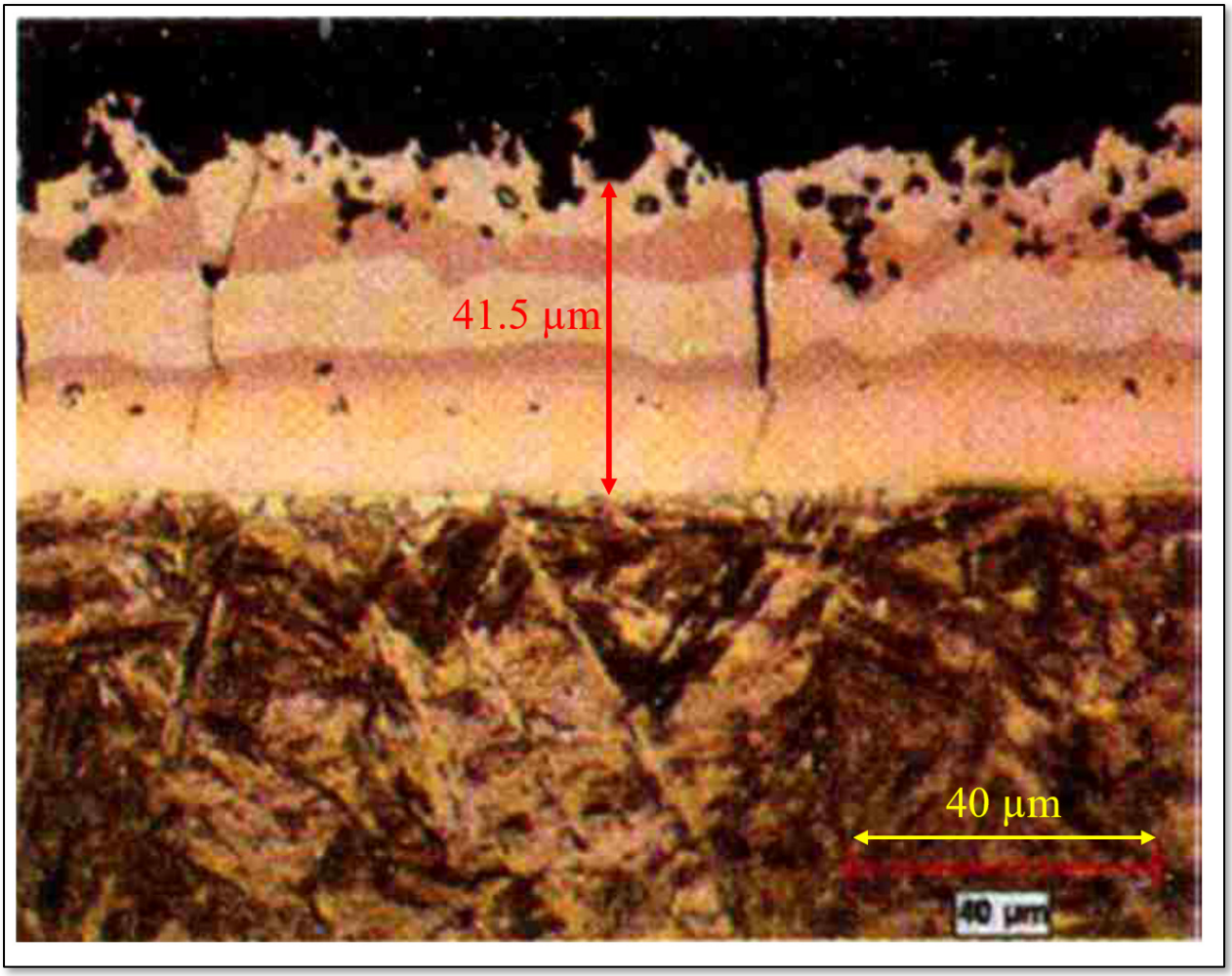
B. Hein

Hein is titled "Hot Stamping of USIBOR 1500 P: Part and Process Analysis Based on Numerical Simulation." Hein uses "Usibor 1500 P," a "precoated boron steel, with a metallic coating of aluminium-silicon [] of approximately 25 µm/side." EX-1019, 164. The steel is "hot-stamp[ed]" by "heating blanks until complete austenitization (900°C to 950°C, during 4 to 10 minutes)" and "transferr[ing] very quickly on a press for the stamping." *Id.*, 163. "The quenching

[] is carried out just after the forming, the heat being absorbed by the closed die (cooling speed between 50°C/s and 100°C/s). The total cycle time (transfer + stamping+ cooling in the die) lies today between 15 s and 25 s." *Id*., 164. "During the heat treatment in the furnaces, this protective coating is transformed into an alloyed layer made of Fe-Al-Si, [] highly adherent on the substrate and with good corrosion properties." *Id*., 165; EX-1003, 138.

Hein's FIG. 4 shows "[s]tructure of the alloyed layer Al-Fe-Si after hot-stamping" with five layers. EX-1019, 165.[4] Five layers can be distinguished. EX-1003, 139. The included 40 µm scale in this figure permits the calculation of exact thicknesses for the coating as a whole and for each layer. *Id*. For example, Dr. Miles' measurements indicate, for at least one possible measurement point, a total coating thickness of 41.5 µm. *Id*.

[4] Measurements and depictions of Hein FIG. 4 are drawn from EX-1020, a higher-resolution color version of EX-1019, in German.



Annotated Hein's FIG. 4

C. GMW14400

GMW14400 is a specification published by General Motors and designed to inform steel makers of the requirements of steel to be used in GM vehicles. Steel manufacturers were required to follow this specification to supply vehicle parts to GM. EX-1003, 140. The specification "covers the requirements for low carbon, heat-treatable boron steel used in the manufacture of structural parts requiring heat treatments to achieve high strength." EX-1026, 1. "Part sections [] supplied under

this standard shall be made by austenitizing a pre cut blank, hot stamping the heated blank and rapid cooling (quenching) the stamped part in the die or via water quenching." *Id*.

GMW14400 requires a "20 to 33" µm Al-Si pre-coating "[p]rior to hot-stamping" where coating thickness "[f]ollowing hot-stamping" is ">35" µm. EX-1026, 7. GMW14400 also requires a certain chemical composition of the base steel. *Id*., 2; EX-1003, 141.

D. Combination of Takagi, Hein, and GMW14400

Takagi describes a pre-coating thickness of 10-20 µm. EX-1016, [0035]. A POSITA would have expected a thickness increase with heat treatment on the order of about "50%." EX-1025, 5:17-20; EX-1003, 142. As a result, using a 20 µm pre-coating a POSITA would have expected Takagi to obtain a coating of 30 µm or more. GMW14400 corroborates this analysis, with GMW14400 using a 20-33 µm pre-coating to obtain a coating > 35 µm. EX-1026, 7. Takagi does not disclose a specific numerical value for thickness after heat treatment. EX-1003, 142.

Given GMW1400's disclosure, and motivated at least by market demand, a POSITA would have found it obvious to implement Takagi's coating thickness to meet GMW1400's specification, adjusting parameters (e.g., pre-coating thickness and heat treatment parameters) as needed. EX-1003, 143-144. *KSR*, 550 U.S. at

402, 419. Such adjustments would have been well within the skill of a POSITA and would have been achievable with a reasonable expectation of success. EX-1003, 143-151.

In pursuit of this goal, the POSITA would have identified Hein as teaching process parameters that, when employed in hot-stamping, produce a coating having a thickness of approximately 40 µm, satisfying GMW14400's >35 µm requirement. EX-1003, 145. Based on this disclosure, the POSITA would have found it obvious to try modifying Takagi's processes based on Hein's and/or GMW1440's process parameters to obtain such a coating. Independent of the teachings of GMW14400, a POSITA would have been motivated by Hein's disclosure that Hein's steel and process parameters provide benefits including high tensile strength and yield strength, a lack of springback, and a "highly adherent" coating with "good corrosion properties." EX-1019, 164-165. Such modifications would have entailed nothing more than "mere application of a known technique to a piece of prior art ready for the improvement." *KSR*, 550 U.S. at 401.

Although Takagi describes a pre-coating thickness of 10-20 µm, the POSITA would have found it obvious to try a pre-coating thickness of "25 µm/side" as described by Hein, and to try a pre-coating thickness range of "20 to 33" µm as described by GMW14400. EX-1019, 164; EX-1026, 7; EX-1003, 146. A POSITA also would have found it obvious to try varying the pre-coating

composition, e.g., by trying the 90 Al% aluminum-silicon pre-coating described by Hein and the 85-95 Al% aluminum-silicon coating bath described by GMW14400. EX-1019, 164; EX-1026, 6; EX-1003, 147. The POSITA further would have found it obvious to try varying the base steel, e.g., by trying a steel having compositions disclosed by GMW1440 and by trying Hein's USIBOR 1500 steel. EX-1019, 164; EX-1026, 2; EX-1003, 148. A POSITA would have found it obvious to try varying the heating parameters described by Takagi, e.g., within the thermal process windows described by Hein. EX-1019, 163-164; EX-1003, 149. All of these parameters were recognized as result-effective in the art, and the corresponding experimentation was well within the skill of a POSITA. EX-1003, 149. Moreover, a POSITA would have had high confidence that the modifications would be successful: the heating profiles used for Takagi's parts are all within or close to the temperature and time ranges disclosed by Hein, and a modified pre-coating thickness of, e.g., 25 μm represents a small modification compared to Takagi's range. EX-1016, FIG. 4; EX-1019, 163; EX-1003, 150.

Based on the routine experimentation, a POSITA would have arrived at various coatings with layers having various thicknesses and compositions. For example, a POSITA would have arrived at "**modified Takagi coatings No. 1 and No. 4**" having, for each of their five layers, the layer composition described for Takagi's Nos. 1 and 4 coatings (or similar composition), and having the layer

thickness and morphology shown in Hein's FIG. 4 (or similar thickness and morphology). Dr. Miles notes that obtaining those compositions and thicknesses would require experimentation. EX-1003, 151. However, given (i) the knowledge that both Takagi's and Hein's processes result in the formation of five-layer coatings, (ii) the relatively small increase in pre-coating thickness associated with a modification of Takagi based on Hein's pre-coating thickness (only from 20 μm to 25 μm), (iii) the art's recognition that layer characteristics (e.g., hardness and corrosion resistance) depend directly on layer composition, and (iv) the art's recognition of the relevant process parameters for modifying layer compositions and thicknesses, the manufacture of the modified coatings would have been obvious. EX-1016, [0019]-[0026]; EX-1003, 151.

The modified Takagi coatings Nos. 1 and 4 are members of a wide class of coatings that are rendered obvious by Takagi, Hein, and GMW14400. EX-1003, 152. Insofar as any aspects of the coating layers are the result of specific heating or pre-coating parameters, Dr. Miles explains that a POSITA would have arrived at such layers by routine experimentation. *Id*. He bases this opinion on a comparison between the values disclosed in the '602 Patent and those in Takagi, Hein, and GMW14400. The values are generally identical or very similar, and the '602 Patent includes no disclosure to suggest an unexpected criticality that would place any of the claimed layer parameters outside the bounds of routine experimentation.

Id. As Dr. Miles states, "[w]hen comparing the '602 Patent to the prior art, a POSITA would have seen very similar processes being applied to very similar steel parts." *Id*. This statement includes the described heating rates, which, as discussed in §IV.B, are disclosed by at least three references. EX-1003, 153.

Parameter	**'602 Patent**	**'602 Patent Example 2**	**Takagi**	**Hein**	**GMW14400**
Pre-coating thickness (μm)	20 – 30	---	10 – 20	25	20 - 33
Heating rate (˚C/s)	4 - 12	10	8; 1-10	---	---
Temperature (˚C)	880 - 940	920	920, 950	900 – 950	---
Hold time (min)	< 3 – 13	< 6	3, 5	<[5] 4 – 10	
Cooling rate (˚C/s)	> 30, or> 50		20 – 100	50 – 100	

E. Analysis of Claims

[1pre]:

As discussed in §III.B, this preamble (or the implicit "stamped" portion) is non-limiting.

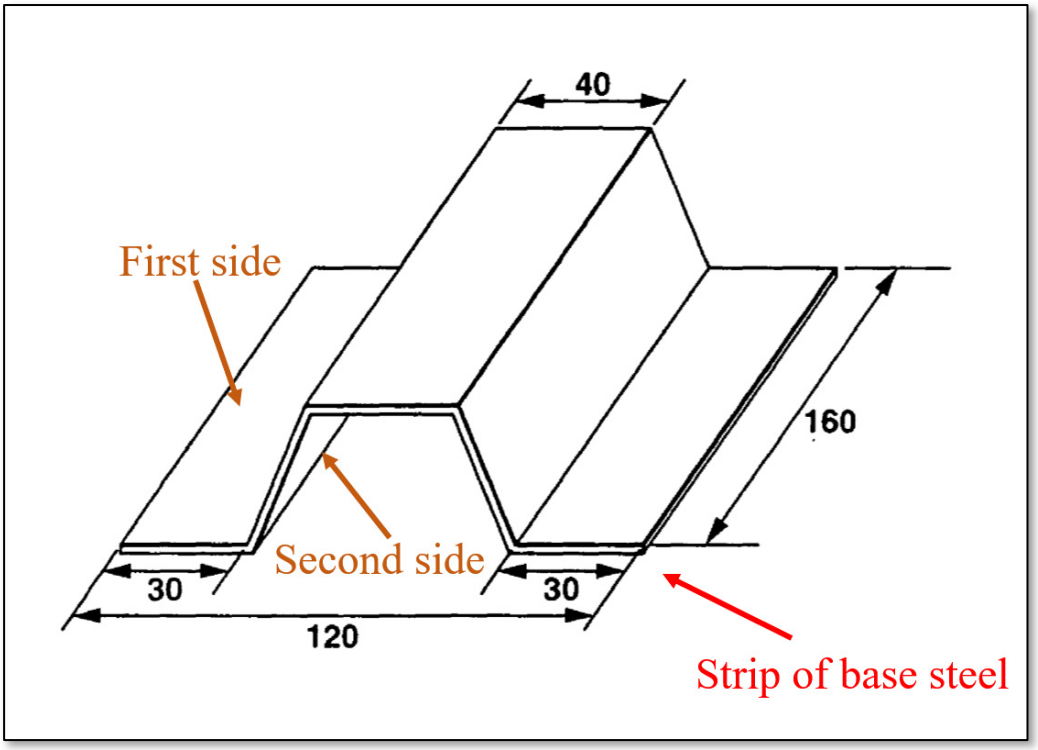
The modified Takagi parts are "precoated steel product[s]" or "precoated steel stamped blanks." Takagi describes that, in the "[t]est [p]rocedure" used for

[5] "<" here indicates that the disclosed time includes both the heating ramp-up time and the hold time.

producing the Nos. 1 and 4, "[f]rom the [] **hot-dip aluminum-coated** [i.e., precoated]" steel sheet, a flat plate [] was cut out, heat-treated [] and **formed into a shape** shown in FIG. 1." EX-1016, [0036]. "Form[ing]" refers to stamping. EX-1003, 154. Further, Hein's FIG. 4 shows a "[s]tructure of the alloyed layer Al-Fe-Si **after hot-stamping**." EX-1019, 165. Hein also clarifies that the precoated part can be referred to as a "**blank**." EX-1019, 163, 166-167.

[1a]:

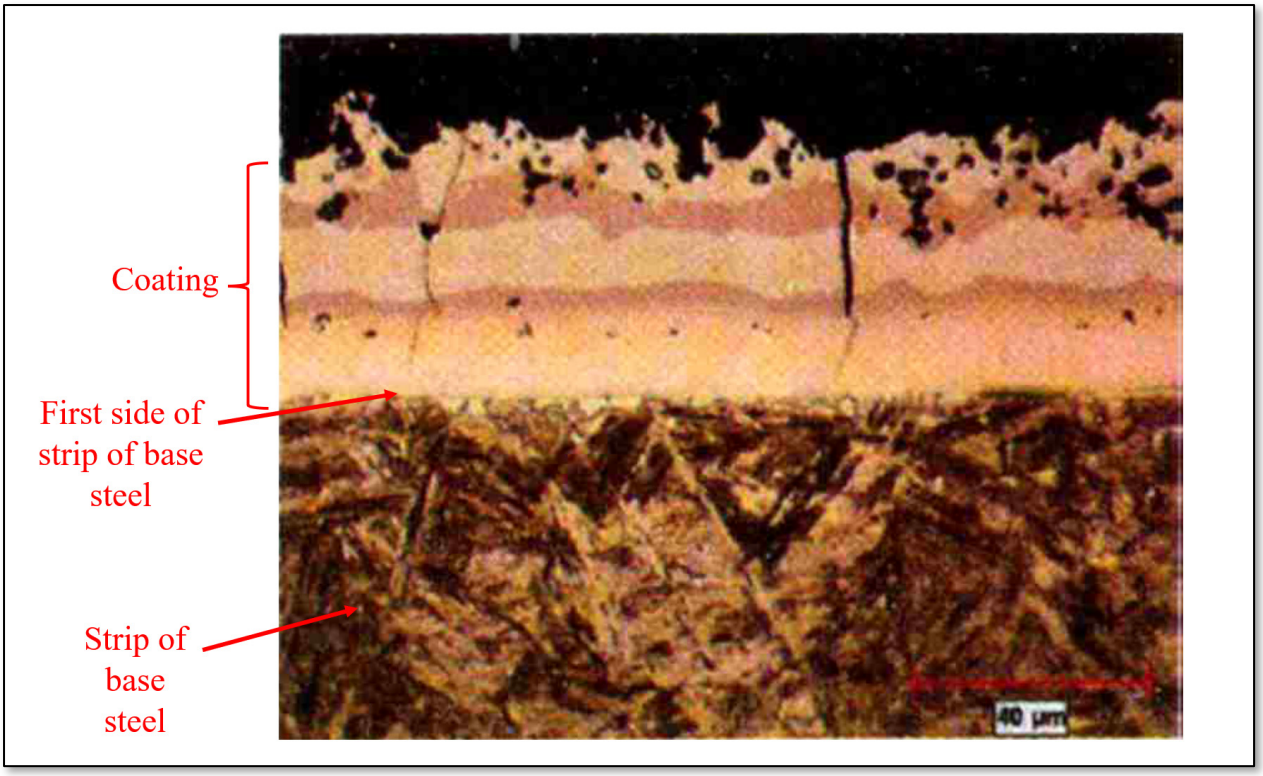
The modified Takagi parts comprise a strip of base steel having a first side and a second side. These sides are shown in Takagi FIG. 1, which illustrates the "shape" of the hot-stamped parts of Takagi Nos. 1 and 4. This shape is obtained by "form[ing]" a "**flat plate**." EX-1016, [0036]. The "base steel," and its two sides, would be underneath a coating. EX-1003, 155.



Annotated Takagi FIG. 1

[1b]:

Hein's FIG. 4 shows an example of a coating which, as discussed in §X.D, corresponds to the modified Takagi coatings Nos. 1 and 4. EX-1003, 156.



Annotated Hein's FIG. 4

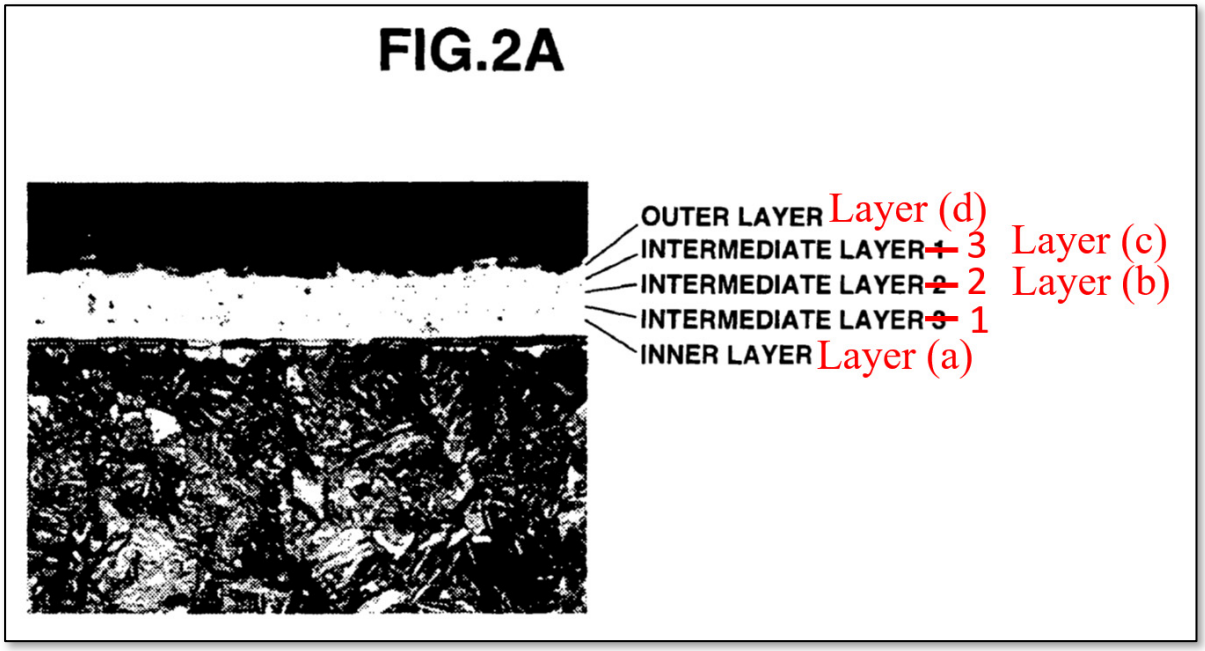
[1c]:

The modified Takagi coatings result from interdiffusion between the base steel and the aluminum or aluminum alloy pre-coating. EX-1003, 157. Takagi describes that "[d]uring the growth of the Al-Si-Fe alloy layer by the heat treatment, **mutual diffusion between Al coating and steel substrate layer** produces various Al-Si-Fe ternary intermetallic compounds." EX-1016, [0016].

[1d]-[1g]:

The modified Takagi coatings have the recited layers. EX-1003, 158-159. For example, the modified Takagi coatings include five layers corresponding to the

Inner, Inter 1, Inter 2, Inter 3, and Outer layers of Takagi's Table 1. At least the **Inner, Inter 2, Inter 3, and Outer layers** of each of the modified Takagi Nos. 1 and 4 coatings teach the recited layers (a), (b), (c), and (d), respectively. The Inner, Inter 2, Inter 3, and Outer layers proceed "from the base steel outwards," as shown in Takagi FIG. 2A.



Annotated Takagi FIG. 2A

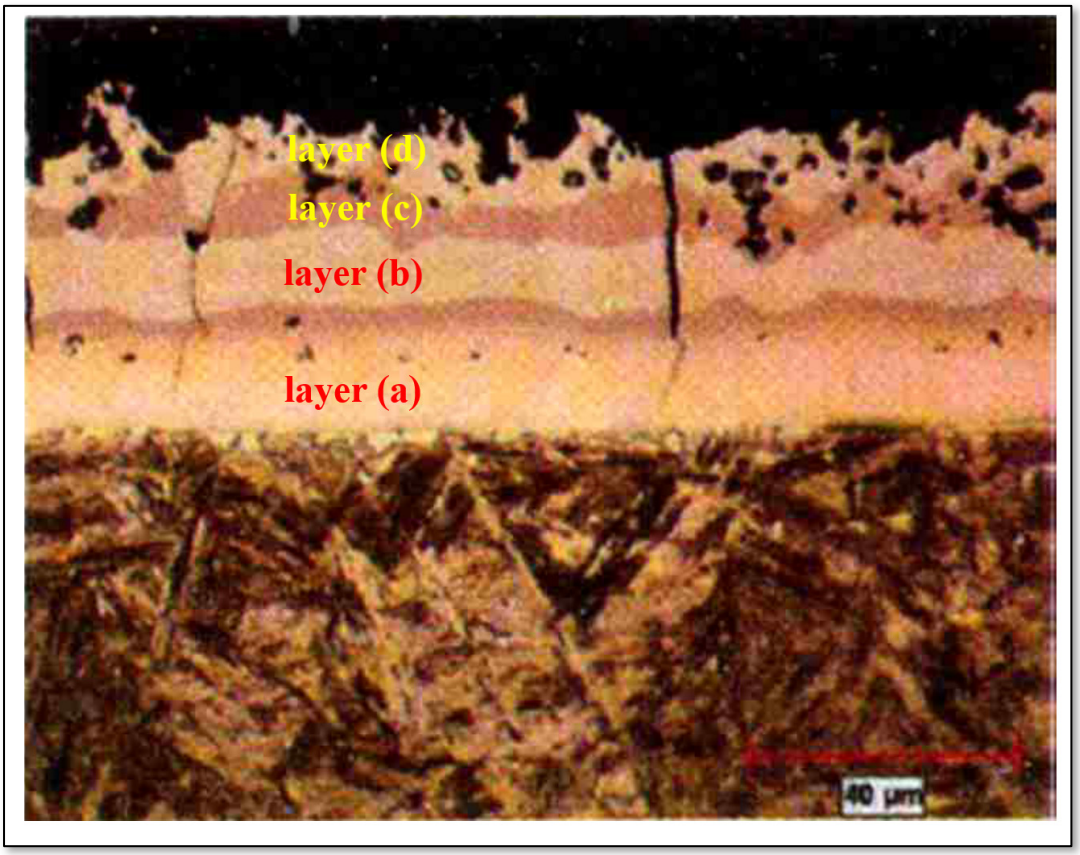
The compositions and thickness/morphology of the modified Takagi coatings' layers, in association with the corresponding layers of the '602 Patent, are shown in the annotated Takagi's Table 1 and Hein's FIG. 4 below. EX-1003, 159.

Corresponding layers of '602 Patent

TABLE 1

No.	PRODUCTION		COATING LAYER STRUCTURE & COMPOSITION (%)						STEEL BASE HARDNESS (Hv)	COATING LAYER HARDNESS (Hv)			OXIDE WEIGHT (mg/dm²)	FORMABILITY	CORROSION RESISTANCE	WELDABILITY
	RAISED TEMPERATURE (°C)	HOLD TIME (min.)	COMPONENT & HARDNESS	INNER (a)	INTER 1	INTER 2 (b)	INTER 3 (c)	OUTER (d)		SOFTEST	AVERAGE	SOFTER RANGE (%)				
1	920	3	Al	7.7	31.0	48.4	31.6	54.8	450	310	415	51	300	○	○	○
			Si	2.0	3.9	1.2	5.7	0.8								
			Fe	89.6	65.9	50.1	62.0	44.5								
			Hv	310	360	750	700	800								
2	900	2	Al	27.2	48.4	31.6	—	54.9	415	380	455	22	275	×	○	○
			Si	4.1	1.2	5.7		0.8								
			Fe	67.2	50.1	61.9		44.1								
			Hv	380	760	720	—	810								
3	930	10	Al	9.4	—	—	—	11.6	400	305	385	78	550	○	×	×
			Si	1.3				1.8								
			Fe	88.4				85.7								
			Hv	305	—	—	—	410								
4	950	5	Al	6.0	27.8	51.9	30.4	47.4	440	280	400	59	385	○	○	○
			Si	1.5	4.3	0.6	5.3	2.2								
			Fe	90.7	66.7	46.8	63.1	49.8								
			Hv	280	340	720	690	800								
5	900	4	Al	3.2	54.5	33.4	—	54.5	440	300	410	56	335	○	○	○
			Si	0.4	2.5	15.3		6.8								
			Fe	94.3	42.7	51.4		38.4								
			Hv	300	740	700	—	810								

Annotated Takagi's Table 1



Annotated Hein's FIG. 4

The Inner, Inter 2, Inter 3, and Outer layers of the modified Takagi coatings satisfy the recited mean iron compositions. EX-1003, 160. Takagi's Table 1 shows the compositions of each of the layers of Nos. 1 and 4, illustrating that (i) in each sample, these layers have different mean iron compositions, and (ii) the iron composition in layer Inter 3 (corresponding to layer (c)) is greater than the iron composition in layer Inter 2 (corresponding to layer (b)) in each sample. As discussed in §X.D, the layers of the modified Takagi coatings have compositions the same as or similar to these compositions. *See* §III.B for a discussion of why a POSITA would have interpreted Takagi's "percent by mass" to be a "mean" composition. EX-1016, [0020]; EX-1003, 49-51, 160.

Corresponding layers of '602 Patent - Iron compositions different for each layer

TABLE 1

(a) (b) (c) (d)

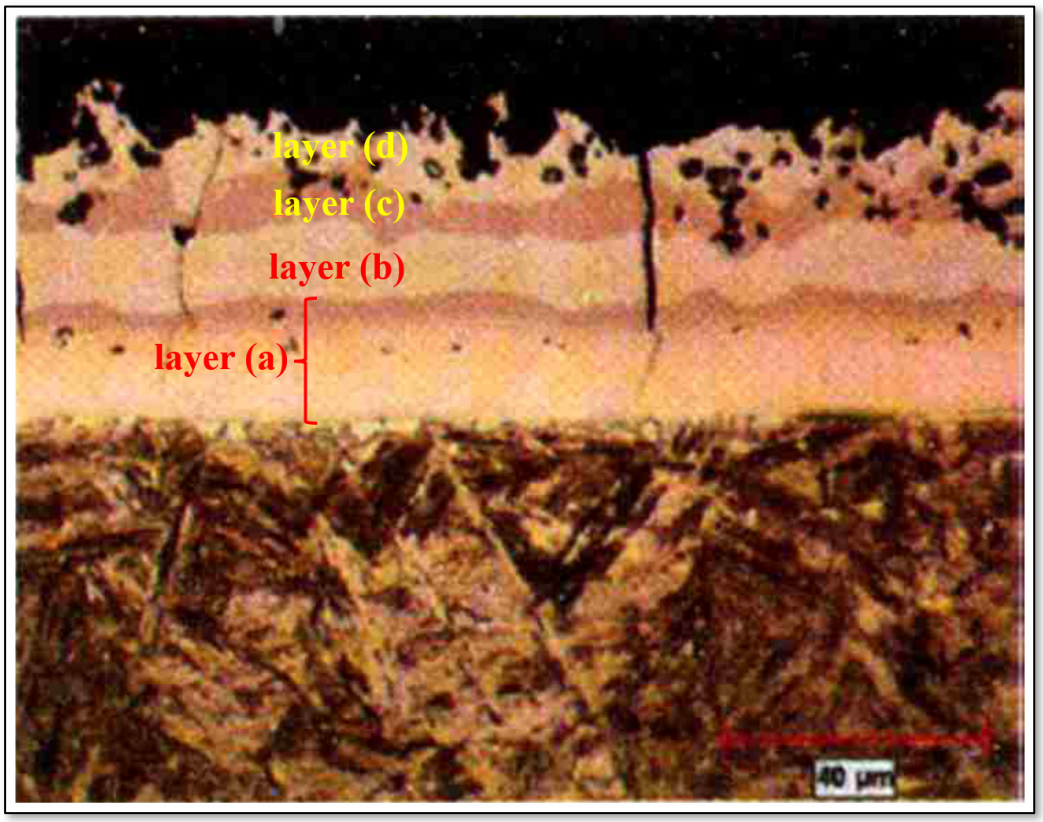
No.	PRODUCTION		COATING LAYER STRUCTURE & COMPOSITION (%)						STEEL BASE HARDNESS (Hv)	COATING LAYER HARDNESS (Hv)			OXIDE WEIGHT (mg/dm²)	FORMABILITY	CORROSION RESISTANCE	WELDABILITY
	RAISED TEMPERATURE (°C)	HOLD TIME (min.)	COMPONENT & HARDNESS	INNER	INTER 1	INTER 2	INTER 3	OUTER		SOFTEST	AVERAGE	SOFTER RANGE (%)				
1	920	3	Al	7.7	31.0	48.4	31.6	54.8	450	310	415	51	300	○	○	○
			Si	2.0	3.9	1.2	5.7	0.8								
			Fe	89.6	65.9	50.1	62.0	44.5								
			Hv	310	360	750	700	800								
2	900	2	Al	27.2	48.4	31.6	–	54.9	415	380	455	22	275	×	○	○
			Si	4.1	1.2	5.7		0.8								
			Fe	67.2	50.1	61.9		44.1								
			Hv	380	760	720	–	810								
3	930	10	Al	9.4	–	–	–	11.6	400	305	385	78	550	○	×	×
			Si	1.3				1.8								
			Fe	88.4				85.7								
			Hv	305	–	–	–	410								
4	950	5	Al	6.0	27.8	51.9	30.4	47.4	440	280	400	59	385	○	○	○
			Si	1.5	4.3	0.6	5.3	2.2								
			Fe	90.7	66.7	46.8	63.1	49.8								
			Hv	280	340	720	690	800								
5	900	4	Al	3.2	54.5	33.4	–	54.5	440	300	410	56	335	○	○	○
			Si	0.4	2.5	15.3		6.8								
			Fe	94.3	42.7	51.4		38.4								
			Hv	300	740	700	–	810								

Fe%(layer (b)) < Fe%(layer (c))

Annotated Takagi's Table 1

In addition, the **Inner and Inter 1** layers of the modified Takagi Nos. 1 and

4 coatings **together** teach the Interdiffusion layer (layer (a)). EX-1003, 161. This mapping, reflected in the annotated Hein's FIG. 4 below, would be consistent with one example of the '602 Patent's disclosure for the reasons discussed in §VI.B. EX-1003, 161.

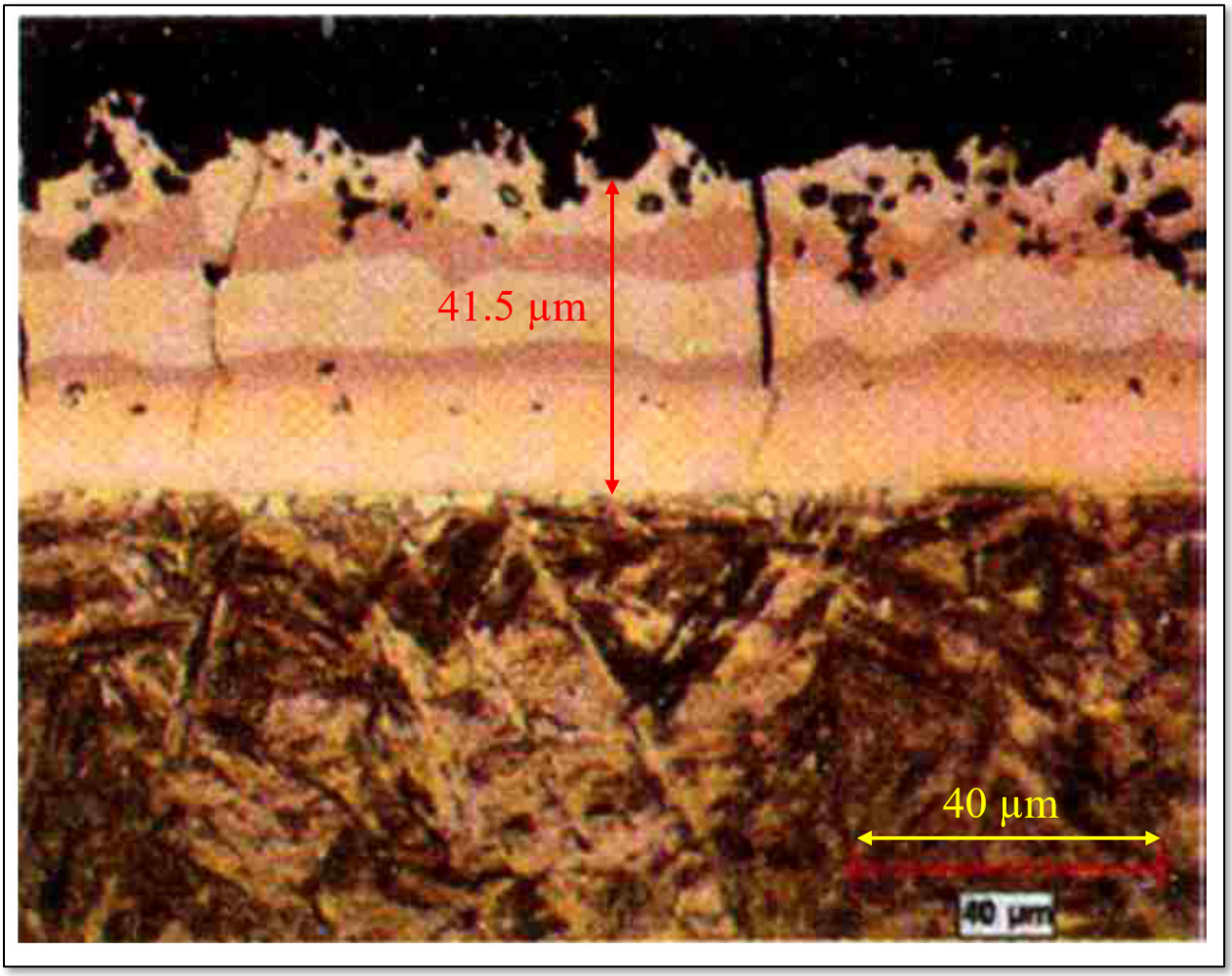


Annotated Hein's FIG. 4

All arguments provided herein that rely on associating the Inner layer with layer (a) apply equally to this composite layer of the Inner and Inter 1 layers, and that alternative mapping should be understood as being included in the discussions below. EX-1003, 162.

[1h]:

The modified Takagi coatings have thicknesses greater than 30 µm. As discussed in §X.D, the modified Takagi coatings have thicknesses the same as or similar to that of Hein's FIG. 4. Dr. Miles' measurements indicate that the Hein FIG. 4 coating has a thickness of 41.5 µm. EX-1003, 163.



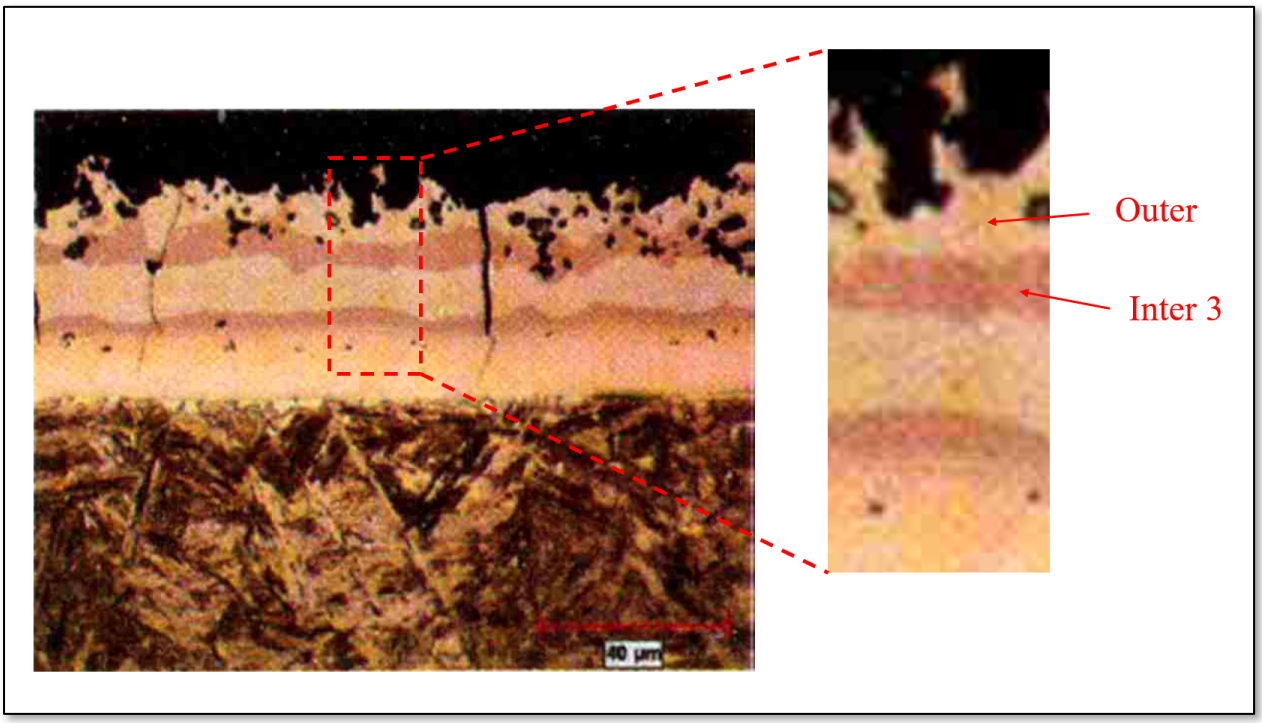
Annotated Hein's FIG. 4

[2]:

The combination of Takagi, Hein, and GMW14400 renders obvious claim 2. For "*less than 10% of layer (c) is present at an extreme surface of the product*,"

Hein's FIG. 4 shows that essentially none of the Inter 3 layer (corresponding to layer (c) of Takagi-Hein-GMW14400 coating) is present at the extreme surface of the coating. EX-1019, FIG. 4; EX-1003, 164-165.

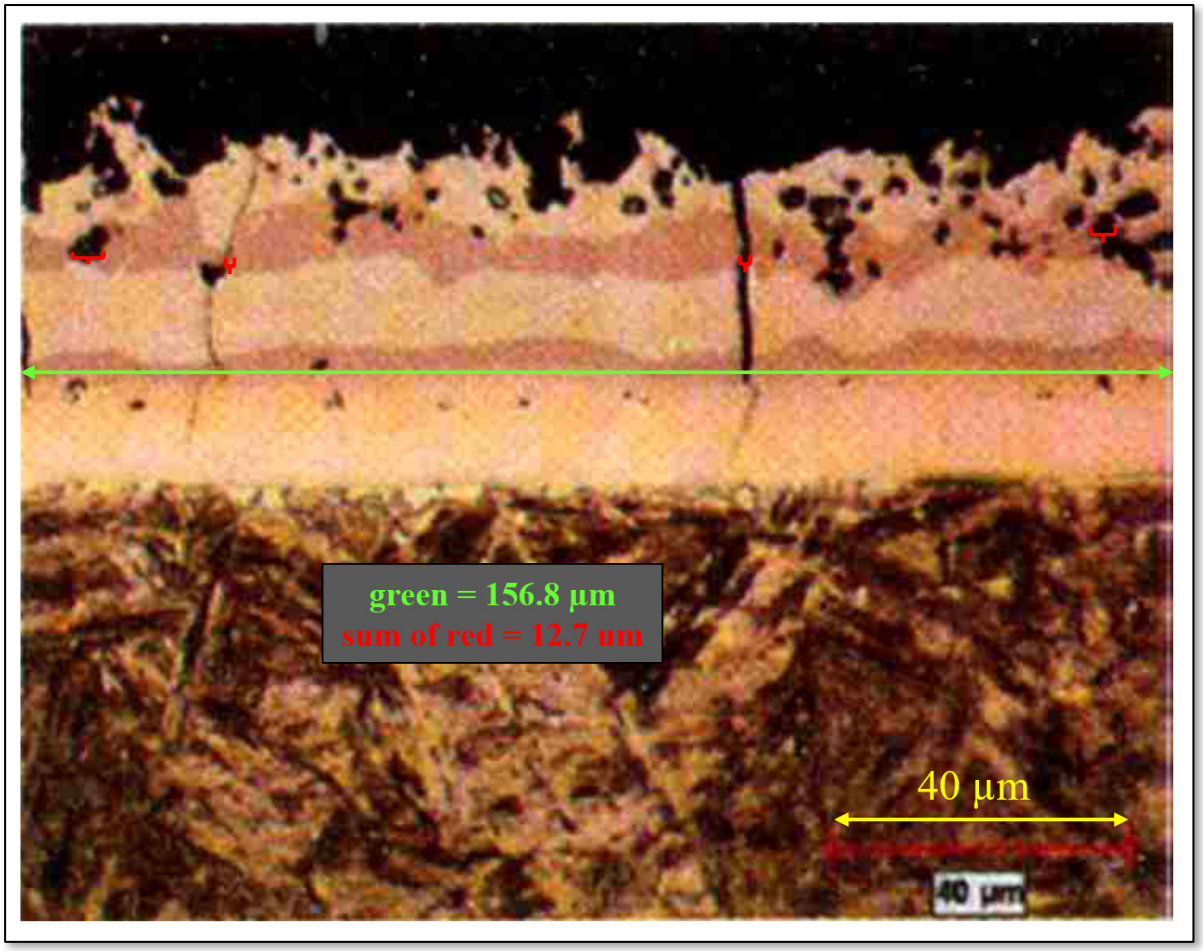
With respect to the first element of claim 2, as shown below, Inter 3 and Outer layers of the modified coating extend continuously or essentially continuously, e.g., as illustrated in the segment of Hein's FIG. 4 enlarged below. Claim 2 merely refers to "a level corresponding to each of the layers" and, thus, the enlarged segment of FIG. 4 demonstrates "a level" of layers (c) and (d) that satisfies claim 2. EX-1003, 166.



Annotated Hein's FIG. 4 (enlarged view)

Even across the entire SEM image in FIG. 4, these layers extend continuously or essentially continuously across the **entire image**, except perhaps

for (i) one or two apparent cracks extending through the Inter 3 and Outer layers and (ii) voids at the left and right edges of the Inter 3 layer. The Inter 3 and Outer layers appear to extend continuously around other voids present in FIG. 4. EX-1003, 167. A POSITA would have considered the layer to be continuous or essentially continuous (or quasi continuous) despite these segments. *Id.* To the extent that these segments are considered to make the layer discontinuous, the indicated segments (indicated in red below) occupy only about 8% of the total width of FIG. 4. *Id.* Therefore, the Inter 3 and Outer layers are "quasi-continuous."



Annotated Hein's FIG. 4

[3]-[4]:

GMW14400's steel compositions satisfy or overlap all composition ranges in [3]-[4]. EX-1026, 2;[6] EX-1003, 168. It would have been obvious to use these steel compositions to satisfy General Motors' requirements. EX-1003, 168. A

[6] As Dr. Miles discusses, a POSITA would have understood that the "0.010 max. %" nitrogen disclosed by GMW14400 is an "impurit[y] inherent in processing." EX-1003, 169.

POSITA would have been further motivated by the recognition that the values in GMW1400 are in agreement with the "Maximum-%" for C, Mn, Si, Cr, Ti, and B described by Hein for USIBOR 1500 steel, which provides "numerous" "technical and economic advantages [] for the manufacturers and the hot-stampers." *Id.*; EX-1019, 164, 165.

GMW1440's lack of disclosure of a Ti% range would have suggested to a POSITA that Ti would be present in small quantities if at all, such that this disclosure teaches a steel with Ti% of less than 0.1%. EX-1003, 169-170.

[5]-[6]:

As discussed for [3], it would have been obvious to use the steel compositions of GMW14400 to satisfy General Motors' requirements. EX-1003, 171. GMW14400 discloses a sulfur composition ≤ 0.01% (≤ 100 ppm). EX-1026, 2. Given this disclosure, the recited range of "20 ppm or less," which is entirely encompassed by the prior art range, is obvious. *See In re Peterson*, 315 F.3d 1325, 1329-30 (Fed. Cir. 2003).

For [6], *see also* [2] above. EX-1003, 172.

[7]-[8]:

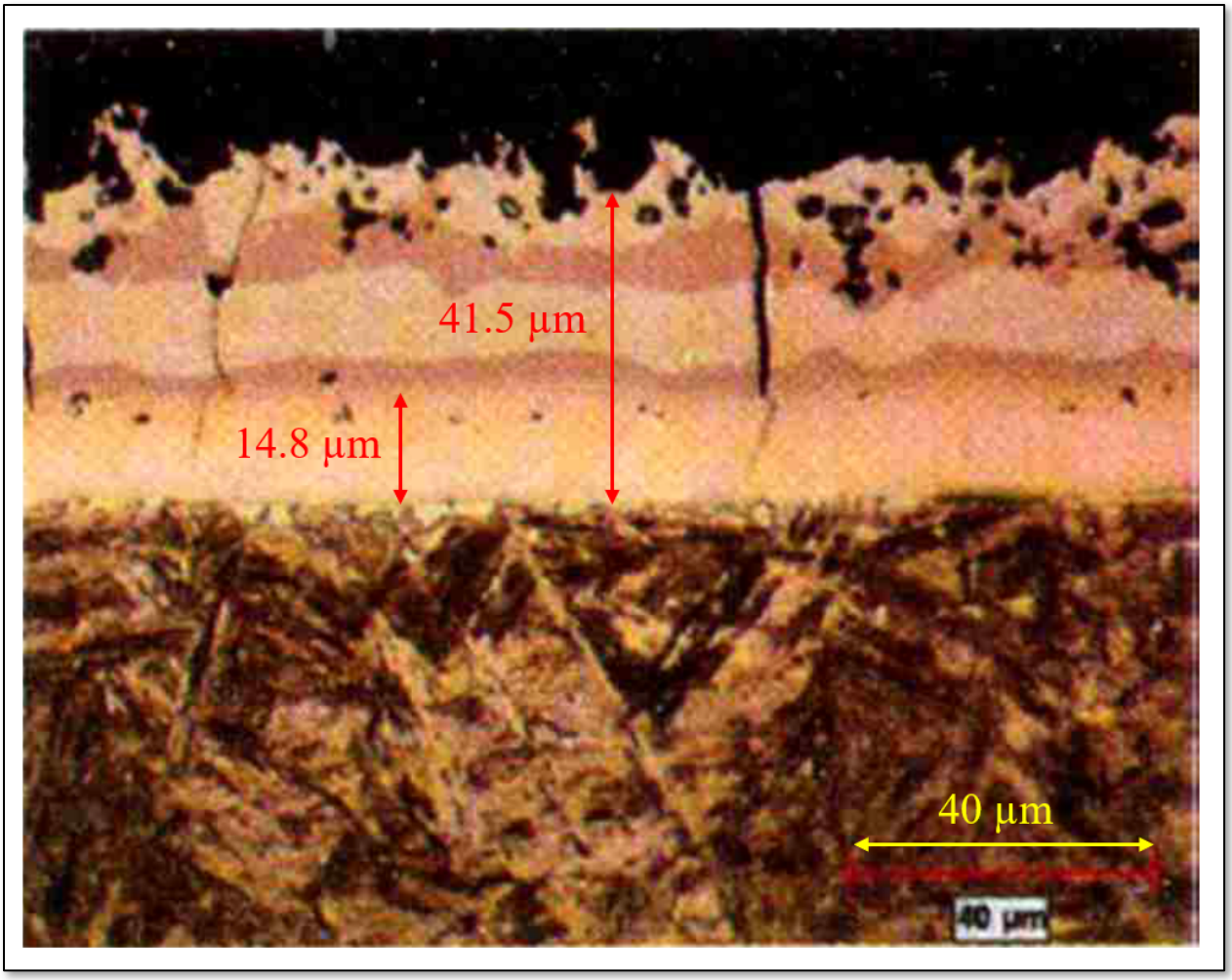
It would have been obvious to try varying the composition of the base steel based on Hein's description of USIBOR 1500 steel and based on GMW14400's requirements. EX-1019, 164; EX-1003, 173. Because GMW1400 is silent as to a

titanium concentration, it would have been obvious to a POSITA to try varying the Ti% within the range disclosed by Hein, e.g., based on Hein's description that USIBOR 1500 steel is particularly advantageous for hot-stamping. EX-1026, 2; EX-1019, 164-165; EX-1003, 173. As a result of this routine experimentation, it would have been obvious for a POSITA to arrive at the disclosed **0.05%** upper limit for Ti% disclosed by Hein, in combination with the **0.01%** upper limit for N% disclosed by GMW14400. EX-1019, 164; EX-1026, 2; EX-1003, 173. These two compositions satisfy the ratio "in excess of 3.42" recited in claims 7-8. EX-1003, 173.

For [8], *see also* [2] above. EX-1003, 174.

[9]-[10]:

As discussed in §X.D, the layers of the modified Takagi coatings have thicknesses the same as or similar to those of Hein's FIG. 4. Dr. Miles' measurements indicate that the deepest layer of the Hein FIG. 4 coating (which corresponds to layer (a)) has a thickness of **14.8 µm**. EX-1003, 175.



Annotated Hein's FIG. 4

This thickness satisfies [9]. If Patent Owner argues that the thickness is not explicitly disclosed, it would have been obvious to try varying the thickness of the layer to obtain a slightly thinner layer, thereby satisfying the claimed thickness ranges. EX-1003, 176.

For [10], it would have been obvious to experiment with the coating thickness to arrive at the claimed less than 10 µm. EX-1003, 177. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to

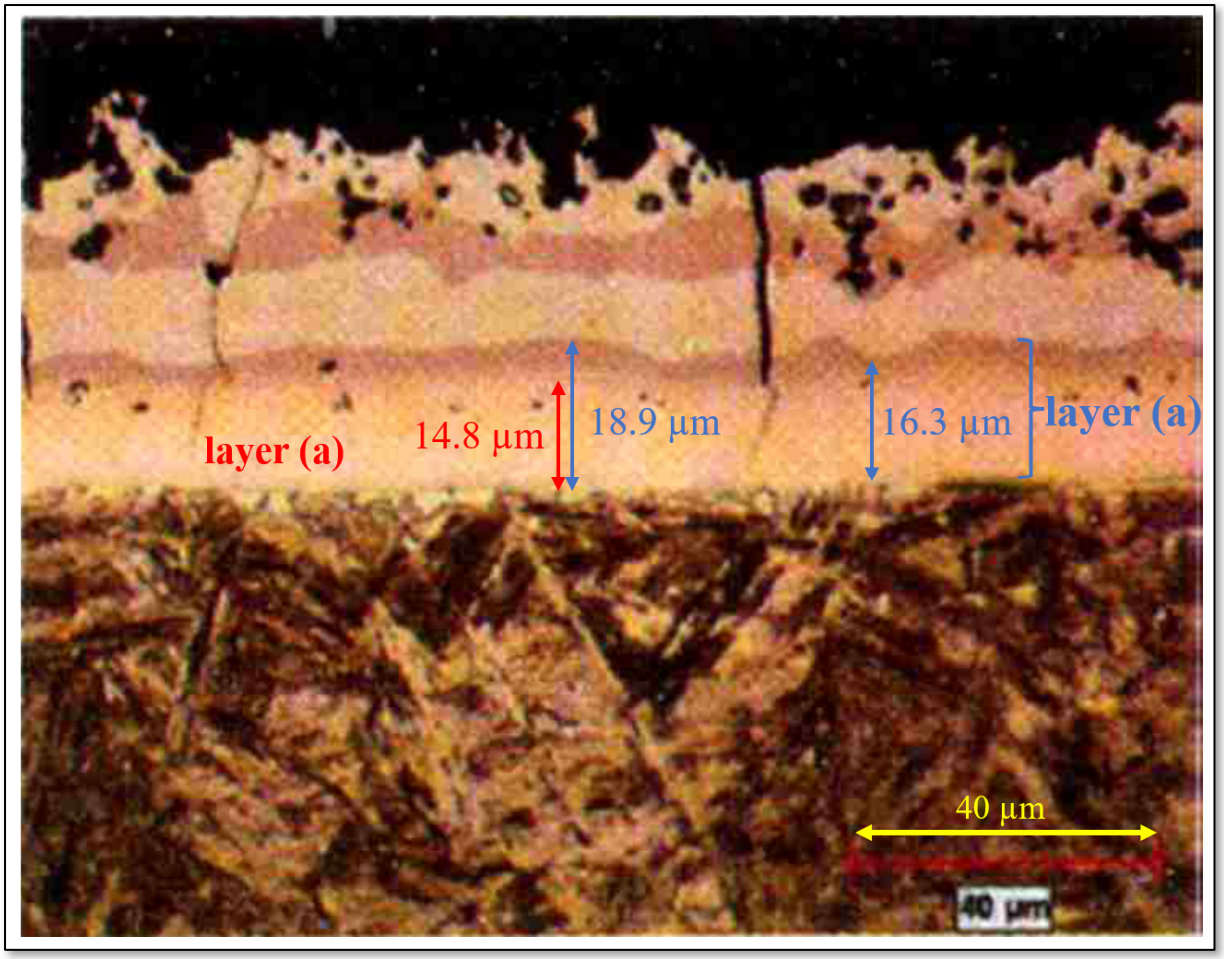
discover the optimum or workable ranges by routine experimentation." *In re Aller* at 456. Here, the claimed range would represent a decrease in thickness for the Inner layer of only several µm, and the '602 Patent does not describe any criticality or unexpected results for "less than 10 micrometers" compared to 14.8 µm in the modified Takagi coating. EX-1003, 177.

Indeed, the '602 Patent does not appear to specifically disclose the claimed range of [10] at all. The range is at most **indirectly** indicated by boilerplate language referring to "all whole numbers, ranges and subranges" between 1 and 15 µm. EX-1001, 6:44-49. The closest description to an actual coating satisfying [10] is that a certain tested part ("ii") has a "10 micrometers thick" interdiffusion layer, and the '602 Patent discusses no benefits associated with that thickness. EX-1011, 12:61-13:6. That same part exhibits an "extremely small" weldability range, which Dr. Miles discusses is an undesirable feature in hot-stamped steel parts. EX-1003, 178. Dr. Miles notes that the "ii" product may correspond to FIG. 2, which is not described as including a superficial layer (i.e., is not described as satisfying claim 1). EX-1003, 179.

A POSITA would have been motivated to experiment with the Inner layer thickness to arrive at the claimed thickness range with a reasonable expectation of success. EX-1003, 180. Takagi explicitly recognizes this thickness as a result-effective variable, noting the thickness's relationship to crack prevention and

corrosion resistance. EX-1016, [0017]. Takagi also describes the physical mechanism behind layer formation and how the layer can be tuned "by controlling the raised temperature of the heating and the holding time at the raised temperature." EX-1016, [0019]. By varying these parameters and the other parameters noted by Takagi and Hein, it would have been obvious for a POSITA to arrive at the claimed thickness. EX-1003, 180-181.

In the case where the Inner and Inter 1 layers are together applied as layer (a), the composite layer has a measured thickness of **18.9 µm** or **16.3 µm**, which renders obvious the claimed thicknesses absent evidence of criticality or unexpected results, for the reasons discussed above. EX-1003, 182.



Annotated Hein's FIG. 4

[11]:

As taught in Takagi's Table 1, the Inner layers of Nos. 1 and 4 have compositions of, or similar to, **89.6% Fe, 7.7% Al, 2.0% Si**, and **90.7% Fe, 6.0% Al, 1.5% Si**, respectively. EX-1003, 183.

Further, Takagi's percentages are "mass %," which is equivalent to weight %. EX-1016, [0020]; EX-1003, 26. As discussed for [11] in §III.B, a POSITA would have understood the disclosed mass/weight % to be based on **total** mass/weight and to correspond to **mean** compositions. EX-1003, 184.

[12]:

As taught in Takagi's Table 1, the Inter 2 layers of Nos. 1 and 4 have compositions of, or similar to, **50.1% Fe, 48.4% Al, 1.2% Si**, and **46.8% Fe, 51.9% Al, 0.6% Si**, respectively. These values are within the recited ranges except for No. 1 Al% (deviation of 4.6%), No. 1 Fe% (deviation of 3.1%), and No. 4 Al% (deviation of 1.1%). As discussed for [12] and [13] in §III.B, and by Dr. Miles, the disclosed compositions render obvious the claimed compositions. EX-1003, 185-187.

[13]:

As taught in Takagi's Table 1, the Inter 3 layers of Nos. 1 and 4 have compositions of, or similar to, **62.0% Fe, 31.6% Al, 5.7% Si**, and **63.1% Fe, 30.4% Al, 5.3% Si**, respectively. EX-1003, 188.

[14]:

As taught in Takagi's Table 1, the Outer layers of Nos. 1 and 4 have compositions of, or similar to, **44.5% Fe, 54.8% Al, 0.8% Si**, and **49.8% Fe, 47.4% Al, 2.2% Si**, respectively. All of the No. 1 values are within the recited ranges. The No. 4 values deviate from the recited ranges by 2.8%, 5.6%, and 0.2% for Fe%, Al%, and Si%, respectively. Absent evidence of criticality or unexpected results, these values render obvious the claimed ranges as discussed for [12] and [13] in §III.B and by Dr. Miles. EX-1003, 186, 189.

[15]: See [12].

[16]: See [13].

[17]: See [14].

[18]: See [9]. The modified Takagi coating has an Inner layer with thickness **14.8 µm**, as disclosed in Hein's FIG. 4. EX-1003, 190. In the case where the Inner and Inter 1 layers are together applied as layer (a), the composite layer has a measured thickness of **18.9 µm** or **16.3 µm**, which renders obvious the claimed thicknesses absent evidence of criticality or unexpected results. *Id.*

[19]:

The modified Takagi coatings No. 1 and 4 have layer-wise Fe% of or similar to **89.6, 50.1, 62.0, 44.5** and **90.7, 46.8, 63.1, 49.8**, all similar to the claimed Fe%. For similar reasons to those discussed for [12] in §III.B and by Dr. Miles, absent a showing of criticality or unexpected results, the values taught by Takagi render obvious the claimed values. EX-1003, 186, 191-192. The '602 Patent fails to describe a "difference in kind and not of degree" associated with the differences between claim 19's Fe% and Takagi's. *Id.*

[20]:

The modified Takagi coatings have Fe% for Inter 3 and Outer layers of **62.0%** and **44.5%** for No. 1 and **63.1% and 49.8%** for No. 4, respectively. These pairs of values both satisfy claim 20, with Inter 3 corresponding to layer (c) and

Outer corresponding to layer (d). EX-1003, 193.

[21]:

See claim 1 above. Claim 21 is identical to claim 1 except for additionally reciting that the fourth mean composition is different from the first and second mean iron compositions. This element is disclosed in Takagi's Table 1. EX-1003, 194.

[22]: See [20].

[23]: The claimed Fe% relationship is satisfied for the modified No. 4 coating based on Takagi's Table 1 (**46.8%** for Inter 2 and **49.8%** for Outer). The modified No. 1 coating (**50.1%** for Inter 2 and **44.5%** for Outer) renders obvious [23] for reasons discussed for [23] in §III.B and for [12] in §X.E. EX-1003, 195-196.

[24]: See claim 1 above. Claim 24 is identical to claim 1 except that (i) mean **aluminum** compositions are recited instead of mean iron compositions, (ii) the fourth mean Al% is "different from the first, second and third mean" Al%, and (iii) "the second mean aluminum composition [is] greater than the third mean aluminum composition." These elements are disclosed for the modified Nos. 1 and 4 coatings in Takagi's Table 1. EX-1003, 197.

[25]:

The claimed Al% relationship is satisfied for the modified No. 4 coating

based on Takagi's Table 1 (fourth Al% **47.4%**, second Al% **51.9%**). The modified No. 1 coating (fourth Al% **54.8%**, second Al% **48.4%**) renders obvious [25] for reasons discussed for [25] in §III.B and for [12] in §X.E. EX-1003, 198.

[26]: See [9] above.

[27]-[30]: See [11]-[14] above.

XI. Ground 2B: Claims 3-4 and 7-8 are obvious over Takagi in view of Hein, GMW14400, and Laurent

A. Analysis of Claims

[3]-[4], [7]-[8]:

As discussed in §V.B, a POSITA would have found it obvious to try using a steel as disclosed by Laurent to realize "very high mechanical resistance after thermal treatment." EX-1023, 1:47-62; EX-1003, 199. The "preferabl[e]" "composition by weight" of Laurent's steel, including the disclosed ratio of Ti to N, satisfies or renders obvious [3]-[4] and [7]-[8]. EX-1023, 1:66-2:14; EX-1003, 199.

XII. Ground 2C: Claims 3-6 are obvious over Takagi in view of Hein, GMW14400, and Nishibata

A. Analysis of Claims

[3]-[6]:

As discussed in §VI.B, a POSITA would have found it obvious to try using the steel compositions of Nishibata to obtain "stabilized strengths and toughnesses" in a hot-stamped part. EX-1050, 2; EX-1003, 200. Nishibata's base

steel compositions having sulfur% of 0.002% and 0.001% (20 ppm and 10 ppm) satisfy or render obvious [5]-[6]. EX-1050, Table 1; EX-1003, 200. Nishibata's steel compositions in Table 1 and pg. 3-4 also render obvious [3]-[4]. EX-1003, 200. *See* §VI.B.

For [6], *see also* [2] in §X.E. EX-1003, 201.

The proposed use of Nishibata's steel with the process and coatings of the Takagi+Hein+GMW14400 combination is further obvious for reasons discussed in §VI.B. For example, Takagi, Hein, GMW14400, and Nishibata are all in the same field of pre-coated boron steels used for automotive parts. EX-1003, 201. Also, as discussed in §VI.B, a POSITA would have recognized that Nishibata provides steel with advantageously low sulfur concentrations, which can result in a formable steel. *Id*. Further, as demonstrated in more detail by Dr. Miles, Nishibata's steels satisfy the elemental concentrations described for Hein's steel, such that (i) the proposed combination would be expected to yield predictable and successful results and (ii) a POSITA would have reduced their time experimenting within the ranges disclosed by Hein by using Nishibata's specific values, e.g., the values for Nishibata's No. 2 steel.

XIII. DISCRETIONARY CONSIDERATIONS

A. 35 U.S.C. §325(d)

Discretionary denial under *Advanced Bionics* is not warranted.

The references applied against claim 1 – Engels for anticipation/obviousness

and the Takagi-Hein-GMW14400 combination – were not applied in rejections during prosecution of the ’602 Patent. *See* EX-1002. As noted in §II.B, only Laurent was applied in a rejection, and Laurent is cited here only as a secondary reference against dependent claims.

The Examiner’s failure to apply Engels, Takagi, Hein, and GMW14400 during prosecution was erroneous, such that part 2 of the *Advanced Bionics* framework is not satisfied. Each of Engels, Takagi, Hein, and GMW14400 is listed as cited on the face of the ’602 Patent. EX-1001, pg. 2-4. However, these references were not used as the basis for any rejection and the Examiner did not discuss them. The Applicant briefly addressed Takagi to note that Takagi fails to teach that “the coating has a thickness greater than 30 micrometers,” a teaching provided herein by Hein and GMW14400. EX-1002, 43-44. None of Engels, Takagi, Hein, and GMW14400, nor the obviousness of the Challenged Claims in view of these references, was otherwise addressed during prosecution.

The Examiner apparently failed to appreciate, e.g., how Engels’ and Takagi’s disclosure of the compositions of each layer in a multi-layer coating would teach the composition-related elements of claim 1, an element listed as leading to allowance in the Notice of Allowance. EX-1002, 11. Nor did the Examiner consider that Engels’ FIG. 5 shows a coating with a thickness greater than 30 μm, as recited in claim 1. The omission of these references from any

applied rejection and failure to consider their teachings constitutes material error.

XIV. FEES

Please charge Deposit Account No. 06-1050 for any fees.

XV. CONCLUSION

The Challenged Claims should be canceled.

XVI. MANDATORY NOTICES UNDER 37 C.F.R § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Petitioner, POSCO Co., Ltd. is the real party-in-interest. VinFast Auto, LLC, VinFast Auto Ltd., VinFast USA Distribution, LLC, Vingroup USA, LLC, and VinFast Trading and Production JSC are additional real parties-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

Petitioner is not aware of any disclaimers, reexamination certificates or petitions for inter partes review for the ’602 Patent. The ’602 patent is the subject of a number of civil actions including: *Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same*, Inv. No. 337-TA-1402 (ITC) filed April 17, 2024; and *ArcelorMittal v. VinFast Auto, LLC et al*, 2-24-cv-03128 (CDCA) filed April 16, 2024.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

Please address all correspondence and service to the address listed above. Petitioner consents to electronic service by email at IPR58281-0002IP1@fr.com (referencing No. 58281-0002IP1).

Respectfully submitted,

Dated September 6, 2024

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter partes* Review totals 13354 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated September 6, 2024

/Jeremy J. Monaldo/

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on September 6, 2024, a complete and entire copy of this Petition for *Inter partes* Review, Power of Attorney, and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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