

**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-1001    | U.S. Patent No. 10,961,602 to Drillet (“the ’602 Patent”)                                                                        |
| 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-1006-13 | [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    | [Reserved]                                                                                                                       |

|         |                                                                                                                                                                                                                                                                                                                                             |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                                                                                                                                                                                                                                                                                        |

|            |                                                                                                                                                                             |
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| EX-1035    | WO Patent Application Publication No. WO02/103073                                                                                                                           |
| EX-1036    | European Publication No. EP1865086                                                                                                                                          |
| EX-1037    | Translation of EX-1036 and Certification of Accuracy                                                                                                                        |
| 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-1040-46 | [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                                                                                                                                    |
| EX-1053    | M. Suehiro, et al, “Properties of Aluminum-coated Steels for Hot-forming,” Nippon Steel Technical Report No. 88, July 2003                                                  |
| EX-1054    | Japanese counterpart of EX-1053                                                                                                                                             |
| EX-1055    | Translation of EX-1054 and Declaration of Accuracy (“Suehiro”)                                                                                                              |

- EX-1056 J.-P. Laurent, “Hot formed Pre-coated boron steels: A solution of the resistance-formability’s dilemma?” 1<sup>st</sup> European Conference of Experts, Hot Forming and Casting Technologies for Lightweight Automobile Design, 27/28 November 2003
- EX-1057 OPPOSITION TO RESPONDENTS’ MOTION TO COMPEL OR IN THE ALTERNATIVE TO STRIKE, *Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same*, Inv. No. 337-TA-1402 (ITC) (December 2, 2024)
- EX-1058 Declaration of June Ann Munford - #3

## 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.                                                                                                                                                  |
| <b>Claim 4</b> |                                                                                                                                                                                                                                                                                                                                                                                  |
| [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. |
| <b>Claim 5</b> |                                                                                                                                                                                                                                                                                                                                                                                  |
| [5]            | The precoated steel product as recited in claim 1 wherein the base steel comprises 20 ppm or less of sulfur.                                                                                                                                                                                                                                                                     |
| <b>Claim 6</b> |                                                                                                                                                                                                                                                                                                                                                                                  |
| [6]            | The precoated steel product as recited in claim 2 wherein the base steel comprises 20 ppm or less of sulfur.                                                                                                                                                                                                                                                                     |
| <b>Claim 7</b> |                                                                                                                                                                                                                                                                                                                                                                                  |
| [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.                                                                                                                                                                                                                                    |
| <b>Claim 8</b> |                                                                                                                                                                                                                                                                                                                                                                                  |
| [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.                                                                                                                                                                                                                                    |
| <b>Claim 9</b> |                                                                                                                                                                                                                                                                                                                                                                                  |
| [9]            | The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 15 micrometers.                                                                                                                                                                                                                                                                |

|                 |                                                                                                                                                                                                    |
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| <b>Claim 10</b> |                                                                                                                                                                                                    |
| [10]            | The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 10 micrometers.                                                                                  |
| <b>Claim 11</b> |                                                                                                                                                                                                    |
| [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 to 10% Al, and 0 to 5% Si.  |
| <b>Claim 12</b> |                                                                                                                                                                                                    |
| [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.   |
| <b>Claim 13</b> |                                                                                                                                                                                                    |
| [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.  |
| <b>Claim 14</b> |                                                                                                                                                                                                    |
| [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.    |
| <b>Claim 15</b> |                                                                                                                                                                                                    |
| [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.  |
| <b>Claim 16</b> |                                                                                                                                                                                                    |
| [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]     | <p>A precoated steel product comprising:</p> <p>a strip of base steel having a first side and a second side; and</p> <p>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:</p> <p>(a) an interdiffusion layer having a first mean iron composition,</p> <p>(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,</p> <p>(c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third</p> |

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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|                 | <p>mean iron concentration being higher than the second mean iron composition, and</p> <p>(d) a superficial layer having a fourth mean iron composition different from the first, second and third mean iron compositions,</p> <p>wherein the coating has a thickness greater than 30 micrometers.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Claim 22</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| [22]            | The precoated steel product as recited in claim 21 wherein the fourth mean iron composition is lower than the third mean iron composition.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Claim 23</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| [23]            | The precoated steel product as recited in claim 22 wherein the fourth mean iron composition is higher than the second mean iron composition.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Claim 24</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| [24pre]         | <p>A precoated steel product comprising:</p> <p>a strip of base steel having a first side and a second side; and</p> <p>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:</p> <p>(a) an interdiffusion layer having a first mean aluminum composition,</p> <p>(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,</p> <p>(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and</p> <p>(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum</p> |

|                 |                                                                                                                                                                                                    |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | compositions, the second mean aluminum composition being greater than the third mean aluminum composition;<br><br>wherein the coating has a thickness greater than 30 micrometers.                 |
| <b>Claim 25</b> |                                                                                                                                                                                                    |
| [25]            | The precoated steel product as recited in claim 24 wherein the fourth mean aluminum composition is less than the second mean aluminum composition.                                                 |
| <b>Claim 26</b> |                                                                                                                                                                                                    |
| [26]            | The precoated steel product as recited in claim 24 wherein the layer (a) has a thickness less than 15 micrometers.                                                                                 |
| <b>Claim 27</b> |                                                                                                                                                                                                    |
| [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. |
| <b>Claim 28</b> |                                                                                                                                                                                                    |
| [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.  |
| <b>Claim 29</b> |                                                                                                                                                                                                    |
| [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. |
| <b>Claim 30</b> |                                                                                                                                                                                                    |
| [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, 1-207.

| <b>Ground</b> | <b>Claims</b>               | <b>Basis (§103)</b>          |
|---------------|-----------------------------|------------------------------|
| 1A            | 1-2, 5-6, 9-30              | Takagi, Cornette             |
| 1B            | 3-4, 7-8                    | Takagi, Cornette, Laurent    |
| 1C            | 3-6                         | Takagi, Cornette, Nishibata  |
| 1D            | 1, 3-4, 11-17, 19-25, 27-30 | Takagi, GMW14400             |
| 1E            | 3-4, 7                      | Takagi, GMW14400, Laurent    |
| 1F            | 3-5                         | Takagi, GMW14400, Nishibata  |
| 2A            | 1-2, 5-6, 9-30              | Suehiro, Cornette            |
| 2B            | 3-4, 7-8                    | Suehiro, Cornette, Laurent   |
| 2C            | 3-6                         | Suehiro, Cornette, Nishibata |
| 2D            | 1-4, 9-30                   | Suehiro, GMW14400            |

| Ground | Claims   | Basis (§103)                 |
|--------|----------|------------------------------|
| 2E     | 3-4, 7-8 | Suehiro, GMW14400, Laurent   |
| 2F     | 3-6      | Suehiro, GMW14400, Nishibata |

The '602 Patent identifies October 30, 2006 as the earliest priority date. EX-1001, 1:6-14. However, in a parallel ITC proceeding, Patent Owner alleges conception in December 2005. EX-1057, 1. Although priority entitlement is not conceded, each reference qualifies as prior art under Patent Owner's alleged conception date:

Takagi qualifies as prior art under §102(b). Takagi is a U.S. Patent Application Publication with a publication date of 1/15/2004. EX-1016.

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.

Suehiro is §102(b) prior art. As June Munford explains, Suehiro was publicly available at least by 10/2/2003. EX-1058.

### **C. Claim Construction**

Because 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.<sup>1</sup> 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 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

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<sup>1</sup> 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.

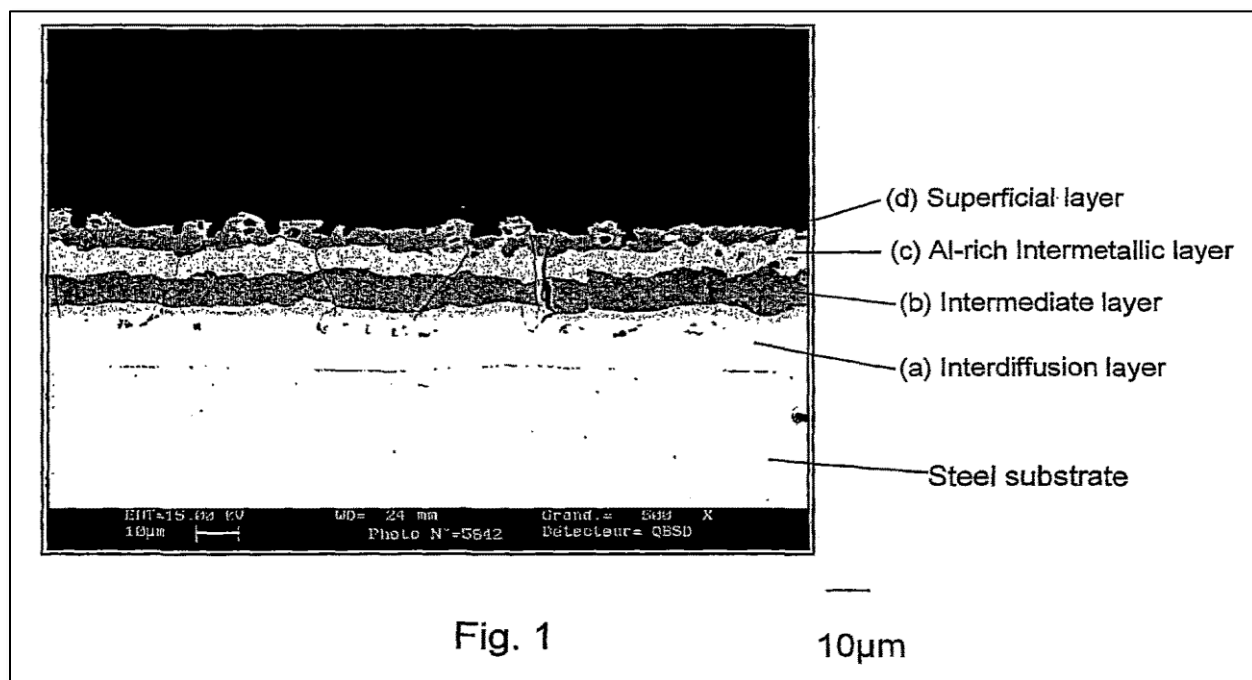
already “important, especially in the automotive industry.” EX-1001, 1:38-39. As the Background describes, processing to obtain a coating typically included “[p]re-coating of a steel sheet[], by hot dipping; [t]rimming or cutting for obtaining blanks; [h]eating the blanks in order to obtain alloying 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.



But, even if these coating layers were “special,” they were not new. This Petition presents multiple sets of grounds that 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 – Takagi and

Suehiro – disclose the recited iron compositions, and each of Cornette and GMW14400 evidences and 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, 13-16.

## **III. GROUND 1A: Claims 1, 2, 5, 6, and 9-30 are obvious over Takagi and Cornette**

### **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, 22.

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, while No. 5 has four distinct layers. EX-1003, 23.

**TABLE 1**

| No. | PRODUCTION              |                  | COATING LAYER STRUCTURE & COMPOSITION (%) |       |         |         |         |       | STEEL BASE HARDNESS (Hv) | COATING LAYER HARDNESS (Hv) |         |                  | OXIDE WEIGHT (mg/dm <sup>2</sup> ) | FORMABILITY | CORROSION RESISTANCE | WELDABILITY |
|-----|-------------------------|------------------|-------------------------------------------|-------|---------|---------|---------|-------|--------------------------|-----------------------------|---------|------------------|------------------------------------|-------------|----------------------|-------------|
|     | RAISED TEMPERATURE (°C) | HOLD TIME (min.) | COMPONENT & HARDNESS                      | INNER | INTER 1 | INTER 2 | INTER 3 | OUTER |                          | SOFTTEST                    | 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   |                          |                             |         |                  |                                    |             |                      |             |

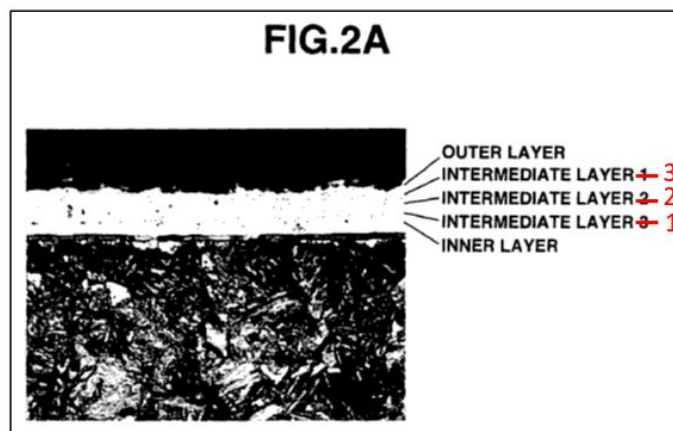
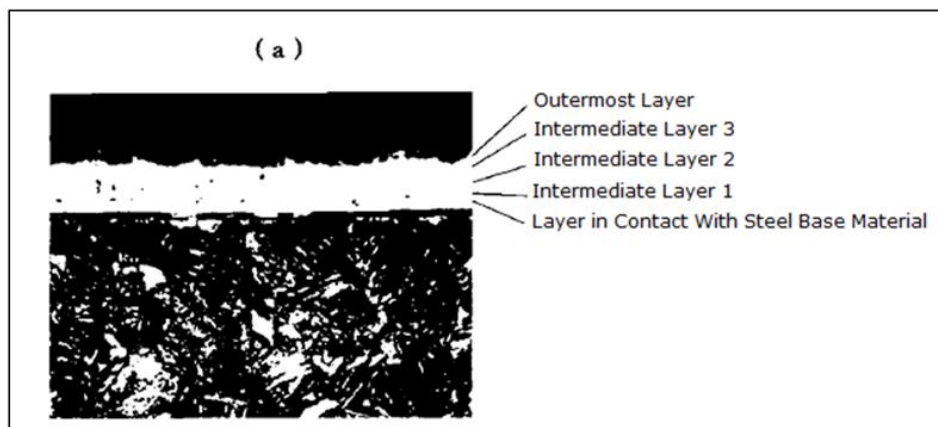
Coatings with five layers

Coating with four layers

**Takagi Table 1<sup>2</sup>**

In Table 1, layers Inner, Inter 1, Inter 2, Inter 3, and Outer are arranged from the base steel outwards. EX-1003, 24. 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. The drawing from the JP filing, along with a corrected version of the US drawing, are shown below.

<sup>2</sup> All annotations are added unless indicated otherwise.



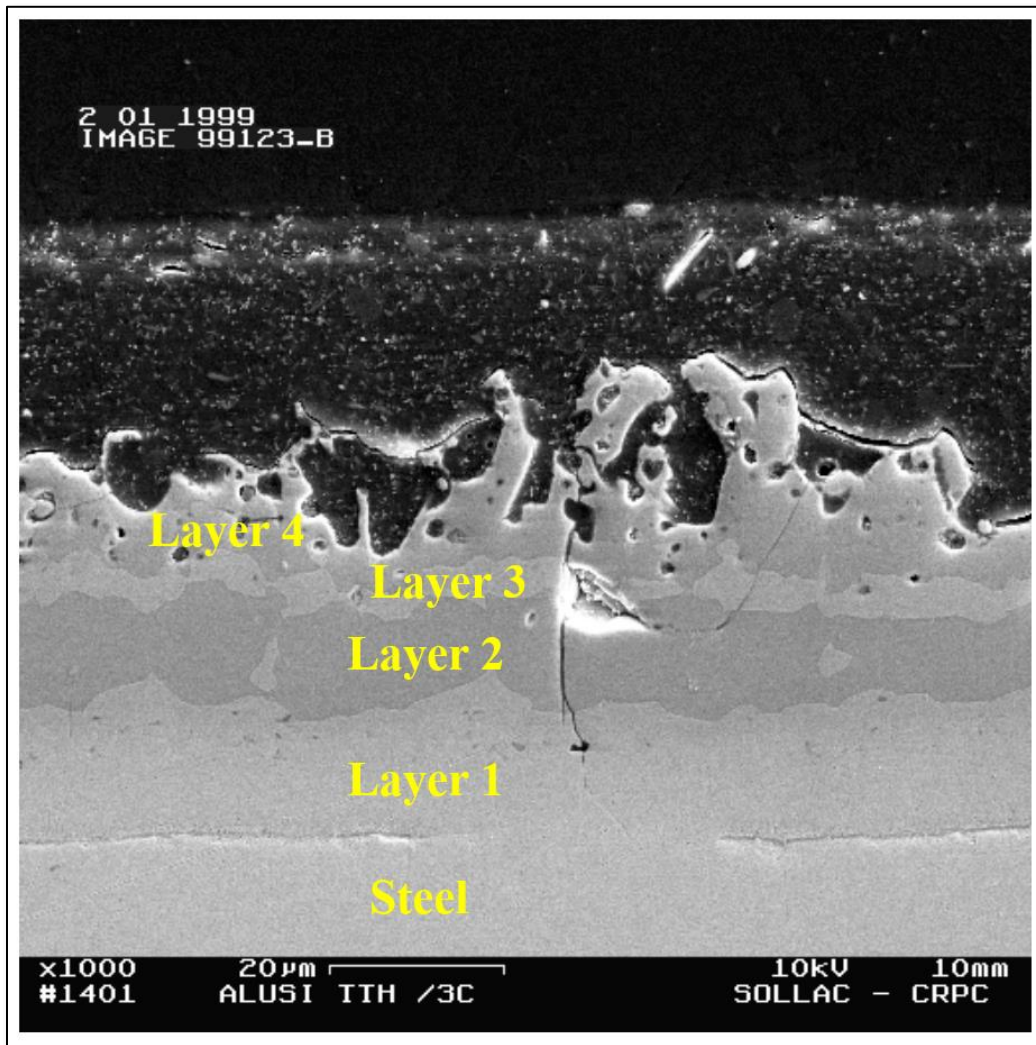
**Top: translation of FIG. 2(a) of JP3738754**

**Bottom: corrected FIG. 2A of Takagi**

## **B. Cornette**

Cornette (“High Strength Steels for Automotive Safety Parts”) describes “mechanical testing and different design solutions associated with” certain steel grades. EX-1014, 3. “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  $\mu\text{m}$  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.* These four layers constitute the Fe-Al-Si coating, with a base steel region underneath. EX-1003, 25-27. In IPR proceedings for the ’683 Patent, in a finding that holds here as discussed in §III.D.1, it was found that these layers and the underlying steel form a “stamped product.” EX-1029, 32-35.



**Cornette FIG. 22**

**C. Takagi-Cornette Combination**

Takagi discloses a pre-coating thickness of 10-20  $\mu\text{m}$  but does not explicitly disclose a post hot-stamping coating thickness corresponding to that pre-coating thickness. EX-1016, [0035]. Based on Cornette, a POSITA would have expected Takagi's post hot-stamping coating thickness to be 30  $\mu\text{m}$  or more. EX-1003, 28. Cornette discloses a post hot-stamping coating thickness of "about 40  $\mu\text{m}$ "

corresponding to a pre-coating thickness of 25  $\mu\text{m}$ , an increase of 60%. EX-1014, 9. When this factor is applied to Takagi's 20  $\mu\text{m}$  pre-coating thickness, the expected coating thickness would be **32  $\mu\text{m}$** . EX-1003, 28. This relationship is corroborated by FR2833504 ("FR Laurent"), which describes that alloying of a pre-coating "generally corresponds to a 50% increase" in thickness for the resulting coating, which would result in a **30  $\mu\text{m}$**  coating thickness if applied to Takagi's 20  $\mu\text{m}$  pre-coating thickness. EX-1025, 5:17-20; EX-1003, 28. This relationship is further evidenced by GMW14400, which uses a "20 to 33"  $\mu\text{m}$  pre-coating to obtain a coating "> 35  $\mu\text{m}$ ." EX-1026, 7. As such, Cornette can be applied as evidencing Takagi's teaching of a 32  $\mu\text{m}$  post hot-stamping coating thickness, without requiring modification of Takagi's coatings. EX-1003, 28.

Further, beyond teaching a post hot-stamping coating thickness of 32  $\mu\text{m}$  corresponding to Takagi's pre-coating thickness, Cornette illustrates that it would have been obvious to a POSITA to focus on the pre-coating thickness and the thickness of the coating after hot-stamping as parameters to be varied and optimized. EX-1003, 29. For example, various prior art documents attest to the importance of layer thickness for determining its properties and effectiveness. EX-1014, 9; EX-1034, [0013]; EX-1026, 7. Cornette itself notes that "[t]he average [pre-coating] layer thickness showing the best compromise between corrosion protection and weldability is 25  $\mu\text{m}$ " and links this "best" pre-coating thickness to

a “typical” thickness of the alloyed “Fe-Al-Si” layer of “about 40  $\mu\text{m}$  at the steel surface.” EX-1014, 9. Certified Translation of JP2004-244704 (“Maki”) notes that “[a] thickness of 20  $\mu\text{m}$  or more is preferred because a thicker layer responsible for corrosion resistance results in greater overall corrosion resistance and a longer material life. Although there are no particular restrictions on the upper limit, the plating thickness is preferably no more than 60  $\mu\text{m}$  due to the upper limit on plating thickness that can be stably produced using the hot-dip plating method.” EX-1034, [0013]; EX-1003, 29-30. Further, GMW14400 requires a coating thickness of “>35”  $\mu\text{m}$  in order to provide vehicle parts to General Motors. EX-1026, 7.

When the prior art recognizes a certain parameter as result-effective, it would have been obvious to a POSITA to optimize that parameter. Here, the references identified above demonstrate that a POSITA would have found it obvious to try varying and experimenting with different coating thicknesses in order to obtain a thickness recognized by the art as beneficial. EX-1003, 31. For example, it would have been obvious for a POSITA to seek to obtain a coating thickness of “about 40  $\mu\text{m}$ ” by using a pre-coating thickness of “25  $\mu\text{m}$ ” as taught by Cornette, in order to achieve “the best compromise between corrosion protection and weldability.” EX-1014, 9; EX-1003, 31. Further reinforcing the obviousness of this combination, these values of Cornette are within the ranges

specified as desirable by Maki and GMW14400. EX-1034, [0013]; EX-1026, 7.

A POSITA would have had a reasonable expectation of success in combining Takagi with Cornette to obtain thicker coatings, e.g., coatings of about 40  $\mu\text{m}$  or about 32.3  $\mu\text{m}$  as measured in Cornette FIG. 22. EX-1003, 32. Cornette's pre-coating thickness of 25  $\mu\text{m}$  represents only a 25% difference compared to Takagi's 20  $\mu\text{m}$  pre-coating thickness, a relatively small change. And, as discussed above, Cornette and FR Laurent are in agreement on the efficacy of adjusting pre-coating thickness to modify coating thickness. *Id.* As such, obtaining the desired coating thickness would have entailed nothing more than applying Cornette's known techniques and parameters to Takagi to obtain a predictable result. *Id.*

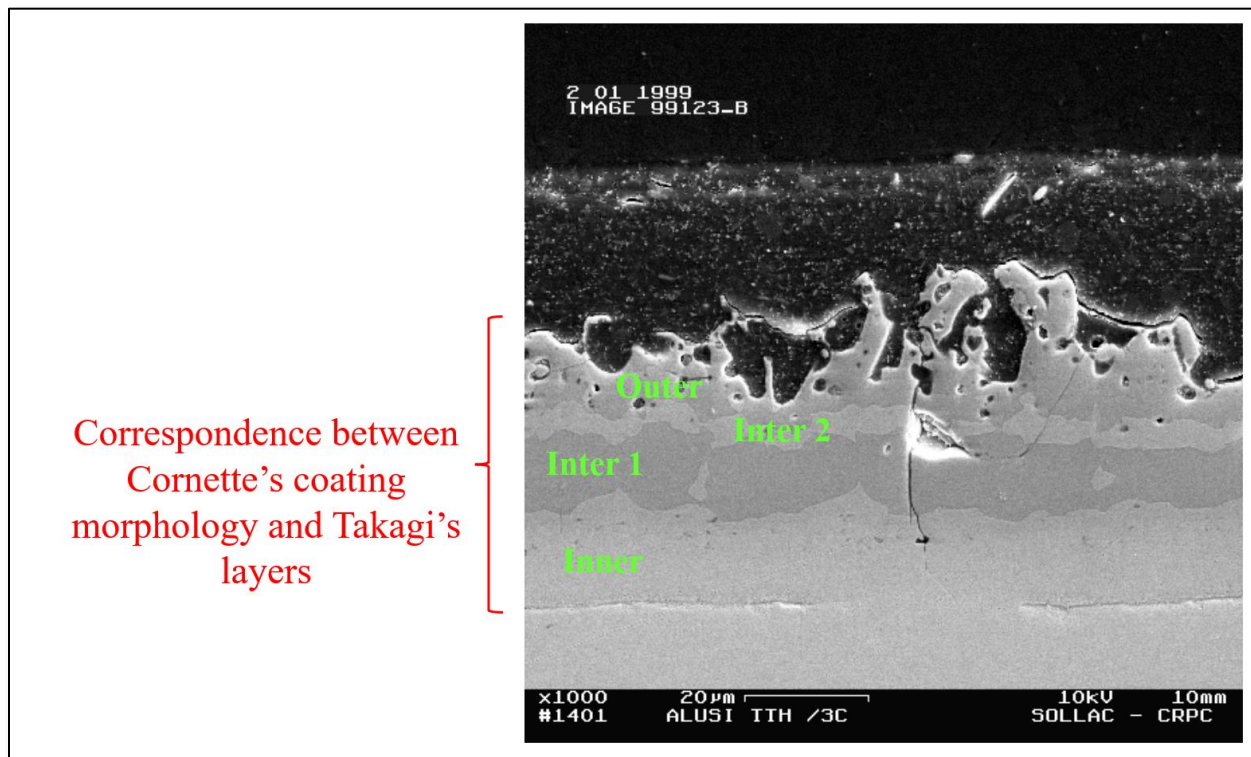
It would also have been obvious to experiment by modifying other aspects of Takagi's hot-stamping process based on Cornette's disclosure. EX-1003, 33. For example, it would have been obvious to try using, as the base steel, the USIBOR 1500 steel noted by Cornette, which provides "excellent mechanical properties of the material after the press hardening process with good corrosion protection." EX-1014, 9; EX-1003, 33. And the POSITA would have found it obvious to try varying the various heating parameters described by Takagi, e.g., within the thermal process window ("Heating 5-10 min. 880-950°C" or "generally 900°C, 5 minutes") described by Cornette. EX-1014, 9; EX-1003, 33. Takagi recognizes each of heating rate, heating temperature, rate of primary cooling, forming

temperature, and quenching rate as result-effective. EX-1016, [0019] and [0026]-[0037]; EX-1003, 33. In experimenting and/or modifying Takagi based on Cornette, a POSITA would have been motivated by Cornette's disclosure that these process parameters (represented, e.g., by Cornette's FIG. 22 coating) provide "good results" for weldability, have "good capacity" for corrosion resistance, and are offer desirable paint adherence. EX-1014, 10-11; EX-1003, 33. A POSITA would have had a reasonable expectation that these modifications would be successful: for example, Cornette's heating temperatures and times are within Takagi's ranges. EX-1016, [0047]; EX-1003, 33.

As a result, based on the foregoing routine experimentation, a POSITA would have arrived at various coatings with layers having various thicknesses and compositions. EX-1003, 34. For example, a POSITA would have arrived at coatings having, for each of their four or five layers, the layer composition described for Takagi's No. 1, 4, or 5 coatings (or similar composition), and having Cornette's total coating thickness of "about 40  $\mu\text{m}$ ," or, as another example, the 32.3  $\mu\text{m}$  thickness shown in Cornette FIG. 22 (see [1h] below). EX-1014, 9; EX-1003, 34. As discussed above in this section, it would have been obvious to achieve this coating thickness, and other coating thicknesses in a similar range, at least by varying the pre-coating thickness, e.g., using a pre-coating thickness of about 25  $\mu\text{m}$ , as taught by Cornette. EX-1003, 34. As such, in view of Cornette, it

would have been obvious to obtain coatings with thicknesses greater than 30  $\mu\text{m}$ , as recited in claim 1. *Id.*

Further, given their similar four-layer structures, a POSITA would have arrived at a **Takagi-Cornette No. 5 coating** such that the coating would have the layer thicknesses and morphologies shown in Cornette FIG. 22 (or similar thicknesses and morphologies). EX-1003, 35. This correspondence of the layer thicknesses/morphologies for the Takagi-Cornette No. 5 coating is shown in annotated Cornette FIG. 22 below. *Id.*



**Cornette FIG. 22**

Dr. Miles discusses that “[c]ertainly, obtaining the foregoing compositions

and coating thickness (and, in the case of the Takagi-Cornette No. 5 coating, the layer thicknesses and morphologies of Cornette FIG. 22) would require experimentation and some degree of trial and error, within the finite number of possible experimental values for some or all of the foregoing thermal treatment parameters and within reasonable expected variation for the relationship between pre-coating thickness and coating thickness. Modification of one parameter (e.g., to obtain a thicker coating) might affect another parameter (e.g., layer composition). However, handling these expected complications would have been well within the bounds of routine experimentation for a metallurgist, given Takagi's and Cornette's disclosures. Given (i) the relatively small increase in pre-coating thickness associated with a modification of Takagi based on Cornette's pre-coating thickness (only from 20  $\mu\text{m}$  to 25  $\mu\text{m}$ ), (ii) the art's recognition that layer characteristics (e.g., hardness and corrosion resistance, as discussed by Takagi) depend directly on layer composition, (iii) the art's clear recognition of the most relevant process parameters for modifying layer compositions and thicknesses, and (iv) in the case of the Takagi-Cornette No. 5 coating, the fact that both Takagi's No. 5 coating and Cornette's coating include four layers, the manufacture of the modified coatings would have been obvious." EX-1016, [0019]-[0026]; EX-1003, 36.

Dr. Miles further explains that "[a]s a result, the No. 1, 4, and 5 coatings

(whether the No. 1, 4, and 5 coatings modified to have Cornette's thicknesses, or the No. 5 coating modified to have the layer morphology of Cornette FIG. 22) are members of a wide class of coatings that are rendered obvious by Takagi in view of Cornette or GMW14400. For example, insofar as any aspects of the coating layers described in the '602 Patent may be the result of specific heating parameters or pre-coating parameters, a POSITA would have arrived at such layers by routine experimentation. This conclusion is based on a comparison between the values disclosed in the '602 Patent and those in the prior art. The values are generally identical or very similar, and the '602 Patent includes no disclosure to suggest an unexpected criticality in any of these parameters that would place any of the claimed layer parameters outside the bounds of routine experimentation. When comparing the '602 Patent to the prior art, a POSITA would have seen very similar processes being applied to very similar steel parts." EX-1001, 5:17-18, 6:63-67, 7:1, 7:10-14, 7:41-45, 11:11-14, 12:32-40; EX-1016, [0026], [0028], [0037], Table 1; EX-1014, 9; EX-1055, [02], [07], [14]-[15], [18], FIG. 3; EX-1003, 37.

| Parameter                  | '602 Patent   | '602 Patent Example 2 | Takagi             | Cornette                 | Suehiro              |
|----------------------------|---------------|-----------------------|--------------------|--------------------------|----------------------|
| Pre-coating thickness (μm) | 20 – 33       | ---                   | 10 – 20            | 25                       | ---                  |
| Heating rate (°C/s)        | 4 - 12        | 10                    | 8; 1-10            | ---                      | ~8 <sup>3</sup> , 10 |
| Temperature (°C)           | 880 - 940     | 920                   | 900, 920, 950      | 880-950; 900             | 900, 950             |
| Hold time (min)            | < 3 – 13      | < 6                   | 3, 4, 5; 2-8; 2-10 | < <sup>4</sup> 5 – 10; 5 | 0.5; 3               |
| Cooling rate (°C/s)        | > 30, or > 50 |                       | 20 – 100; 30       | ---                      | > 20, > 30           |

As such, a POSITA would have had a reasonable expectation that Cornette's and Takagi's teachings could be combined to obtain thicker coatings, e.g., coatings having the 32.3 μm or "about 40 μm" thickness of Cornette. EX-1003, 38. Dr. Miles provides further discussion on why the compositions recited in the '602 Patent would be within the scope of reasonable experimentation and optimization to achieve in coatings having thicknesses greater than 30 μm. EX-1003, 39-42.

Dr. Miles further notes that Cornette's innermost layer, mapped below to layer (a), may include a shading gradient suggestive of two sub-layers. EX-1003,

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<sup>3</sup> Based on "2 min" heating time to reach "950°C". EX-1055, [14].

<sup>4</sup> "<" in this table indicates that the disclosed time includes both the heating ramp-up time and the hold time.

41. To the extent Cornette FIG. 22 is interpreted in this manner, the combination of Takagi and Cornette can also yield Takagi-Cornette No. 1 and 4 coatings having the layer compositions of Takagi and the layer thicknesses and/or morphologies of Cornette FIG. 22's five total layers, of which two are sub-layers in the innermost layer. *Id.* This mapping should be understood as being applied and included below for discussions that rely on Cornette's layer thicknesses and/or morphology. *Id.*

#### **D. Analysis of Claims**

##### **1. Claim 1**

[1pre]:

##### **The preamble is non-limiting**

The preamble of claim 1 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.

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” (EX-1001, 5:63, 11:13), the ’602 Patent is silent as to any structural difference imparted by “stamp[ing].”

**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. *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.

**Takagi teaches the preamble**

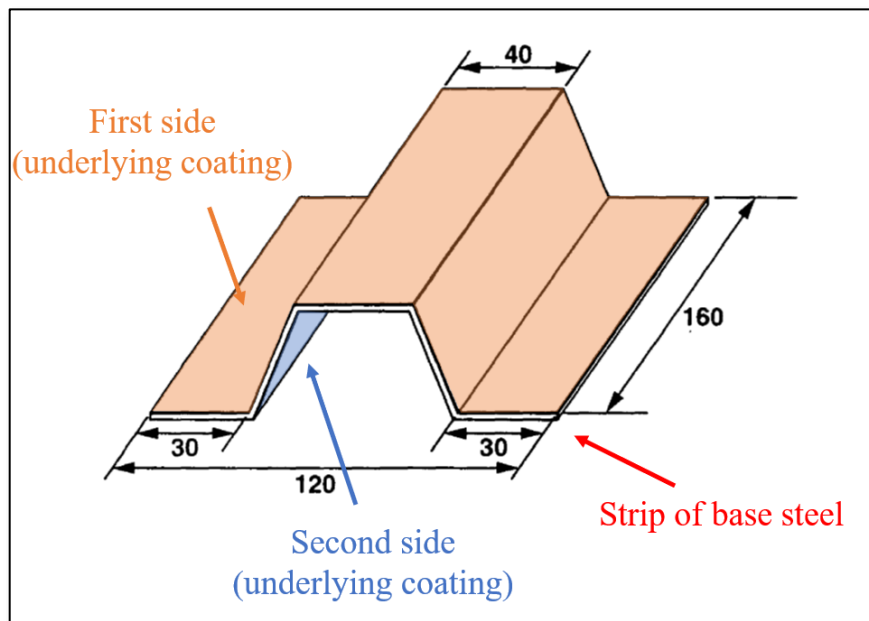
Takagi's parts are "precoated steel product[s]" or "precoated steel stamped blanks."<sup>5</sup> EX-1003, 43. Takagi describes that, in the "[t]est [p]rocedure" used for producing Takagi's samples, "[f]rom the [] **hot-dip aluminum-coated** [i.e., precoated]" steel sheet, a flat plate [] was cut out, heat-treated [] and **formed into a shape** shown in FIG. 1." EX-1016, [0036]. "Form[ing]" refers to stamping, because the blanks are "formed" into a part by the stamping. EX-1003, 43. Further, as discussed above in the description of Cornette, Cornette throughout refers to "hot stamping," and Cornette FIG. 22 illustrates a hot-stamped product. EX-1014, 10-11; EX-1003, 43.

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<sup>5</sup> Drawing upon the definition of "product" provided in the '602 patent. EX-1001, 14:56.

[1a]:

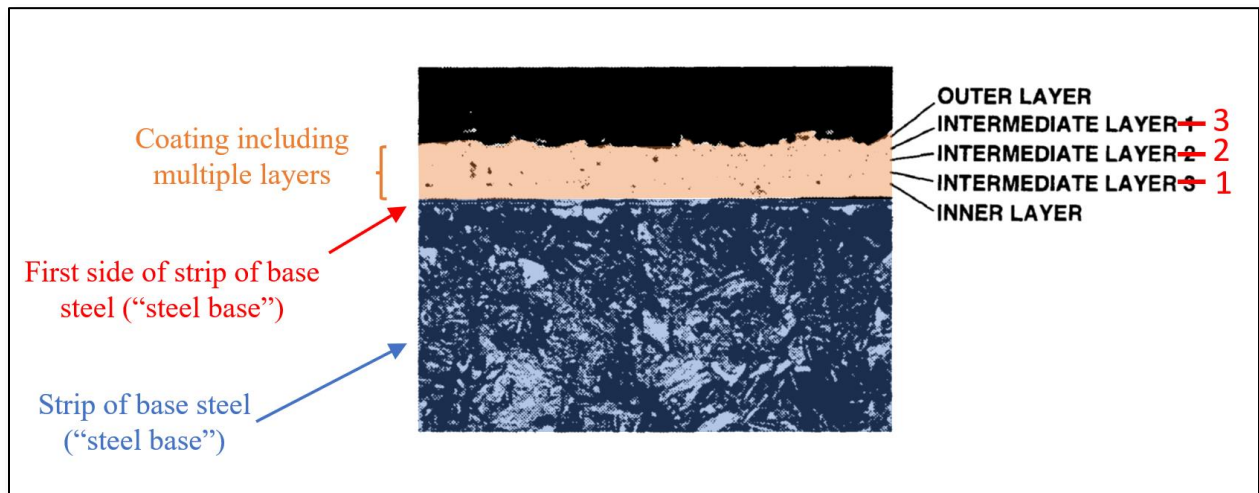
Takagi's No. 1, 4, and 5 parts include a strip of base steel having a first side and a second side. EX-1003, 44. These sides are shown, e.g., in Takagi FIG. 1, which illustrates the "shape" of the hot-stamped parts of Takagi No. 1, 4, and 5. *Id.* This shape is obtained by "form[ing]" a "flat plate." EX-1016, [0036]. The "base steel" of the FIG. 1 part, and its two sides, are underneath a coating, the coating formed by "hot-dip[ping]," e.g., "immersing a strip continuously in a bath of molten aluminum" (or aluminum-silicon). EX-1016, [0013]; EX-1003, 44. This is corroborated by Cornette, which describes the presence of a "base material" or "substrate" of "boron steel." EX-1014, 9.



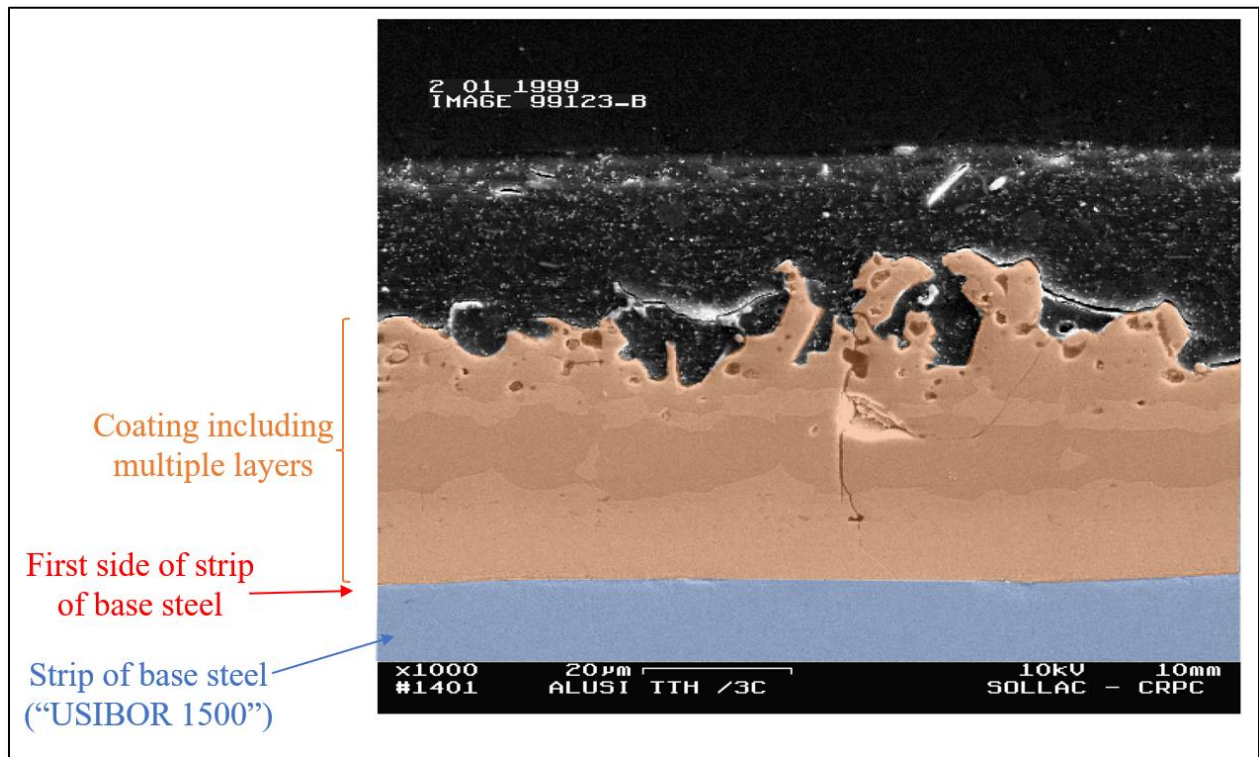
**Takagi FIG. 1**

[1b]:

Takagi's parts include the recited coating. EX-1003, 45. These coatings are illustrated, e.g., in Takagi FIG. 2A. *Id.* For combination with Cornette, such a coating is also shown in Cornette's FIG. 22 coating, which corresponds to the Takagi No. 5 coating as a Takagi-Cornette coating as discussed above. *Id.*



**Takagi FIG. 2A (annotated and corrected)**



**Cornette FIG. 22 (annotated)**

[1c]:

Takagi's coatings result from interdiffusion between the base steel, and an aluminum or aluminum alloy pre-coating. EX-1003, 46. For example, 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]. Similarly, Cornette describes an "alloying reaction between substrate (iron) and the coating (aluminum – silicon) which leads to a hard multiphase alloy layer." EX-1014, 9. A POSITA would have understood this "alloying reaction" to be equivalent to or

involve interdiffusion. EX-1003, 46.

[1d]:

Takagi alone or Takagi modified by Cornette discloses the recited layers (a)-(d). EX-1003, 47. As one example, as shown in annotated Takagi FIG. 2A below, the **Inner, Inter 2, Inter 3, and Outer layers** of each of the Takagi (or Takagi-Cornette) No. 1 and 4 coatings teach the recited layers (a)-(d), respectively. *Id.* As another example, the **Inner, Inter 1, Inter 2, and Outer layers** of the Takagi (or Takagi-Cornette) No. 5 coating (which lacks an Inter 3 layer) teach the recited layers (a)-(d), respectively. *Id.* These mappings are summarized in the table below. A POSITA would have understood that other mappings are also possible. *Id.*, 47-49.

| <b>Takagi layer</b> | <b>No. 1 and 4 mapping</b> | <b>No. 5 mapping</b> |
|---------------------|----------------------------|----------------------|
| Outer               | Layer (d)                  | Layer (d)            |
| Inter 3             | Layer (c)                  | --                   |
| Inter 2             | Layer (b)                  | Layer (c)            |
| Inter 1             | --                         | Layer (b)            |
| Inner               | Layer (a)                  | Layer (a)            |

The compositions of the coatings' layers, in association with the corresponding layers of the '602 Patent, are shown in the annotated Takagi Table 1 below.

**Corresponding layers of '602 patent**

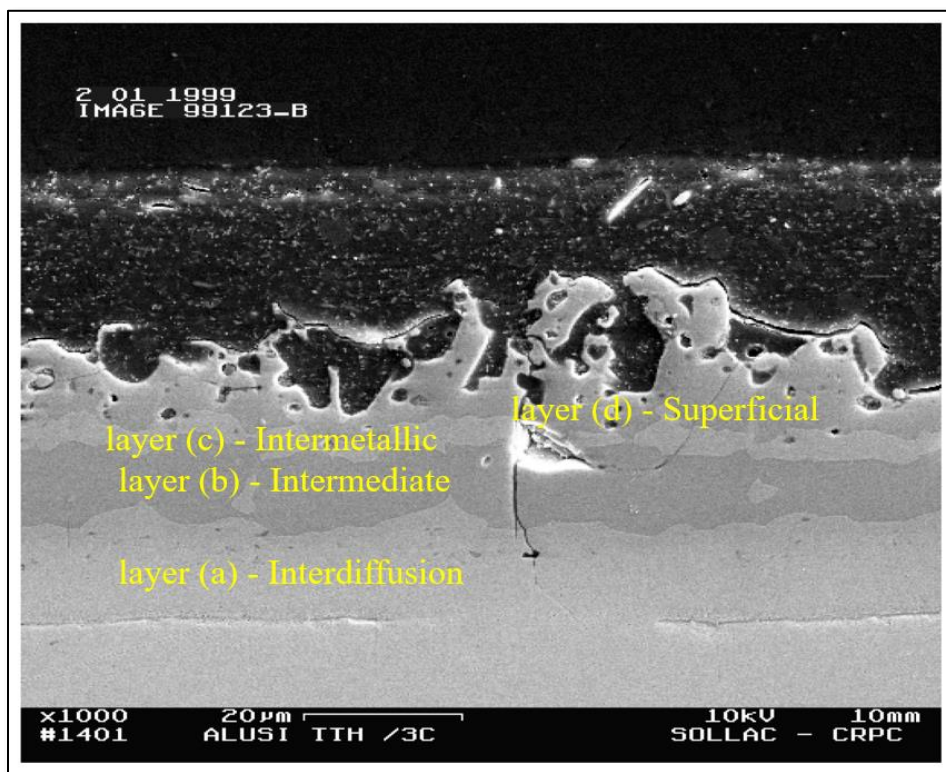
**TABLE 1**

| No. | PRODUCTION              |                  | COATING LAYER STRUCTURE & COMPOSITION (%) |       |         |         |         |       | STEEL BASE HARDNESS (Hv) | COATING LAYER HARDNESS (Hv) |         |                  | OXIDE WEIGHT (mg/dm <sup>2</sup> ) | FORMABILITY | CORROSION RESISTANCE | WELDABILITY |
|-----|-------------------------|------------------|-------------------------------------------|-------|---------|---------|---------|-------|--------------------------|-----------------------------|---------|------------------|------------------------------------|-------------|----------------------|-------------|
|     | RAISED TEMPERATURE (°C) | HOLD TIME (min.) | COMPONENT & HARDNESS                      | INNER | INTER 1 | INTER 2 | INTER 3 | OUTER |                          | SOFTTEST                    | 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                                        | (a)   | —       | (b)     | (c)     | (d)   | 400                      | 305                         | 385     | 78               | 550                                | ○           | ×                    | ×           |
|     |                         |                  | Si                                        | —     | —       | —       | —       | —     |                          |                             |         |                  |                                    |             |                      |             |
|     |                         |                  | 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   |                          |                             |         |                  |                                    |             |                      |             |

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

**Takagi Table 1 (annotated)**

For the Takagi-Cornette No. 5 coating in which Takagi's layers have the thicknesses and/or morphologies of Cornette's corresponding layers, or similar thicknesses and/or morphologies, the mapping is illustrated below.



**Cornette FIG. 22**

The “interdiffusion layer” corresponds to the Inner layer of the Takagi or Takagi-Cornette No. 1, 4, and 5 coatings. EX-1003, 50. According to Takagi’s Table 1, this Inner layer has first mean iron compositions of 89.6%, 90.7%, and 94.3% in the No. 1, 4, and 5 coatings, respectively. *Id.*

Based on Takagi’s description that the percentages in Table 1 are “percent by mass,” a POSITA would have understood that these percentages refer to “mean” compositions. EX-1016, [0020]; EX-1003, 51. 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, 51.

Absent a statement or suggestion otherwise—which Takagi does not provide—a POSITA would have understood Takagi’s disclosures of compositions to be disclosures of mean compositions, thereby satisfying this claim element. EX-1003, 52.

Alternatively, consistent with an example of the ’602 Patent, for the No. 1 and 4 coatings, the “interdiffusion layer” can correspond to the Inner and Inter 1 layers together. Dr. Miles discusses that “[b]ased on my review of the literature, this is a common characteristic of the coatings of hot-stamped steels: a deepest layer of the coating may include two sub-layers, depending on the exact thermal process to which the coating was subjected.” EX-1003, 53-56. In this case, the mappings are as shown below.

| <b>Takagi layer</b> | <b>Alternative No. 1 and 4 mapping</b> |
|---------------------|----------------------------------------|
| Outer               | Layer (d)                              |
| Inter 3             | Layer (c)                              |
| Inter 2             | Layer (b)                              |
| Inner + Inter 1     | Layer (a)                              |

[1e]:

Takagi alone or Takagi modified by Cornette discloses the intermediate layer. EX-1003, 57. According to Takagi’s Table 1, the layer corresponding to the intermediate layer (Inter 2 for the No. 1 and 4 coatings, and Inter 1 for the No. 5

coating) has second mean iron compositions of 50.1%, 46.8%, and 42.7%, respectively. These second mean iron compositions are different from the corresponding first mean iron compositions of the interdiffusion layer.

*[1f]*

Takagi alone or Takagi modified by Cornette discloses the intermetallic layer. EX-1003, 58. According to Takagi's Table 1, the layer corresponding to the intermetallic layer (Inter 3 for the No. 1 and 4 coatings, and Inter 2 for the No. 5 coating) has third mean iron compositions of 62.0%, 63.1%, and 51.4%, respectively. These third mean iron compositions are different from the corresponding first and second mean iron compositions, and are also higher than the corresponding second mean iron compositions.

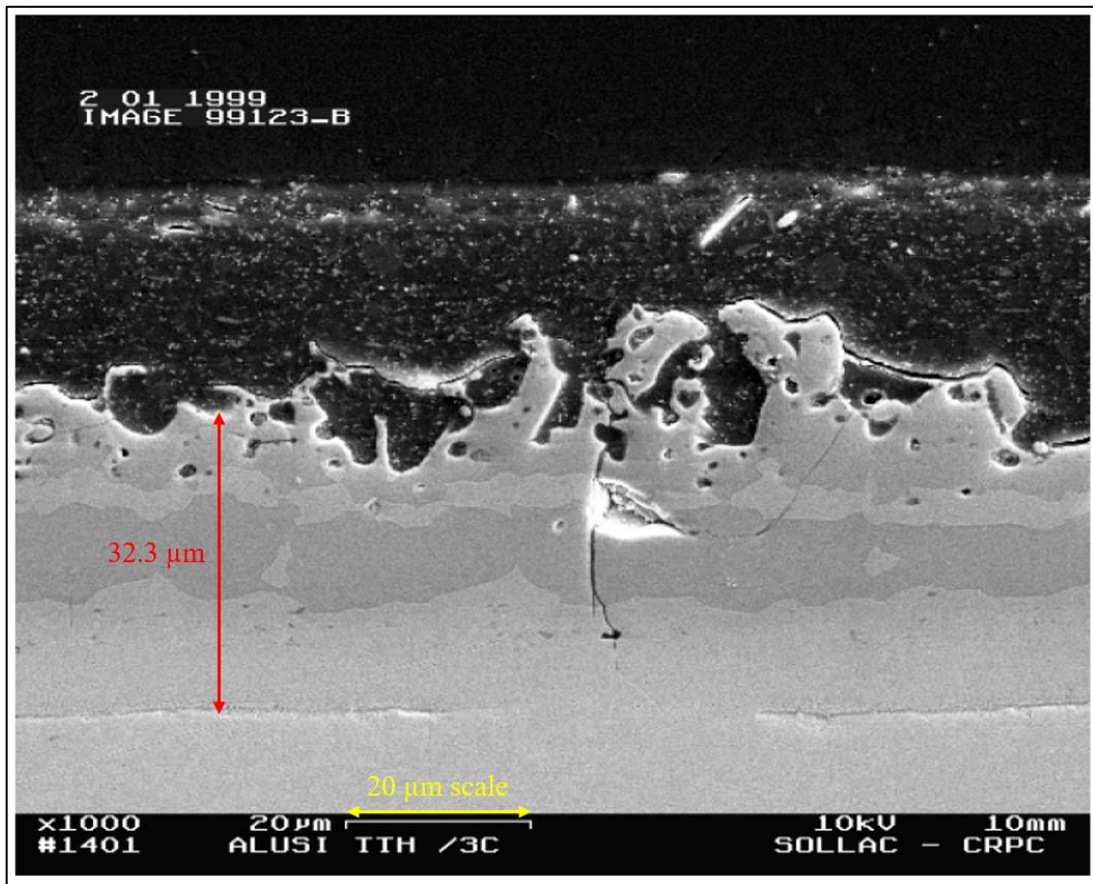
*[1g]:*

Takagi alone or Takagi modified by Cornette discloses the superficial layer. EX-1003, 59. According to Takagi's Table 1, the Outer layer, which corresponds to the superficial layer, has fourth mean iron compositions of 44.5%, 49.8%, and 38.4% for the No. 1, 4, and 5 coatings, respectively. These fourth mean iron compositions are different from the corresponding third mean iron compositions.

*[1h]:*

Takagi alone or Takagi modified by Cornette teaches a coating thickness greater than 30  $\mu\text{m}$ . EX-1003, 60. As discussed above, applying Cornette's

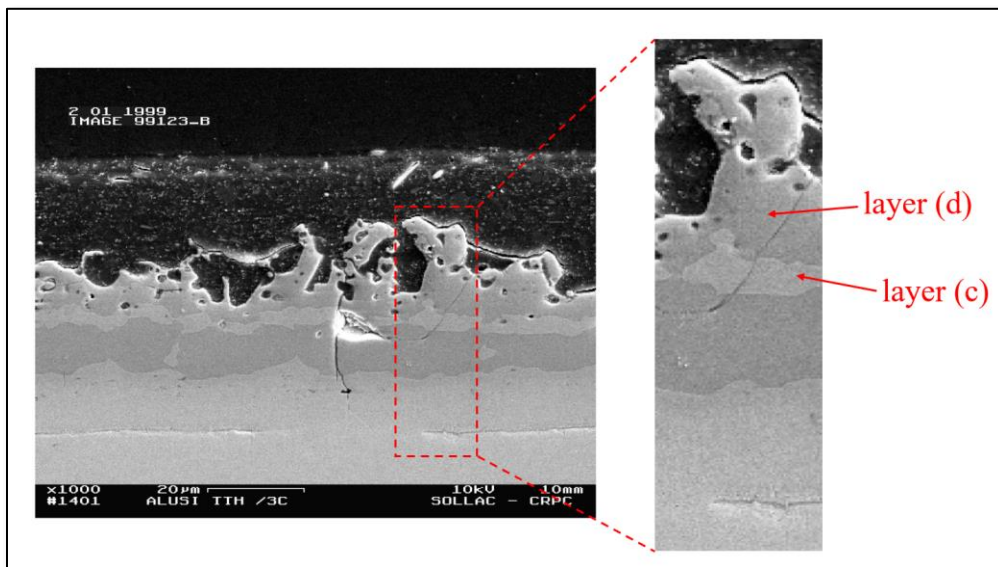
thickness increase of 60% to Takagi's 20  $\mu\text{m}$  pre-coating thickness results in a thickness of **32  $\mu\text{m}$** , greater than 30  $\mu\text{m}$ . EX-1014, 9; EX-1016, [0035]; EX-1003, 60. Further, in reference to the Takagi-Cornette combination, the Takagi-Cornette No. 1, 4, and 5 coatings are modified to have thicknesses similar to Cornette's part, e.g., 32.3  $\mu\text{m}$  or "about 40  $\mu\text{m}$ ," satisfying the recitation of "greater than 30 micrometers." EX-1003, 60. For example, based on Cornette, it would have been obvious to a POSITA to try varying process parameters such as thermal parameters and/or pre-coating thickness, as a matter of routine experimentation, to arrive at a coating having the thickness of the coating shown in Cornette FIG. 22. *Id.* Based on the scale included in that drawing, the thickness of that coating, for at least one measurement position, is approximately **32.3  $\mu\text{m}$** . *Id.* This measurement is shown in the annotated drawing below. The '602 Patent alleges no criticality associated with this claimed range. EX-1003, 61.



**Cornette FIG. 22**

## **2. Claim 2**

The outer two layers of Cornette FIG. 22 are quasi continuous. EX-1003, 62-67. For example, the layers' continuity is 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, 63. As discussed above for the Takagi-Cornette combination, these layers reflect an obvious morphology of layers (c) and (d) of at least the Takagi-Cornette No. 5 coating.

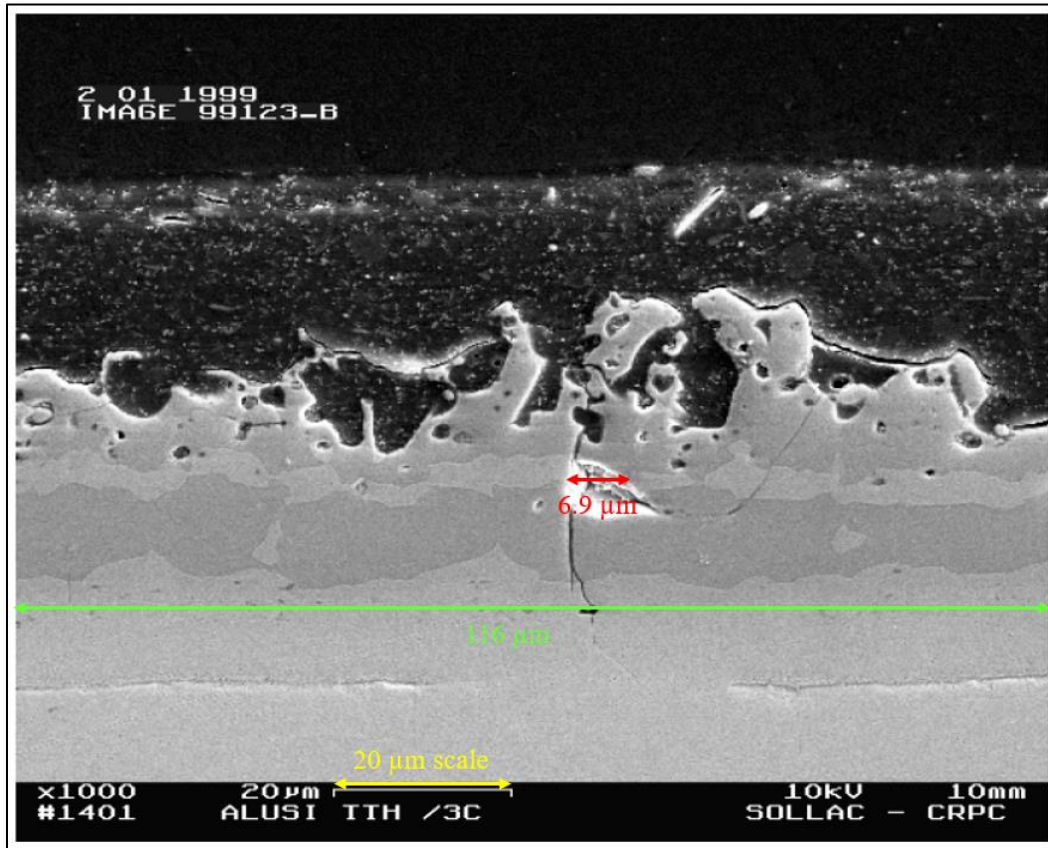


**Cornette FIG. 22**

Even across the entirety of the SEM image in FIG. 22, these layers extend continuously or essentially continuously across the entire image, except for at most one segment (indicated with red below). EX-1003, 64. A POSITA would have considered the layers to be continuous or essentially continuous (or quasi continuous) despite this segment. *Id.* To the extent that this segment is considered to make the layer discontinuous, the segment occupies only about 6% (6.9 µm/116 µm) of the total width of FIG. 22. *Id.* Therefore, layer (c) in Cornette FIG. 22 is “quasi-continuous” even if the indicated red section is interpreted as a discontinuity. *Id.*

Indeed, as Dr. Miles noted, the red section may be damaged and is therefore an artifact originating post-processing rather than reflecting a characteristic of the coating itself. As such, a correct analysis would include the red section, resulting in

layer (c) being fully continuous across FIG. 22. Accordingly, layers (c) and (d) of the Takagi-Cornette No. 5 coating are quasi continuous. EX-1003, 65-66.



**Cornette FIG. 22**

Cornette FIG. 22 illustrates, based on visual inspection and the relative shadings of different layers, that essentially none of the second-highest layer (corresponding to layer (c) of the Takagi-Cornette No. 5 coating) is present at the extreme surface of the coating. EX-1003, 67. Accordingly, the corresponding limitation is rendered obvious by the Takagi-Cornette combination.

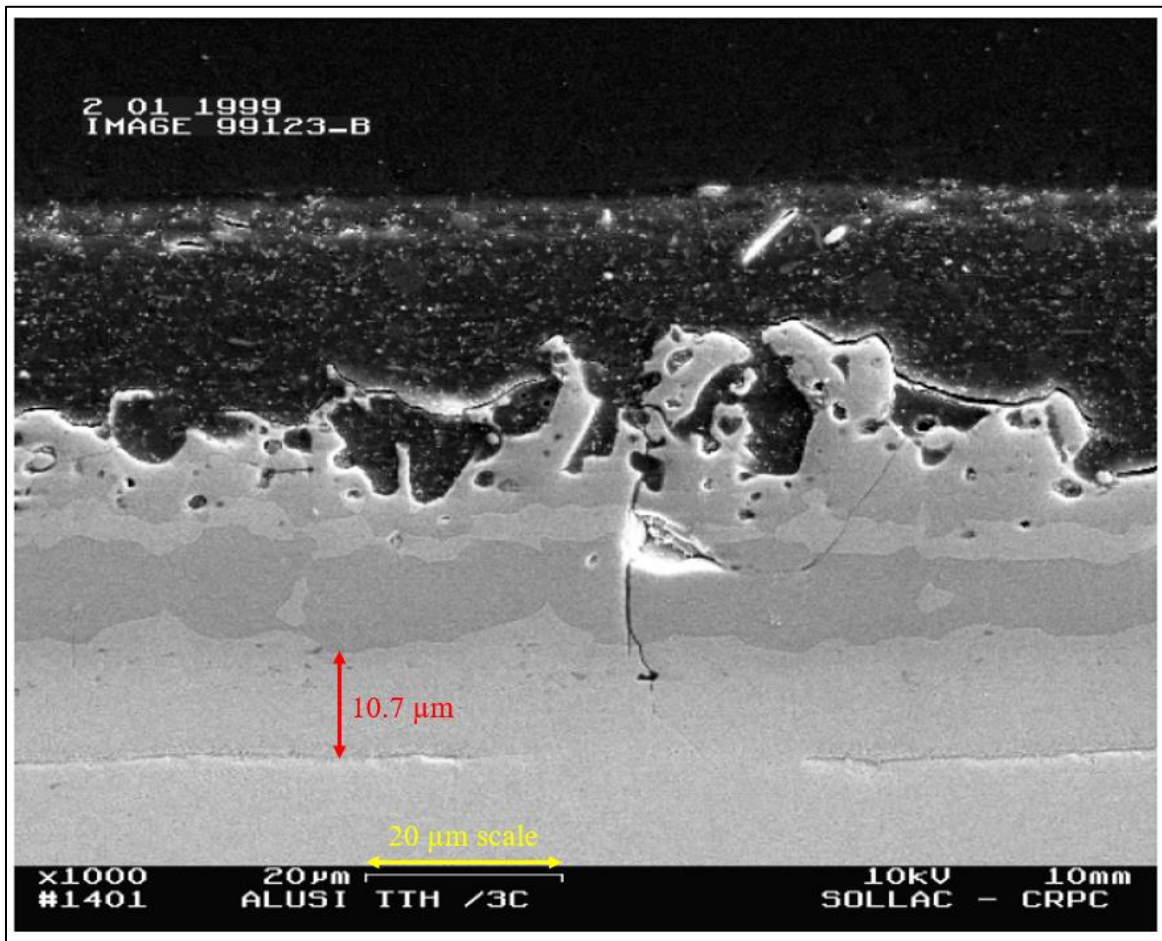
### **3. Claims 5 and 6**

As discussed above in reference to the Takagi-Cornette combination, it

would have been obvious for a POSITA to use, as the base steel, the USIBOR 1500 steel described by Cornette as providing “excellent mechanical properties of the material after the press hardening process with good corrosion protection.” EX-1014, 9; EX-1003, 68. According to Cornette, this steel has a maximum sulfur content of 0.008%, or 80 ppm. It would have been obvious for a POSITA to optimize the sulfur content within this range, for example, to arrive at the claimed range of “20 ppm or less.” EX-1003, 68. A POSITA would have interpreted Cornette’s disclosure of a maximum sulfur content as strongly suggestive of sulfur content as a relevant parameter to be optimized. *Id.*

#### **4. Claim 9**

As discussed above in reference to the Takagi-Cornette combination, Cornette FIG. 22 represents an obvious morphology of the Takagi-Cornette No. 5 coating, and, correspondingly, the inner layer of FIG. 22 represents an obvious morphology of layer (a). EX-1003, 69. Based on the annotated FIG. 22 below, this layer has a measured thickness of **10.7  $\mu\text{m}$** , satisfying this claim. *Id.* Indeed, the ’602 Patent describes no criticality, unexpected results, or qualitative difference for the claimed ranges. *Id.*



**Cornette FIG. 22**

**5. Claim 10**

As discussed above in reference to claim 9, the layer of Cornette corresponding to layer (a) has a measured thickness of 10.7 μm. EX-1014, FIG. 22. However, it would have been obvious to experiment with the layer thicknesses (e.g., by adjusting thermal parameters) to arrive at the claimed less than 10 μm. EX-1003, 70. The claimed range would represent a decrease in thickness for layer (a) of less than 1 μm, and the '602 Patent does not describe any criticality or unexpected results for “less than 10 micrometers” compared to 10.7 μm in the

Takagi-Cornette coating. *Id.* Nor would a POSITA have expected there to be such a qualitative or critical difference, in view of well-understood principles of metallurgy. *Id.*

A POSITA would have readily understood that the 0.7  $\mu\text{m}$  difference between 10.7  $\mu\text{m}$  and 10  $\mu\text{m}$  would have been less than manufacturing tolerances for layer thicknesses of coatings on hot-stamped steel parts. EX-1003, 71. Indeed, GMW14400 describes that thickness measurements of the pre-coating should be conducted with instruments that “have a capability of  $\pm 1.0 \mu\text{m}$  accuracy,” indicating a tolerance for and expectation of thickness variations on that scale. EX-1026, 3; EX-1003, 71.

A POSITA would have been motivated to experiment with the layer (a) (Inner layer) thickness to arrive at the claimed thickness range with a reasonable expectation of success. EX-1003, 72. Takagi explicitly recognizes this thickness as a result-effective variable, noting the thickness’ relationship to crack prevention and corrosion resistance. EX-1016, [0017]; EX-1003, 72. It is true that Takagi generally suggests that the Inner layer should be thicker rather than thinner. EX-1016, [0017]; EX-1003, 72. However, Takagi’s recognition of the Inner layer thickness as a relevant parameter would have led a POSITA to try reducing its thickness as a matter of routine optimization, e.g., to confirm Takagi’s teachings and assess the relationship between layer thickness and material properties

throughout a broad range of values. EX-1003, 72.

Takagi also describes that the layer can be tuned “by controlling the raised temperature of the heating and the holding time at the raised temperature.” EX-1016, [0019]; EX-1003, 73. By varying these parameters and the other parameters noted by Takagi and Cornette (e.g., heating rate and temperature), it would have been obvious for a POSITA to arrive at the claimed thickness. EX-1016, [0037]; EX-1014, 9; EX-1003, 73.

## **6. Claim 11**

As taught in Takagi’s Table 1, the Inner layers of Nos. 1 and 4 have compositions of **89.6% Fe, 7.7% Al, 2.0% Si**, and **90.7% Fe, 6.0% Al, 1.5% Si**, respectively, within the claimed range. EX-1003, 74.

The Inner layer of the No. 5 coating has a composition of **94.3% Fe, 3.2% Al, 0.4% Si**. EX-1016, Table 1. These iron and silicon compositions are within the claimed range, whereas the Al% differs by 0.8% from the 4% of claim 11. EX-1003, 75. Takagi’s Al% value, which is close to the claimed range, renders obvious the claimed range for the reasons discussed below for claim 12. *Id.*

Further, Takagi’s percentages are “mass %,” which is equivalent to weight %. EX-1016, [0020]; EX-1003, 76. A POSITA would have understood these percentages to be based on total weight. EX-1003, 76. For example, the composition percentages for each layer do not sum to 100%, suggesting that the

percentages are based on a total weight and not, e.g., limited to consideration of Fe, Al, and Si. *Id.*

## 7. Claim 12

The intermediate layer corresponds to the Inter 2 layer of the Takagi/Takagi-Cornette No. 1 and 4 coatings and the Inter 1 layer of the Takagi/Takagi-Cornette No. 5 coating. EX-1003, 77. These layers have compositions, respectively, of or similar to (i) **50.1% Fe, 48.4% Al, 1.2% Si**, (ii) **46.8% Fe, 51.9% Al, 0.6% Si**, and (iii) **42.7% Fe, 54.5% Al, 2.5% Si**. These values are within the recited ranges except for No. 1 Al% (deviation of 4.6%), No. 1 Fe% (deviation of 3.1%), No. 4 Al% (deviation of 1.1%), and No. 5 Si% (deviation of 0.5%).

These compositions render obvious the claimed compositions. EX-1003, 78. It is 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 the claimed ranges compared to Takagi's very similar values. A POSITA would not expect there to be any qualitative difference in layer properties between, e.g., a 53% Al layer and a 51.9% Al layer, or between a 2% Si layer and a 2.5% Si layer. EX-1003, 78.

Moreover, a POSITA would have been motivated to experiment with various Al%, Fe%, and Si% to arrive at the claimed compositions. EX-1003, 79. First, a POSITA would have naturally understood that the concentrations of components in a layer would be relevant for determining properties of that layer. *Id.* In addition, Takagi describes both Fe% and Al% as result-effective, noting specifically Fe%'s relationship to hardness and Al%'s relationship to corrosion resistance. EX-1016, [0020]-[0021]; EX-1003, 79. Takagi also describes the physical mechanism behind layer formation and how "the diffusion quantity of Fe [can be] varied" (which would correspond to control of Al%, Fe%, and Si%) "by controlling the raised temperature of the heating and the holding time at the raised temperature." EX-1016, [0019]; EX-1003, 79. This emphasis on layer composition as a parameter to be tuned would have been corroborated by (i) Maki's disclosure that Al% at least partially determines corrosion resistance, (ii) WO02/103073's disclosure that Si% and Al% modulate layer hardness, workability, weldability, and/or corrosion resistance, and (iii) the Laurent Presentation's detailed measurements of layer composition within a hot-stamped coating. EX-1034, [0012]; EX-1035, 25:21-28, 29:3-7, 31:6-12; EX-1056, 7; EX-1003, 79. By varying the parameters noted by Takagi and Cornette (e.g., heating rate, heating temperature, holding time, and the like), it would have been obvious for a POSITA to arrive at the claimed compositions as a result of routine experimentation on

result-effective variables. EX-1003, 79.

Also, Dr. Miles discusses that “[t]he above differences in Al%, Fe%, and Si% (e.g., the difference between 51.9% and 53%) would have been well within manufacturing tolerances and measurement accuracy for a micron-scale layer in a thin, multi-layer coating. Layers would never be perfectly uniform, and the composition of the layer would be expected to vary from part-to-part and within a given part.” EX-1003, 80-81.

#### **8. Claim 13**

As taught in Takagi’s Table 1, the Inter 3 layers of Nos. 1 and 4 have compositions of **62.0% Fe, 31.6% Al, 5.7% Si**, and **63.1% Fe, 30.4% Al, 5.3% Si**, respectively, values within the claimed range. EX-1003, 82.

#### **9. Claim 14**

As taught in Takagi’s Table 1, the Outer layers of Nos. 1, 4, and 5 have compositions of **44.5% Fe, 54.8% Al, 0.8% Si**; **49.8% Fe, 47.4% Al, 2.2% Si**; and **38.4% Fe, 54.5% Al, 6.8% 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. For No. 5, the Al% is within the claimed range, while the Fe% differs by 0.6% and the Si% differs by 4.8%. Absent evidence of criticality or unexpected results, these values render obvious the claimed ranges as discussed for [12] and by Dr. Miles. EX-1003, 83.

**10. Claims 15-17**

See claims 12-14. EX-1003, 84.

**11. Claim 18**

See claim 9. For example, the Takagi-Cornette No. 5 coating has an interdiffusion (Inner) layer with a measured thickness of **10.7  $\mu\text{m}$** . EX-1003, 85. Indeed, the '602 Patent describes no criticality, unexpected results, or qualitative difference for the claimed ranges. *Id.*

**12. Claim 19**

The No. 1, 4, and 5 coatings have layer-wise Fe% of **89.6, 50.1, 62.0, 44.5; 90.7, 46.8, 63.1, 49.8; and 94.3%, 42.7%, 51.4%, 38.4%**, all similar to the claimed Fe%. EX-1003, 86.

As discussed above, 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. Here, the '602 Patent describes no criticality or unexpected results for the first, second, third, and fourth mean iron compositions required in claim 19, as opposed to Takagi's disclosure. EX-1003, 87. Absent a showing of criticality or unexpected results, the values taught by Takagi render obvious the claimed values. *Id.* For example, 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.*

**13. Claim 20**

*See* [1e]-[1f].

The third mean iron compositions of the No. 1, 4, and 5 coatings are 62.0%, 63.1%, and 51.4%, respectively, while the fourth mean iron compositions are 44.5%, 49.8%, and 38.4%. EX-1016, Table 1. The corresponding pairs of these values satisfy the recited relationship. EX-1003, 88.

**14. Claim 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, 89. Specifically, Takagi's fourth mean iron compositions (the iron compositions of the Outer layers of the No. 1, 4, and 5 coatings) are 44.5%, 49.8%, and 38.4%, respectively, which are different from the iron compositions disclosed for the other layers of those coatings. EX-1016, Table 1; EX-1003, 89.

**15. Claim 22**

*See* [20]. EX-1003, 90.

**16. Claim 23**

The claimed Fe% relationship is satisfied for the No. 4 coating based on Takagi's Table 1 (**46.8%** for Inter 2 and **49.8%** for Outer). The No. 1 coating has Fe% of **50.1%** for Inter 2 and **44.5%** for Outer, and the No. 5 coating has **42.7%**

for Inter 1 and **38.4%** for Outer, which render obvious [23] for reasons discussed for [12]. EX-1003, 91.

**17. Claim 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 relationships are directly disclosed for the No. 1 and 4 coatings in Takagi’s Table 1 based on the correspondence between Takagi’s layers and the first through fourth layers discussed for claim 1. EX-1016, Table 1; EX-1003, 92-96. For the No. 5 coating, these relationships are also directly disclosed, except for the description of equal values of Al%, which render obvious different values. EX-1003, 97-98.

**18. Claim 25**

See claim 24.

For the No. 4 coating, the recited aluminum composition relationship is directly satisfied based on the Inter 2 and Outer Al%. EX-1016, Table 1; EX-1003, 99-100. For the No. 5 coating, the disclosed second and fourth mean aluminum compositions are equal, which renders obvious different values for these parameters. EX-1016, Table 1; EX-1003, 100. For the No. 1 coating, the second

and fourth mean aluminum compositions are 48.4% and 54.8%, respectively, which render obvious claim 24 for reasons discussed for [12]. EX-1016, Table 1; EX-1003, 100.

**19. Claim 26**

See claims 9, 10, and 18. EX-1003, 101.

**20. Claims 27-30**

See claims 11-14. EX-1003, 102.

**IV. GROUND 1B: Claims 3, 4, 7, and 8 are obvious over Takagi, Cornette, and 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; EX-1003, 103. Laurent discusses elemental components of the steel and how those components improve performance. EX-1023, 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. This disclosure indicates that the steels of Laurent are well-suited for hot-stamping processes. EX-1003, 103.

**B. Takagi-Cornette-Laurent Combination**

It would have been obvious to use the steel compositions of Laurent as the base steel when applying Takagi-Cornette. EX-1003, 104. While Takagi discloses certain characteristics of a “[b]ase material” including a “steel sheet,” Takagi does

not disclose elemental concentrations of the base steel. EX-1016, [0046]; EX-1003, 104. Thus, as a potential alternative to Cornette, a POSITA would have looked to Laurent for base steel composition. EX-1003, 104. A POSITA would have been motivated by Laurent's discussion of advantages of such a steel, including advantages of the particular elements and concentrations that "make[] it possible to obtain high mechanical characteristics which may exceed 1500 MPa for mechanical resistance." EX-1023, 2:46-50; EX-1003, 104. For example, Laurent describes that certain concentrations are used "for their effect on hardenability" and are "optimized from the point of view of weldability." EX-1023, 4:19-33; EX-1003, 104. A POSITA would have had a reasonable expectation of success in using Laurent's base steel, given that Laurent discloses the steel in the specific context of hot-stamping ("stamping" and "hot-shaping"), the method applied by Takagi and Cornette. EX-1023, 2:46-61; EX-1003, 104.

The use of Laurent's steel instead of Cornette's would have constituted "mere substitution of one element [the Laurent steel] for another [the USIBOR 1500 steel of Cornette] known in the field." *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007); EX-1003, 105. Indeed, Cornette's steel (USIBOR 1500) and Laurent's steel have generally similar compositions, such that the substitution of one for the other would have constituted only a minor modification. EX-1014, 9; EX-1023, 1:66-2:10; EX-1003, 105.

## C. Analysis of Claims

### 1. Claims 3 and 4

The “preferabl[e]” steel “composition by weight” of Laurent disclosed at the top of col. 2 satisfies or renders obvious [3]-[4]. EX-1023, 1:66-2:10; EX-1003, 106. For example, it would have been obvious to optimize compositions within Laurent’s ranges, to arrive at values within the ranges of claims 3-4. EX-1003, 106. It is well-established that a recited range overlapping with or lying inside a range disclosed by the prior art is obvious, absent countervailing evidence such as unexpected results, which have not been alleged or evidenced here. *In re Wertheim*, 541 F.2d 257; *In re Geisler*, 116 F.3d 1465, 1469-71; *In re Bergen*, 120 F.2d 329, 332.

### 2. Claims 7 and 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. It would have been obvious to use this Ti:N range in order to prevent boron combination as described by Laurent. EX-1003, 107.

## V. GROUND 1C: Claims 3-6 are obvious over Takagi, Cornette, and Nishibata

### A. Nishibata

Nishibata describes steel compositions and process parameters for “hot forming” (i.e., hot-stamping) for automotive components. EX-1050, 1. Nishibata describes that the inclusion of certain elements, in certain concentrations, can improve properties of the steel. EX-1003, 108. 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. Takagi-Cornette-Nishibata Combination**

It would have been obvious to use the steel compositions of Nishibata as the base steel when applying Takagi and Cornette. EX-1003, 109. As noted in §IV.B, Takagi does not disclose elemental concentrations of the base steel, such that a POSITA would have looked to Nishibata to teach the base steel composition. *Id.* A POSITA would have been motivated by Nishibata’s discussion of advantages of such a steel, including that the steel provides “stabilized strengths and toughnesses.” EX-1050, 2. For each element, Nishibata provides a target concentration range and reasoning as to why that range is desirable. EX-1050, 5-6.

For sulfur, a POSITA would have been motivated to use Nishibata’s sulfur concentration based on Nishibata’s comment that sulfur is “effective in raising the hardening ability of the steel plate and raising the stabilizing of its strength” if

included at a sufficiently low concentration. EX-1050, 6; EX-1003, 110. It was recognized that the inclusion of sulfur at high concentrations can deteriorate steel formability. EX-1052, [0088]; EX-1051, 5. 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  $\leq 20$  ppm sulfur). EX-1003, 110.

A POSITA would have had a reasonable expectation of success in using Nishibata's base steel, given that Nishibata discloses the steel in the specific context of hot-stamping ("hot-press[ing]"), the method applied by Takagi and Cornette. EX-1050, 7-8; EX-1003, 111.

The use of Nishibata's steel instead of Cornette's would have constituted "mere substitution of one element [the Nishibata steel] for another [the USIBOR 1500 steel of Cornette] known in the field." *KSR*, 550 U.S. at 416; EX-1003, 112. Indeed, Cornette's steel (USIBOR 1500) and Nishibata's steel have generally similar compositions, such that the substitution of one for the other would have constituted only a minor modification. EX-1014, 9; EX-1050, Table 1; EX-1003, 113-114.

### **C. Analysis of Claims**

#### **1. Claims 3 and 4**

Nishibata's composition ranges, corresponding to the discrete values

provided in Nishibata Table 1, are entirely within or substantially overlap with the ranges recited in '602 patent claims 3 and 4, rendering obvious the claims. EX-1050, Table 1; EX-1003, 115.

## **2. Claims 5 and 6**

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 " $\leq 0.05\%$ ." EX-1050, 4.

Nishibata's steel compositions in pg. 5-6 ("1. Composition of the base steel plate") also satisfy or overlap with the compositions of [3]-[6], rendering obvious those compositions. EX-1003, 117; EX-1050, 3-4.

## **VI. GROUND 1D: Claims 1, 3-4, 11-17, 19-25, and 27-30 are obvious over Takagi and GMW14400**

### **A. GMW14400**

GMW14400 is a material specification published by General Motors and designed to inform steel makers of the requirements of steel to be used in GM vehicles. EX-1003, 118-119. 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”  $\mu\text{m}$  Al-Si pre-coating “[p]rior to hot-stamping” where coating thickness “[f]ollowing hot-stamping” is “>35”  $\mu\text{m}$ . EX-1026, 7. GMW14400 also requires a certain chemical composition of the base steel. *Id.*, 2.

#### **B. Takagi-GMW14400 Combination**

GMW14400 substitutes for Cornette, as applied in Grounds 1A-1C, to teach and motivate a coating thickness “>35”  $\mu\text{m}$ . EX-1026, 7; EX-1003, 120.

GMW14400’s coating thickness “>35”  $\mu\text{m}$  can be achieved using a pre-coating thickness (“[p]rior to hot-stamping”) of “20 to 33”  $\mu\text{m}$ , a range that overlaps with Takagi’s pre-coating thickness range of 10-20  $\mu\text{m}$ . EX-1016, [0035]; EX-1026, 7; EX-1003, 120. As such, GMW14400 evidences Takagi’s teaching of coating thicknesses greater than 30  $\mu\text{m}$ . EX-1003, 120.

Further, GMW14400 demonstrates strong market motivation and demand to achieve such a thickness, as steel researchers and manufacturers would have been highly motivated to conform to General Motors’ requirements. EX-1003, 121. Accordingly, to the extent Takagi fails to explicitly teach a coating thickness greater than 30  $\mu\text{m}$ , it would have been obvious to modify Takagi to have such a

thickness, given GMW14400. *Id.* For example, it would have been obvious to experiment with pre-coating thicknesses in the range of “20 to 33”  $\mu\text{m}$  specified by GMW14400, with this range representing only a very small to moderate increase in pre-coating thickness compared to Takagi’s 20  $\mu\text{m}$ . EX-1016, [0035]; EX-1026, 7; EX-1003, 122. See §III.C for discussion of the well-established and predictable link between pre-coating thickness and coating thickness. In view of GMW14400, a POSITA would have had a reasonable expectation of success in achieving coating thicknesses greater than 30  $\mu\text{m}$ , e.g., GMW14400’s “>35”  $\mu\text{m}$  coating thicknesses. EX-1003, 122.

### **C. Analysis of Claims**

#### **1. Claims 1, 11-17, 19-25, and 27-30**

See discussion for Ground 1A, with GMW14400’s evidence of coating thicknesses greater than 30  $\mu\text{m}$ , and GMW14400’s motivation and teachings on how to obtain coating thicknesses greater than 30  $\mu\text{m}$ , substituted for Cornette’s. EX-1003, 123.

#### **2. Claims 3-4**

GMW14400’s steel compositions satisfy or overlap all composition ranges

in [3]-[4], rendering obvious those compositions. EX-1026, 2;<sup>6</sup> EX-1003, 124-126.

It would have been obvious to use these steel compositions to satisfy General Motors' requirements. EX-1003, 124-125. 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, satisfying a steel with Ti% of less than 0.1%. EX-1003, 126.

**VII. GROUND 1E: Claims 3-4 and 7 are obvious over Takagi, GMW14400, and Laurent**

**A. Takagi-GMW14400-Laurent Combination**

For reasons discussed in §IV.B for the Takagi-Cornette-Laurent combination, it would have been obvious for a POSITA to try using Laurent's base steel when applying Takagi and GMW14400. EX-1003, 127. Notably, Laurent's compositions are similar to those of GMW14400, such that this substitution would have been only a minor modification. EX-1026, 2; EX-1023, 1:66-2:10; EX-1003, 127.

**B. Analysis of Claims**

See §IV.C. Laurent's compositions (top of col. 2) satisfy or render obvious the compositions of claims 3-4, and Laurent's disclosure that "[t]itanium, the ratio

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<sup>6</sup> 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, 125.

of the content of which with respect to the nitrogen content should be in excess of 3.42” teaches claim 7. EX-1023, 1:66-2:10, 4:25-26; EX-1003, 128.

**VIII. GROUND 1F: Claims 3-5 are obvious over Takagi, GMW14400, and Nishibata**

**A. Takagi-GMW14400-Laurent Combination**

For reasons discussed in §V.B for the Takagi-Cornette-Nishibata combination, it would have been obvious for a POSITA to try using Nishibata’s base steel when applying Takagi and GMW14400. EX-1003, 129. Notably, Nishibata’s compositions are similar to those of GMW14400, such that this substitution would have been only a minor modification. EX-1026, 2; EX-1050, Table 1; EX-1003, 129.

**B. Analysis of Claims**

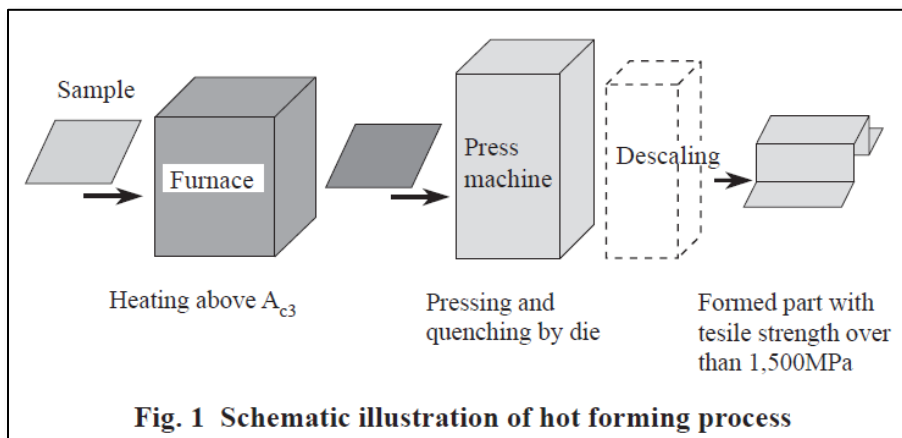
See §V.C. The compositions in Nishibata Table 1 and pg. 5-6 satisfy or render obvious the compositions of claims 3-5. EX-1050, Table 1; EX-1003, 130.

**IX. GROUND 2A: Claims 1-2, 5-6, and 9-30 are obvious over Suehiro and Cornette**

**A. Suehiro**

Like the ’602 Patent, Suehiro is directed to “forming methods including mold quenching, hot forming, hot stamping, and hot pressing ... to obtain parts

with a strength of about 1500 MPa.” EX-1055, [02].<sup>7</sup> Suehiro outlines the hot forming method that was “already in practical use” and was the same as that of the ’602 Patent. EX-1055, [3]; EX-1003, 131-132. Referring to FIG. 1 (reproduced below), the method starts with “heat[ing]” “steel sheets” “to a temperature in the austenite range [such as] 850°C or higher,” and then “the steel sheet is taken out of the furnace and transported to a press machine, where it is pressed with a mold at room temperature and quenched at the same time.” EX-1055, [03].



**Suehiro FIG. 1**

Suehiro recognizes the desirability of an aluminized steel sheet for “excellent hardenability” and “excellent heat resistance” and identifies a high-level

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<sup>7</sup> EX-1053, the English document corresponding to EX-1054, is substantially the same as the translation (EX-1055) and provides the same support for the arguments in this Petition. Parallel citation to the English document is omitted for brevity.

chemical composition of the aluminized steel. EX-1055, [05], Table 1; EX-1003, 133.

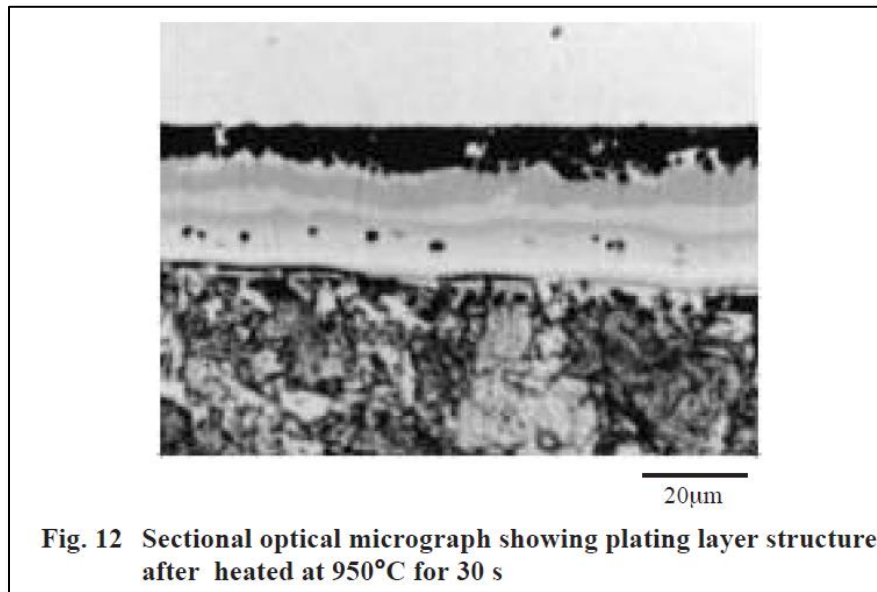
| Table 1: Composition of Steel Sheets Used in the Study (mass%) |     |      |       |
|----------------------------------------------------------------|-----|------|-------|
| C                                                              | Mn  | Cr   | B     |
| 0.22                                                           | 1.2 | 0.15 | 0.002 |

**Suehiro Table 1**

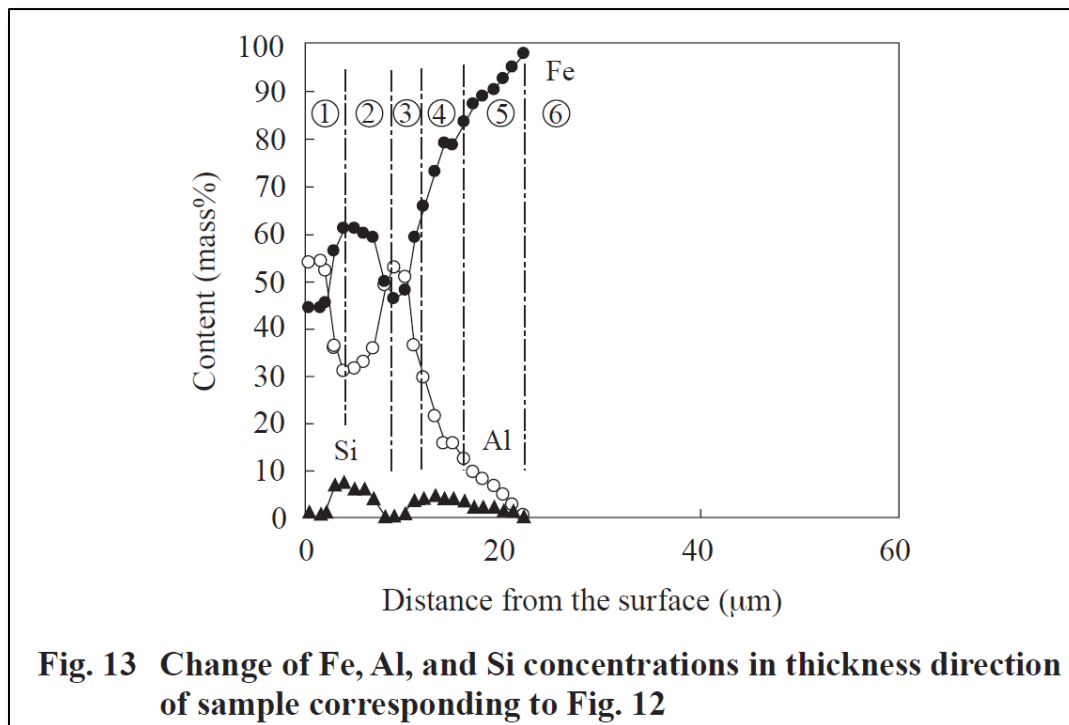
Similar to the '602 Patent, Suehiro shows an example of an Fe-Al-Si alloy layer structure of the steel sheet product after hot forming. EX-1055, [14]-[15]; EX-1003, 134. In particular, Suehiro's "Figure 12 shows the alloying state after holding at 950°C for 0.5 min, and Figure 13 shows the results of SEM-EDS measurements of Fe, Al, and Si concentrations in the surface plating layer in the direction of the plate thickness." EX-1055, [14]-[15]; EX-1003, 134. FIG. 12 shows a total coating thickness of about 22  $\mu\text{m}$ . EX-1003, 134.<sup>8</sup>

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<sup>8</sup> This Petition uses figures from EX-1053, which are higher-quality than, but otherwise identical to, the corresponding figures of the translated document EX-1055.



**Suehiro FIG. 12**



**Suehiro FIG. 13**

## **B. Suehiro-Cornette Combination**

In relation to claim limitation [1h], in view of Cornette, a POSITA would

have been motivated and found it obvious to adjust the coating thickness of Suehiro to be greater than 30  $\mu\text{m}$ , for reasons discussed in §III.C. EX-1003, 135. For example, a POSITA would have been motivated to increase the coating thickness, compared to Suehiro's coating thickness of about 22  $\mu\text{m}$ , to achieve the "typical" thickness of "about 40  $\mu\text{m}$ " that Cornette describes is associated with "the best compromise between corrosion protection and weldability." EX-1014, 9; EX-1003, 135.

And, as discussed in §III.C, the prior art is replete with recognition of coating thickness as a result-effective variable, all of which would have caused a POSITA to try varying the coating thickness, including pursuing thicker coatings. EX-1003, 136. To achieve this objective, a POSITA would have identified Cornette as a reference that teaches thicker coatings, such as "about 40  $\mu\text{m}$ " or 32.3  $\mu\text{m}$ . EX-1014, FIG. 22; EX-1003, 136. Based on Cornette's disclosure, a POSITA would have found it obvious to try modifying Suehiro's processes based on Cornette's process parameters and conditions in order to obtain such a coating, e.g., by trying Cornette's "25  $\mu\text{m}$ " pre-coating thickness and/or by trying, and experimenting based on, Cornette's disclosed thermal parameters. EX-1014, 9, FIG. 21; EX-1003, 136.

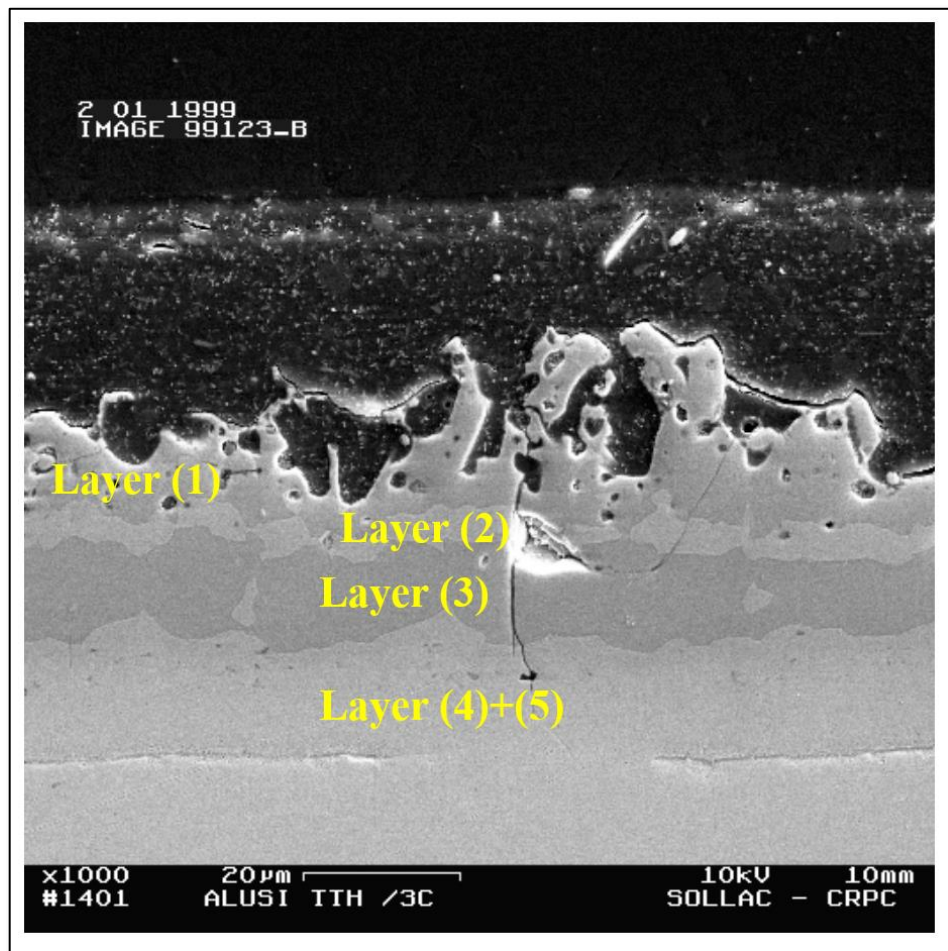
A POSITA would have had confidence that these modifications would be successful, because the processes disclosed in Suehiro and Cornette are consistent

with one another, such as use of the same precoated steel (e.g., both using USIBOR 1500 steel) and similar heating temperatures and times (e.g., “[h]eating 5-10 min. 880-950 °C” in Cornette and “850 °C or higher” or 950 °C for 2.5-7 mins in Suehiro with a 3 min holding time). EX-1021, 9, FIG. 21; EX-1055, [14]-[16]; EX-1003, 137. Thus, modification of Suehiro based on Cornette would have constituted only a minor modification. EX-1003, 137. And, as noted in §III.C, a POSITA would have also been aware of a direct correlation between pre-coating thickness and coating thickness. EX-1025, 5:17-20. Further, Suehiro and Cornette together identify the key parameters of interest for adjusting coating characteristics, including “[h]eating rate,” “[h]olding time,” pre-coating thickness, and temperature, with similar values to those of the ’602 Patent and other references. EX-1055, FIG. 3; EX-1014, 9; EX-1003, 137; See §III.C.

Therefore, adjustments to achieve a thicker coating, such as Cornette’s thicknesses, would have been well within the skill of POSITA and would have been achievable with a reasonable expectation of success. EX-1003, 138. The modifications to Suehiro would have entailed nothing more than applying Cornette’s known techniques and parameters to Suehiro to obtain a predictable result. *Id.*

As a further modification, for reasons discussed in §III.C for the Takagi-Cornette combination, it would have been obvious, and within the skill of a

POSITA, in modifying Suehiro's coating based on Cornette, to arrive at layer characteristics (e.g., layer thickness and/or morphology) matching, or similar to, those shown in Cornette FIG. 22. EX-1003, 139. For example, as a result of routine experimentation and optimization, it would have been obvious to arrive at Suehiro's layers (1)-(5) with the thicknesses and/or morphologies of Cornette's corresponding layers, as shown below. *Id.* Layers (4)-(5), as depicted in Suehiro FIG. 12, appear as one layer with a shading gradient, such that these layers together can be mapped to Cornette's innermost layer, which exhibits a similar shading gradient. *Id.*, 139-141.



**Cornette FIG. 22**

**C. Analysis of Claims**

**1. Claim 1**

*[1pre]:*

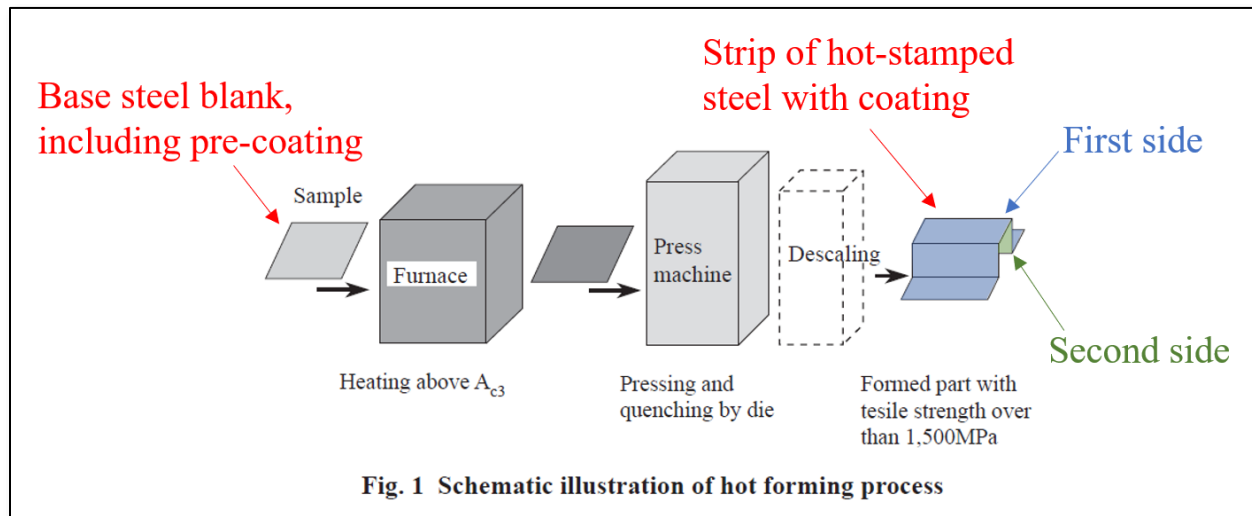
As discussed in §III.D.1, this preamble is non-limiting.

Further, Suehiro’s “hot stamp[ed],” “quench[ed]” “steel sheets” formed from “coated” steel are “precoated steel product[s]” or “precoated steel stamped blanks.”

EX-1055, [02], Title; EX-1003, 142.

[1a]:

Suehiro's "hot stamp[ed]," "quench[ed]" "steel sheets" are "strips of base steel having a first side and a second side." EX-1055, [02]; EX-1003, 143. For example, in its description of the hot stamping process, Suehiro illustrates blanks having first sides and second sides, as shown in annotated FIG. 1 below. EX-1003, 143.



**Suehiro FIG. 1**

[1b]:

Suehiro's "layered alloy phase" "after holding at 950°C for 0.5 min" is 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." EX-1055, [15]; EX-1003, 144.

[1c]:

Suehiro's "layered alloy phase" "results from interdiffusion between the base steel, and an aluminum or aluminum alloy pre-coating." EX-1055, 4; EX-

1003, 145. For example, Suehiro describes that the alloy layer structure derives from “an aluminum plating containing 10% Si” and that, as the steel sheets are heated, “Al diffuses.” EX-1055, [14]-[16]; EX-1003, 145-146.

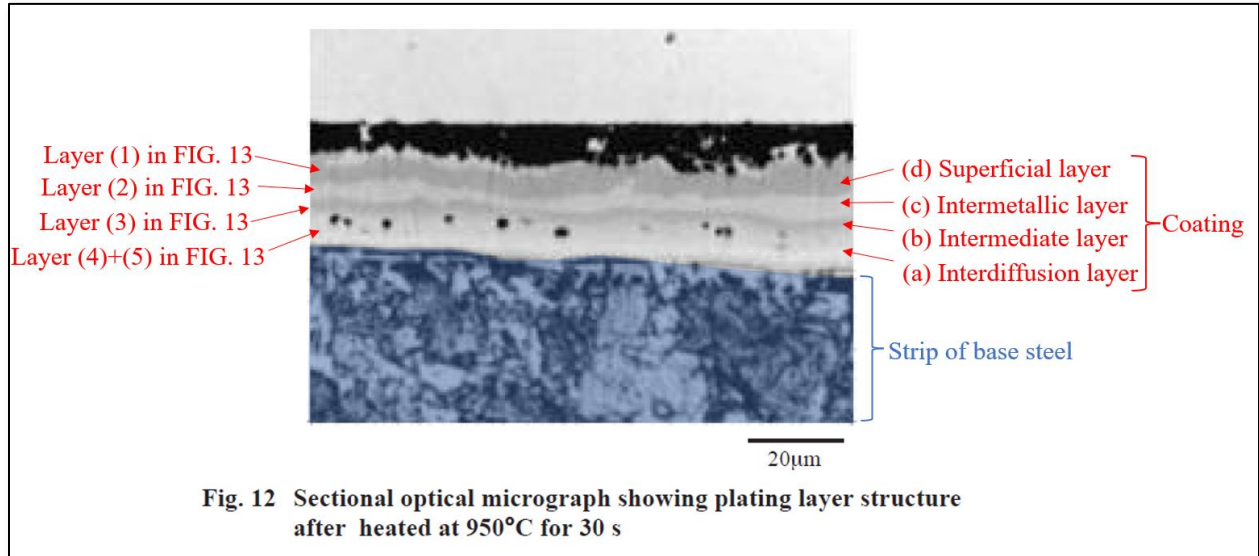
*[1d]:*

Suehiro’s “layered alloy phase” includes, proceeding from the base steel outwards, (a) an interdiffusion layer, (b) an intermediate layer, (c) an intermetallic layer, and (d) a superficial layer. EX-1055, [15]; EX-1003, 147. Suehiro describes that this “alloy phase consists of five layers.” EX-1055, [15]. These five layers are labeled by Suehiro in FIG. 13. EX-1003, 147. At least four layers are also visible in FIG. 12, based on their different shadings. *Id.* The innermost visually-defined layer has a shading gradient that suggests it encompasses layers (4) and (5) together, with layer (4) less visually distinct. *Id.* As a result, and consistent with an example in the ’602 Patent as discussed in §III.D.1, Suehiro’s layer (4) would be understood as forming a sub-layer of an overall layer composed of both layers (4) and (5). *Id.*

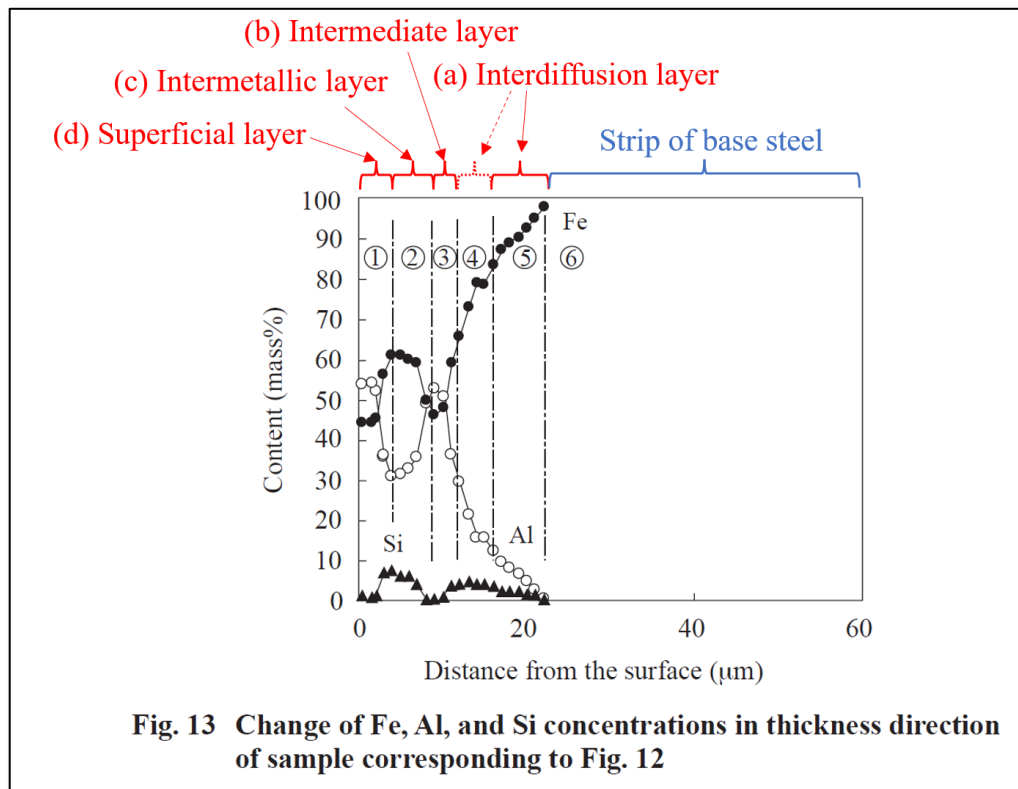
Of the layers:

- Layer (5) (alternatively, layers (4) and (5) together) teaches layer (a) (the “interdiffusion layer”). As shown in FIG. 12, layer (5) is arranged directly on the underlying steel. EX-1003, 148.
- Layer (3) teaches layer (b) (the “intermediate layer”). *Id.*

- Layer (2) teaches layer (c) (the “intermetallic layer”). *Id.*
- Layer (1) teaches layer (d) (the “superficial layer”). *Id.*



**Suehiro FIG. 12**



**Suehiro FIG. 13**

Thus, Suehiro's layer (5) or (4)+(5) is "an interdiffusion layer." EX-1003, 149-150. An average of the layer (5) (or (4)+(5)) datapoints in FIG. 13 is indicative of a first mean iron composition. *Id.* This calculation results in a value of **91.9%** in the case where layer (5) is the interdiffusion layer, or **84.6%** where layers (4)+(5) are the interdiffusion layer. *Id.*

[1e]:

See [1d] above. Suehiro's layer (3) is an "intermediate layer" having an average of composition datapoints, for layer (3) in FIG. 13, of **51.1%**. EX-1003, 151.

[1f]:

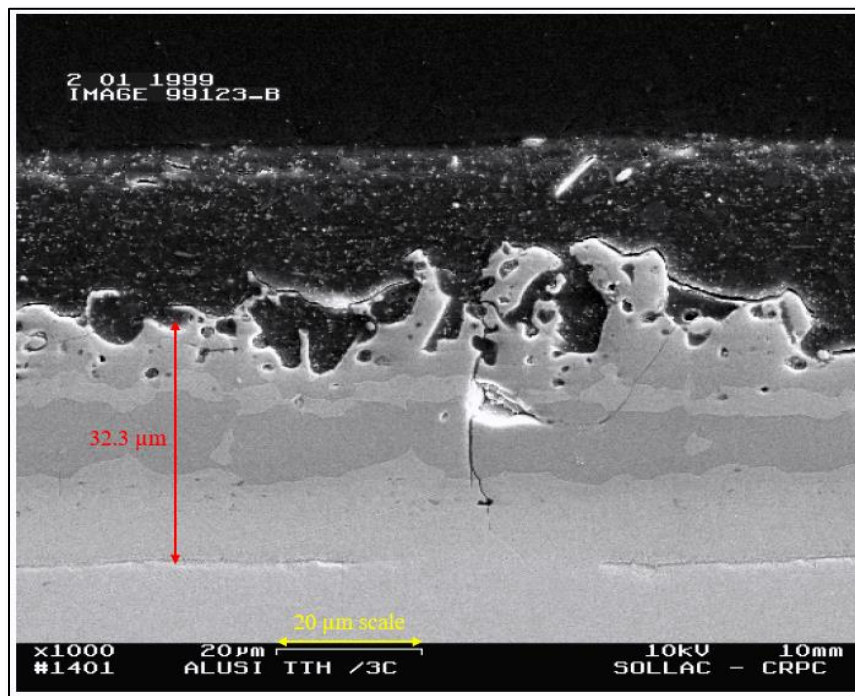
See [1d] above. Suehiro's layer (2) is an "intermetallic layer" having an average of composition datapoints, for layer (2) in FIG. 13, of **57.4%**. EX-1003, 152. This third value is greater than the second value for layer (2). *Id.*

[1g]:

See [1d] above. Suehiro's layer (1) is a "superficial layer" having an average of composition datapoints, for layer (1) in FIG. 13, of **50.2%** based on the datapoints in FIG. 13. EX-1003, 153.

[1h]:

As discussed above (§IX.B), given Cornette, it would have been obvious for the Suehiro coating to be modified to have a thickness greater than 30  $\mu\text{m}$ . EX-1003, 154. For example, it would have been obvious to arrive at a modified coating having a thickness such as the "typically about 40  $\mu\text{m}$ " taught by Cornette or the approximately 32.3  $\mu\text{m}$  thickness shown in Cornette FIG. 22. *Id.*



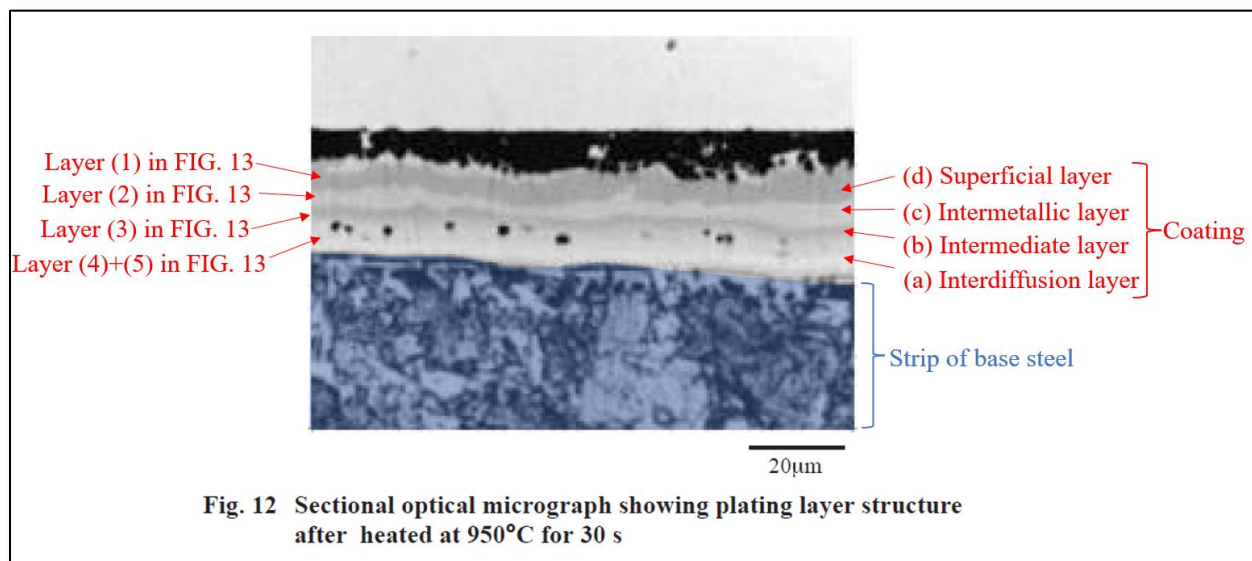
**Cornette FIG. 22**

## **2. Claim 2**

For “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),” Suehiro’s FIG. 12 illustrates that each of layer (2) and (1) (corresponding to layers (c) and (d)) extends continuously without discontinuity (e.g., pore, slit, etc.) across the entire SEM image in FIG. 12, as shown below. EX-1003, 155.

For “less than 10% of layer (c) is present at an extreme surface of the product,” Suehiro’s FIG. 12 shows that essentially none of layer (2) (corresponding to layer (c)) is present at the extreme surface of Suehiro’s coating. This is evident by an examination of Suehiro’s FIG. 12, in which the lighter shaded layer (2) is

entirely covered by the darker layer (1). EX-1003, 156.



### **Suehiro FIG. 12**

In addition, for the modification of Suehiro's coating to have layer morphologies as shown in Cornette FIG. 22, the resulting coating would satisfy claim 2 for reasons discussed above for the Takagi-Cornette combination. See §III.D.2; EX-1003, 157.

### **3. Claims 5 and 6**

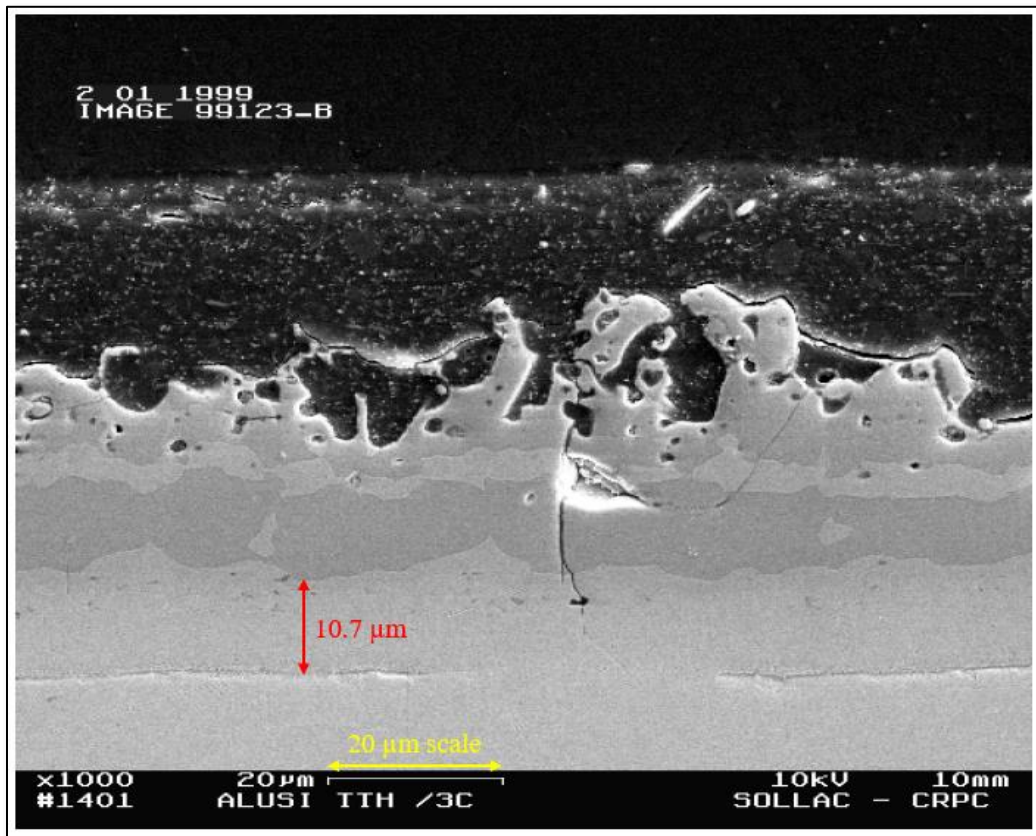
Suehiro and Cornette both disclose USIBOR 1500 as the base steel for hot forming. EX-1014, 9; EX-1055, [02]. See §III.D.3 (Ground 1A) for why it would have been obvious to arrive at the claimed sulfur composition based on Cornette's disclosed USIBOR 1500 composition. EX-1003, 158.

### **4. Claim 9**

Based on FIG. 13, Suehiro's layer (5) (corresponding to layer (a)) has a

thickness of 6.2  $\mu\text{m}$  in comparison to a total coating thickness of 22.2  $\mu\text{m}$ . EX-1003, 159. Scaling this proportional layer thickness to the 32.3  $\mu\text{m}$  coating thickness shown in Cornette FIG. 22 gives a layer thickness of **9  $\mu\text{m}$**  that would be expected if Suehiro's coating were modified to have the 32.3  $\mu\text{m}$  thickness. EX-1003, 159. This satisfies claim 9. *Id.*, 159-162.

In addition, for the modification of Suehiro's coating to have layer thicknesses as shown in Cornette FIG. 22, the innermost layer satisfies claim 9. EX-1003, 163. As shown in FIG. 22, the innermost layer (corresponding to layer (a)) has a measured thickness of **10.7  $\mu\text{m}$** , satisfying this claim, as illustrated in annotated FIG. 22 below.



**Cornette FIG. 22**

**5. Claim 10**

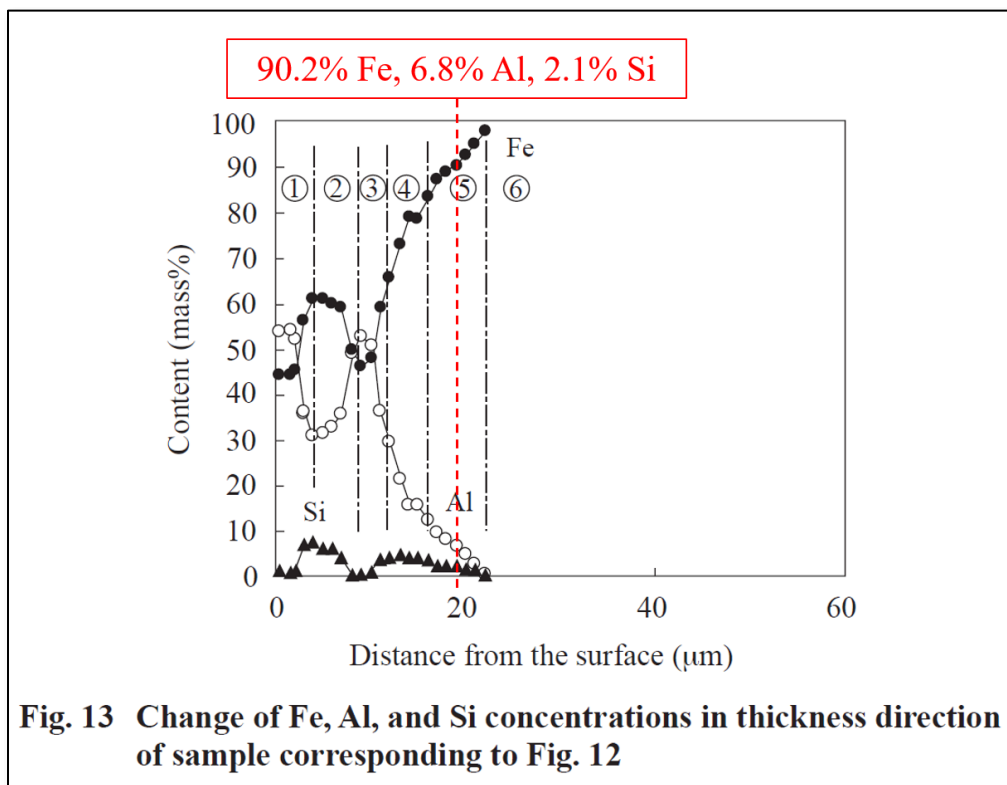
As discussed for claim 9, the expected layer (5) thickness (corresponding to layer (a)) of **9 μm** obtained by scaling Suehiro's layer thicknesses based on Cornette's coating thickness satisfies claim 10. EX-1003, 164.

In addition, for the modification of Suehiro's coating to have layer thicknesses as shown in Cornette FIG. 22, the measured thickness of **10.7 μm** renders obvious the claimed range of "less than 10 micrometers." EX-1003, 165. Based on the 10.7 μm thickness, a POSITA would have found it obvious to experiment with the coating thickness to arrive at the claimed thickness of less than

10  $\mu\text{m}$ . EX-1003, 165. See discussion of claim 10 for Ground 1A (§III.D.5).

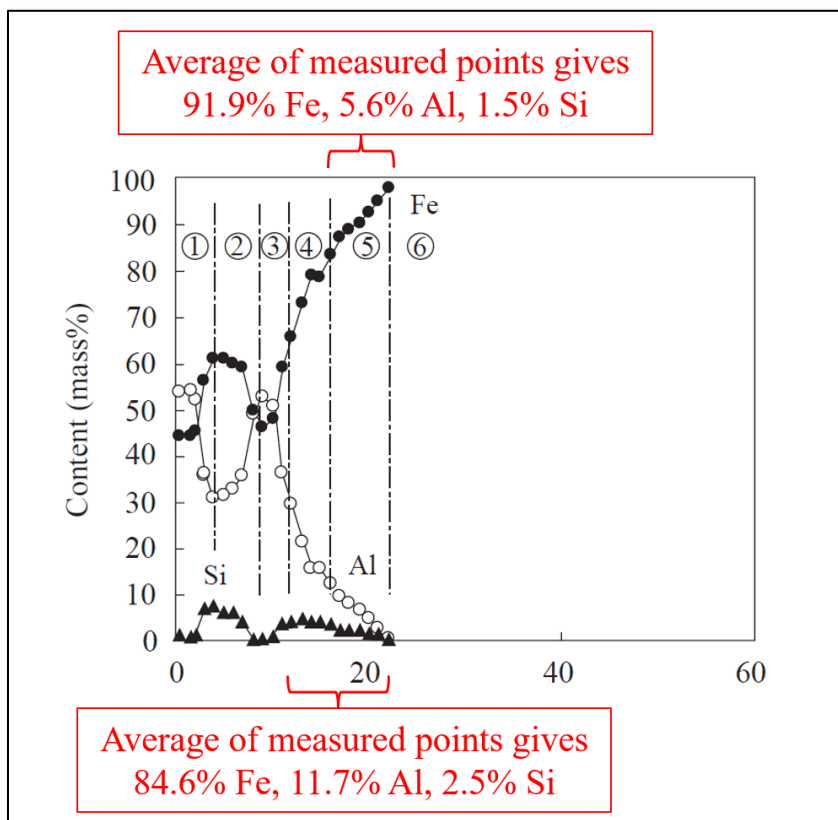
## 6. Claim 11

Suehiro's layer (5), or layers (4)+(5), which correspond to the "interdiffusion layer," teach the recited composition. EX-1003, 166. For example, for the measurement position indicated in annotated FIG. 13 below, Suehiro's layer (5) has a "mass%" composition (equivalent to a composition "by weight") of 90.2% Fe, 6.8% Al, and 2.1% Si, values within the claimed ranges. *Id.* These values, and Suehiro's other sets of Fe, Al, and Si concentration, sum to less than 100%, indicating that these are concentrations "based on total weight." *Id.*



**Suehiro FIG. 13**

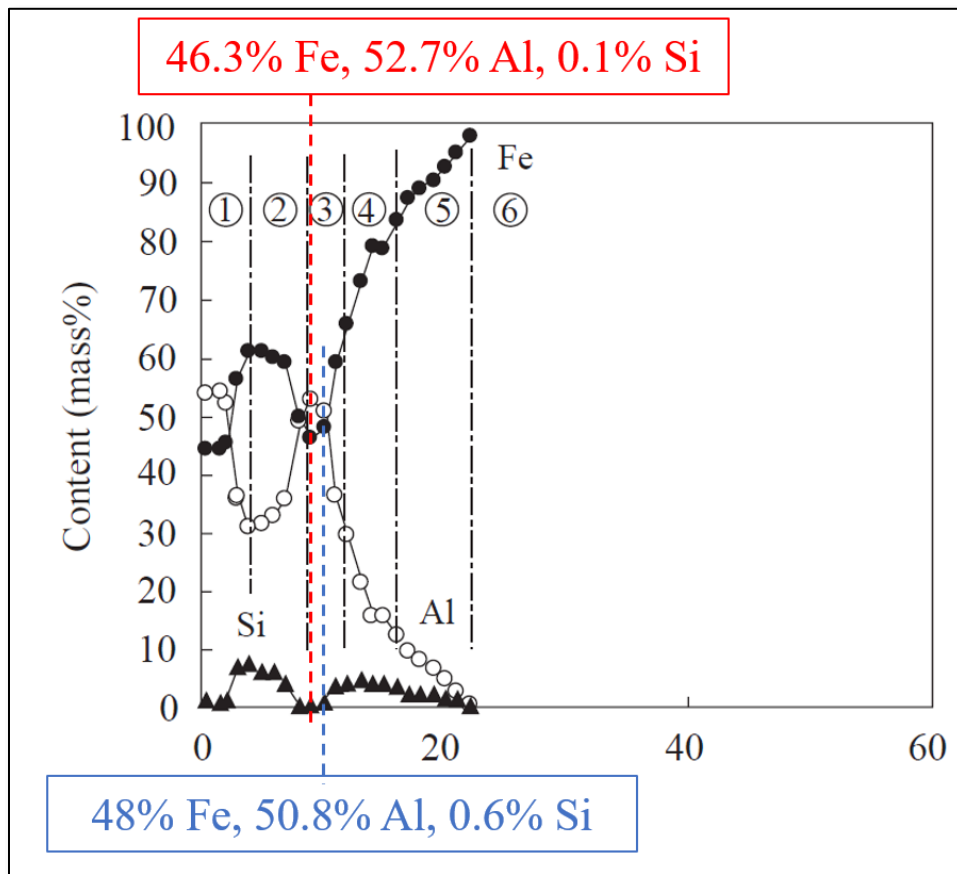
As another measurement of Suehiro's coating, the measured compositions within each layer can be averaged. EX-1003, 167. Performing this analysis gives a composition of 91.9% Fe, 5.6% Al, 1.5% Si for layer (5), or a composition of 84.6% Fe, 11.7% Al, 2.5% Si for layers (4) and (5) together. EX-1055, FIG. 13; EX-1003, 167. The layer (5) values are within the claimed range, while the layers (4)+(5) composition has Fe% deviating from the claimed range by 1.4% and Al% deviating from the claimed range by 1.7%. EX-1003, 167. These values, which are close to the claimed range, render obvious the claimed range for reasons discussed for claim 12 in §III.D.7 (Ground 1A), e.g., in the absence of any alleged criticality, unexpected results, or qualitative difference in properties. *Id.*



**Suehiro FIG. 13**

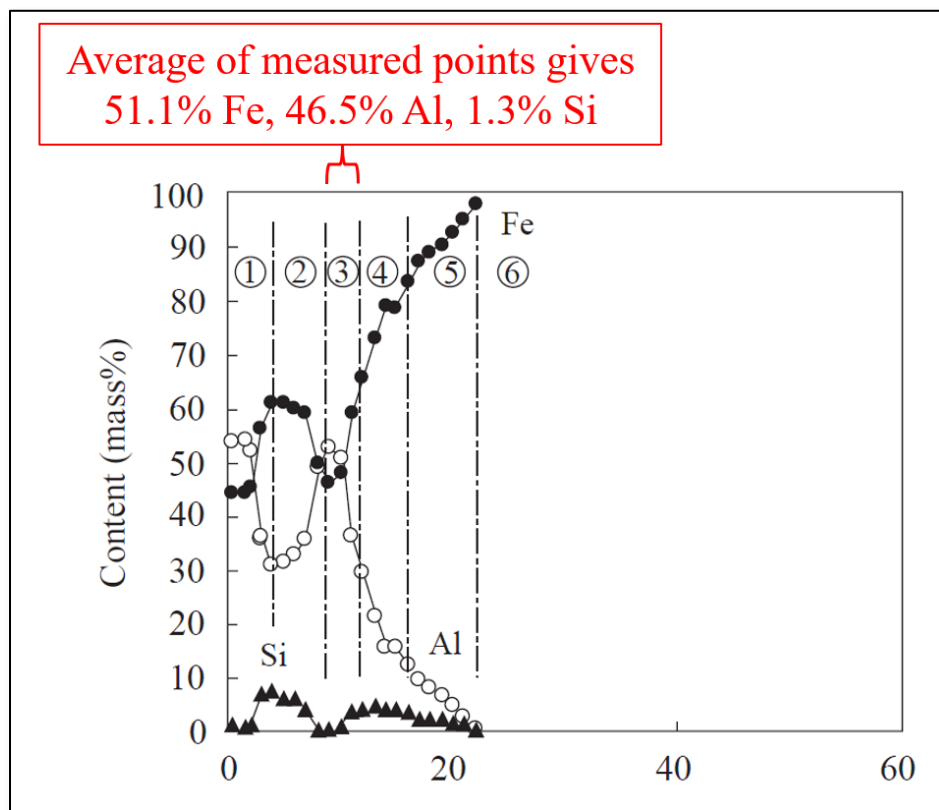
**7. Claim 12**

Suehiro's layer (3), which corresponds to the "intermediate layer," teaches the recited composition. EX-1003, 168. For example, for the two measurement positions indicated in annotated FIG. 13 below, Suehiro's layer (3) has a composition of 46.3% Fe (within range), 52.7% Al (0.3% deviation), 0.1% Si (within range), or 48% Fe (1% deviation), 50.8% Al (2.2% deviation), 0.6% Si (within range). *Id.* These values satisfy or render obvious the ranges of claim 12 for reasons discussed in §III.D.7. *Id.*



**Suehiro FIG. 13**

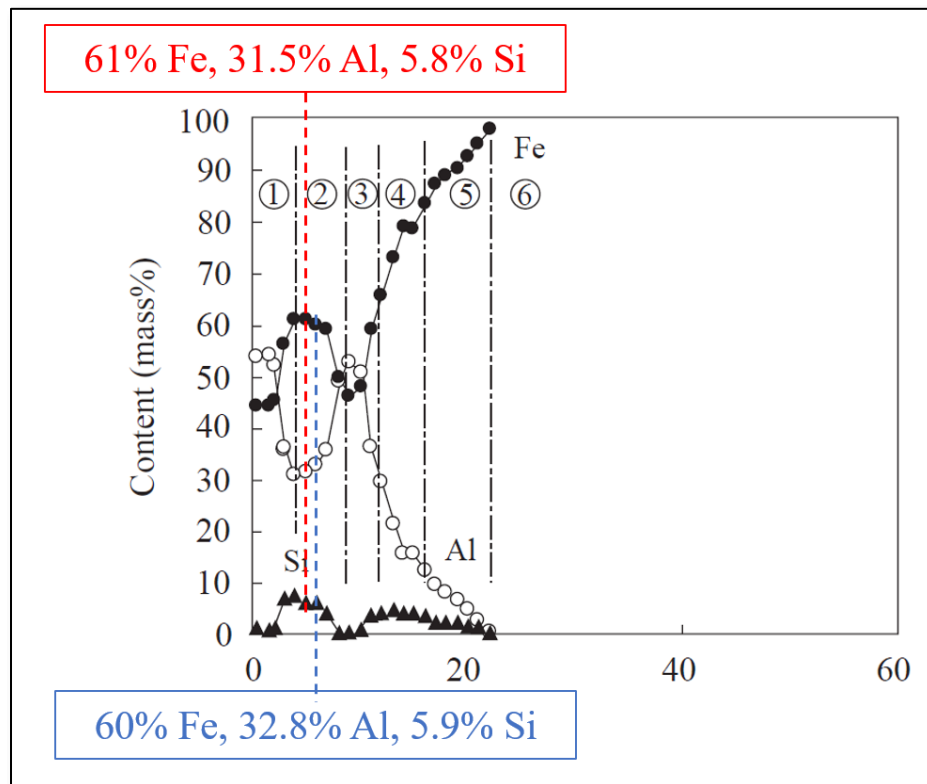
As another measurement of Suehiro's coating, the average of the measured compositions within layer (3) is 51.1% Fe (deviation of 4.1%), 46.5% Al (deviation of 6.5%), 1.3% Si (within range). EX-1003, 169. These values satisfy or render obvious the ranges of claim 12 for reasons discussed in §III.D.7. *Id.*



**Suehiro FIG. 13**

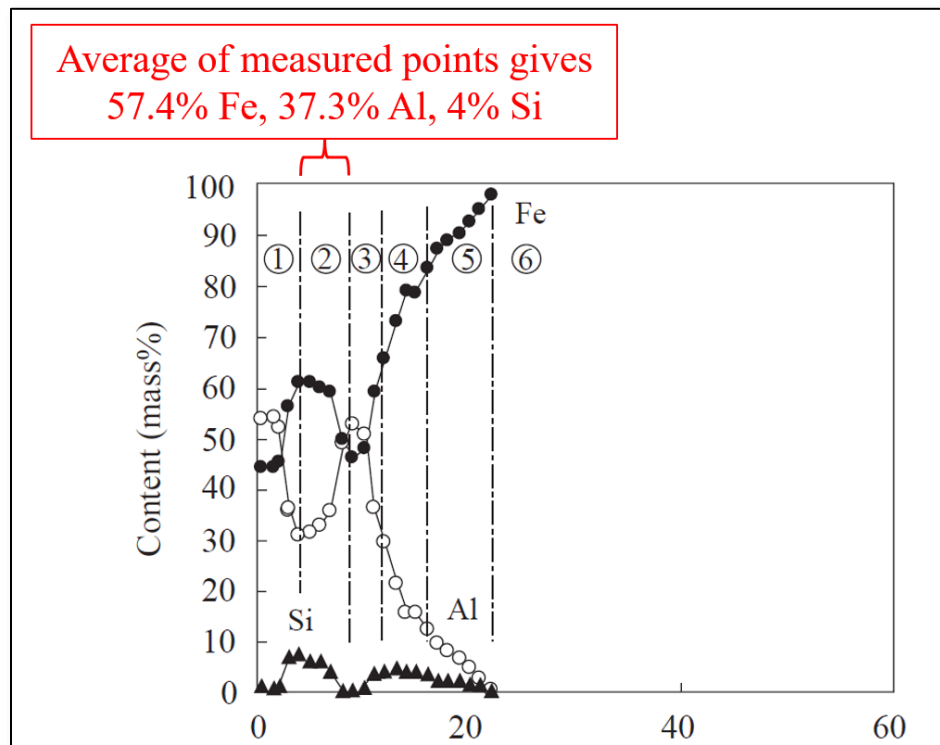
## **8. Claim 13**

Suehiro's layer (2), which corresponds to the "intermetallic layer," teaches the recited composition. EX-1003, 170. For example, for the two measurement positions indicated in annotated FIG. 13 below, Suehiro's layer (2) has a composition of 61% Fe (1% deviation), 31.5% Al (within range), 5.8% Si (within range), or 60% Fe (2% deviation), 32.8% Al (within range), 5.9% Si (within range). *Id.* These values satisfy or render obvious the ranges of claim 13 for reasons discussed in §III.D.7. *Id.*



**Suehiro FIG. 13**

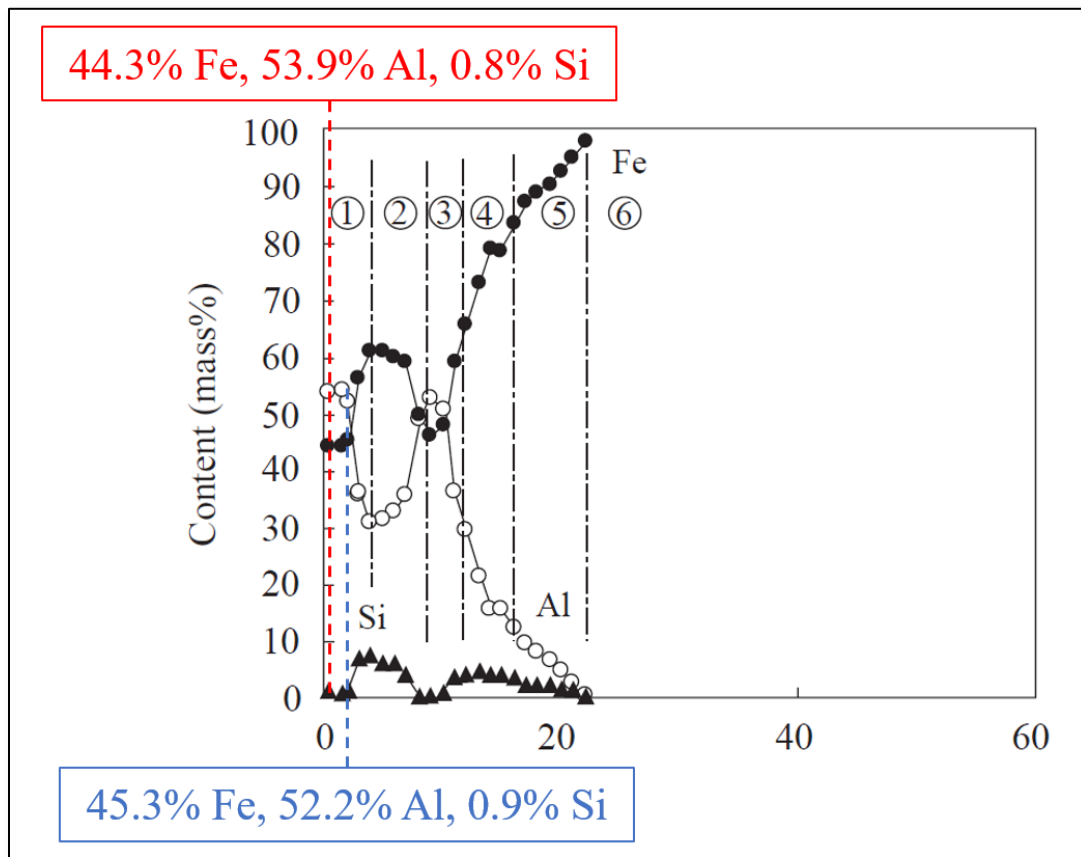
As another measurement of Suehiro's coating, the average of the measured compositions within layer (2) is 57.4% Fe (4.6% deviation), 37.3% Al (3.3% deviation), 4% Si (within range). EX-1003, 171. These values satisfy or render obvious the ranges of claim 13 for reasons discussed in §III.D.7. *Id.*



**Suehiro FIG. 13**

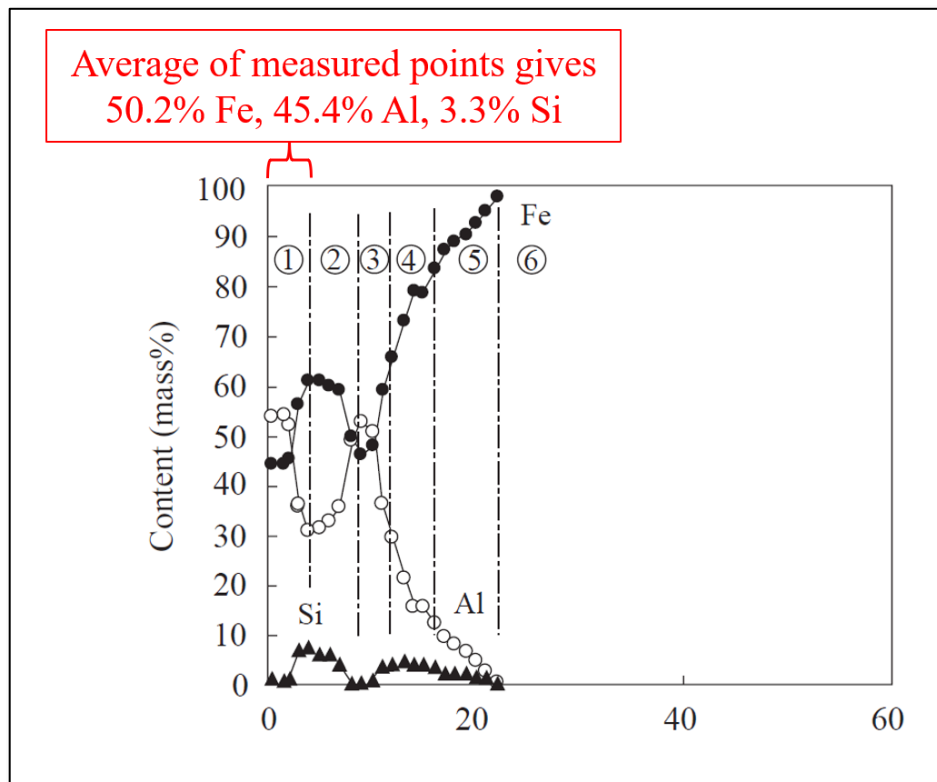
**9. Claim 14**

Suehiro's layer (1), which corresponds to the "superficial layer," teaches the recited composition. EX-1003, 172. For example, for the two measurement positions indicated in annotated FIG. 13 below, Suehiro's layer (1) has a composition of 44.3% Fe (within range), 53.9% Al (within range), 0.8% Si (within range), or 45.3% Fe (within range), 52.2% Al (0.8% deviation), 0.9% Si (within range). *Id.* These values satisfy or render obvious the ranges of claim 14 for reasons discussed in §III.D.7. *Id.*



**Suehiro FIG. 13**

As another measurement of Suehiro's coating, the average of the measured compositions within layer (1) is 50.2% Fe (3.2% deviation), 45.4% Al (7.6% deviation), 3.3% Si (1.3% deviation). EX-1003, 173. These values render obvious the ranges of claim 14 for reasons discussed in §III.D.7. *Id.*



**Suehiro FIG. 13**

**10. Claim 15**

See claim 12. EX-1003, 174.

**11. Claim 16**

See claim 13. EX-1003, 175.

**12. Claim 17**

See claim 14. EX-1003, 176.

**13. Claim 18**

See analysis of claim 9, which establishes that layer (5) of the Suehiro coating, which corresponds to the interdiffusion coating, has a thickness of 9  $\mu\text{m}$  when scaled to the thickness of Cornette's FIG. 22 coating, or has a thickness of

10.7  $\mu\text{m}$  in the Suehiro-Cornette coating in which layer thicknesses are those shown in Cornette FIG. 22. EX-1003, 177.

**14. Claim 19**

The disclosed compositions of Suehiro's layers (1)-(5) render obvious the recited iron compositions. EX-1003, 178. As discussed for claim 1, based on FIG. 13, the calculated average values indicative of first through fourth mean iron compositions are 91.9%, 51.1%, 57.4%, and 50.2%, which render obvious the recited compositions for reasons discussed in §III.D.7. *Id.*

**15. Claim 20**

As discussed for claim 1, the calculated average value indicative of the fourth mean iron composition of layer (1) is 50.2%, which is lower than the calculated average value of 57.4% for layer (2), indicative of the third mean iron composition. EX-1055, FIG. 13; EX-1003, 179.

**16. Claim 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 Suehiro FIG. 13, based on the calculated average values of the composition datapoints for each layer (91.9%, 51.1%, 57.4%, and 50.2%), which are indicative of the mean iron compositions. EX-1003, 180.

**17. Claim 22**

See claim 20. EX-1003, 181.

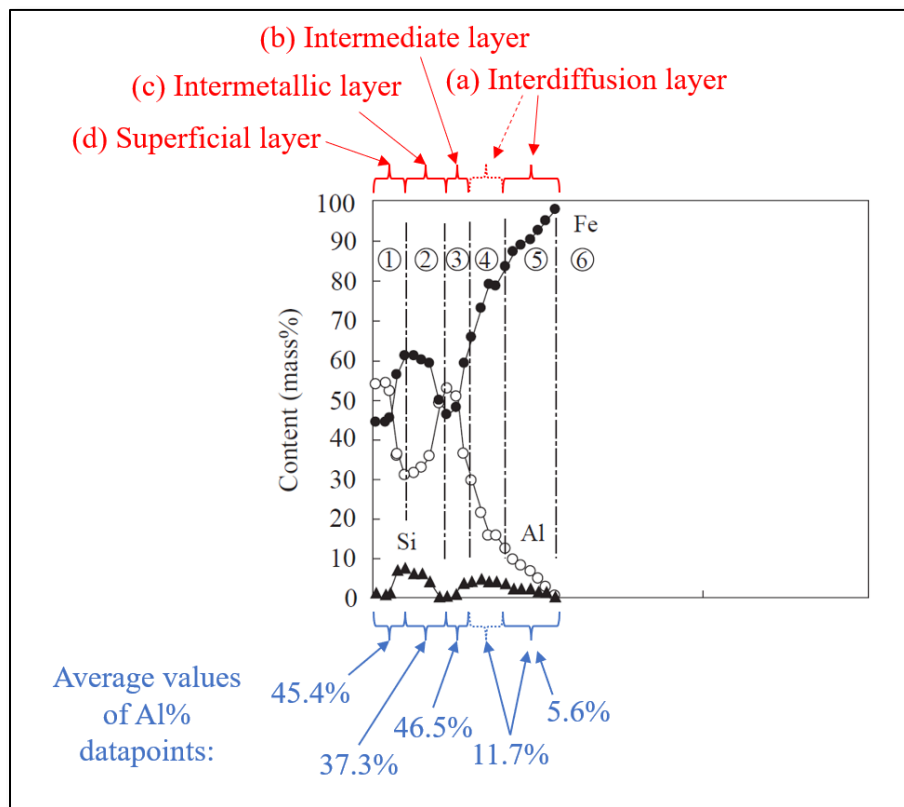
**18. Claim 23**

The recited iron composition relationship is rendered obvious by Suehiro FIG. 13. EX-1003, 182. As discussed for claim 1, based on FIG. 13, the calculated average of Suehiro's datapoints for layer (1) (indicative of the fourth mean iron composition) is 50.2%, and the calculated average of Suehiro's datapoints for layer (3) (indicative of the second mean iron composition) is 51.1%. *Id.* This pair of values, which differ by only 0.9%, renders obvious claim 23 for reasons discussed in §III.D.7. *Id.* The small deviation between 51.1% and 50.2% is well within the bounds of routine experimentation, manufacturing tolerances, and measurement accuracy, such that it would have been obvious for a POSITA to arrive at a pair of slightly different values satisfying the relationship of claim 23. *Id.*

**19. Claim 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 Suehiro-Cornette coatings as illustrated in Suehiro FIG. 13. EX-1003, 183.

For example, the composition datapoints within each of Suehiro's layers can be averaged to obtain values indicative of mean aluminum compositions. EX-1003, 184. Performing this calculation results in values of 5.6% for layer (5) or 11.7% for layers (4)+(5) (interdiffusion); 46.5% for layer (3) (intermediate); 37.3% for layer (2) (intermetallic); and 45.4% for layer (1) (superficial). *Id.* These values satisfy claim 24.



**Suehiro FIG. 13**

**20. Claim 25**

See claim 24. The calculated average value indicative of the fourth mean aluminum composition is 45.4%, which is less than the calculated 46.5% average

value indicative of the second mean aluminum composition. EX-1003, 185.

**21. Claim 26**

See claims 9, 10, and 18. EX-1003, 186.

**22. Claims 27-30**

See claims 11-14. EX-1003, 187.

**X. GROUND 2B: Claims 3-4 and 7-8 are obvious over Suehiro, Cornette, and Laurent**

**A. Suehiro-Cornette-Laurent Combination**

For reasons discussed in §IV.B, it would have been obvious to try using Laurent's steel compositions in the hot stamping processes described by Suehiro and Cornette. EX-1003, 188. This would have constituted no more than substitution of one element (the Laurent steel) for another (the USIBOR 1500 steel of Suehiro or Cornette) known in the field. EX-1055, [02]; EX-1014, 9; EX-1003, 188. Further, Laurent's steel composition is similar to those of both Suehiro and Cornette, such that the substitution of one for the other would have constituted a minor modification. EX-1055, Table 1; EX-1014, 9; EX-1023, 1:66-2:10; EX-1003, 188.

**B. Analysis of Claims**

**1. Claims 3 and 4**

See discussion of claims 3-4 for Ground 1B (§IV.C.1). Laurent's steel, applied to Suehiro and Cornette as discussed in §X.A, satisfies or renders obvious

the recited compositions. EX-1003, 189.

## **2. Claims 7 and 8**

See discussion of claims 7-8 for Ground 1B (§IV.C.2). Laurent discloses the recited elemental ratio. EX-1023, 4:25-26; EX-1003, 190.

## **XI. GROUND 2C: Claims 3-6 are obvious over Suehiro, Cornette, and Nishibata**

### **A. Suehiro-Cornette-Nishibata Combination**

For reasons discussed in §V.B, it would have been obvious to try using Nishibata's steel compositions in the hot stamping processes described by Suehiro and Cornette. EX-1003, 191. As noted above for the Suehiro-Cornette-Laurent combination, this would have constituted no more than substitution of one element (the Nishibata steel) for another (the USIBOR 1500 steel of Suehiro and/or Cornette) known in the field. EX-1055, [02], Table 1; EX-1014, 9; EX-1003, 191. Further, Nishibata's steel composition is similar to those of both Suehiro and Cornette, such that the substitution of one for the other would have constituted a minor modification. EX-1055, [02], Table 1; EX-1014, 9; EX-1023, 1:66-2:10; EX-1003, 191; EX-1050, Table 1.

### **B. Analysis of Claims**

#### **1. Claims 3 and 4**

See discussion of claims 3-4 for Ground 1C (§V.C.1). Nishibata's steel, applied to Suehiro and Cornette as discussed in §XI.A, satisfies or renders obvious

the recited compositions. EX-1003, 192.

## **2. Claims 5 and 6**

See discussion of claims 5-6 for Ground 1C (§V.C.2). Nishibata's steel, applied to Suehiro and Cornette as discussed in §XI.A, satisfies or renders obvious the sulfur concentrations. EX-1003, 193.

## **XII. GROUND 2D: Claims 1-4 and 9-30 are obvious over Suehiro and GMW14400**

### **A. Suehiro-GMW14400 Combination**

See §§VI.A and IX.B. GMW14400 substitutes for Cornette, as applied in Grounds 2A-2C, to motivate a coating thickness ">35"  $\mu\text{m}$ . Based on GMW14400, a POSITA would have been strongly motivated to achieve a coating thickness ">35"  $\mu\text{m}$ , as required by GMW14400. in order to satisfy market requirements. EX-1026, 7; EX-1003, 194. Indeed, it would have been obvious for a POSITA to experiment with pre-coating thicknesses in the range of "20 to 33"  $\mu\text{m}$  specified by GMW14400. EX-1026, 7; EX-1003, 194. See §III.C for discussion of the well-established and predictable link between pre-coating thickness and coating thickness. Accordingly, in view of GMW14400, a POSITA would have had a reasonable expectation of success in achieving coating thicknesses greater than 30  $\mu\text{m}$ , e.g., GMW14400's ">35"  $\mu\text{m}$  coating thicknesses. EX-1003, 194.

### **B. Analysis of Claims**

#### **1. Claims 1-2, 11-17, 19-25, and 27-30**

See discussion for Ground 2A. GMW14400's teachings on obtaining coating thicknesses greater than 30  $\mu\text{m}$  (e.g., GMW14400's corresponding pre-coating thickness range) are substituted for Cornette's. EX-1003, 195.

## **2. Claims 9-10, 18, and 26**

As discussed for [9], based on FIG. 13, Suehiro's layer (5) (corresponding to layer (a)) has a thickness of 6.2  $\mu\text{m}$  in comparison to a total coating thickness of 22.2  $\mu\text{m}$ . EX-1003, 196. Scaling this proportional layer thickness to the 35  $\mu\text{m}$  coating thickness specified by GMW14400 gives a layer thickness of **9.8  $\mu\text{m}$**  that would be expected if Suehiro's coating were modified to have the 35  $\mu\text{m}$  thickness. EX-1003, 196. This value satisfies or renders obvious claims 9-10, 18, and 26.

## **3. Claims 3-4**

GMW14400's steel compositions satisfy or overlap all composition ranges in [3]-[4], rendering obvious those compositions. EX-1026, 2; EX-1003, 197. It would have been obvious to use these steel compositions to satisfy General Motors' requirements. EX-1003, 197.

## **XIII. GROUNDS 2E, 2F: Claims 3-4 and 7-8 are obvious over Suehiro, GMW14400, and Laurent, and claims 3-6 are obvious over Suehiro, GMW14400, and Nishibata**

See discussion of the Suehiro-Cornette-Laurent and Suehiro-Cornette-Nishibata combinations (§§X-XI), and the comparison of GMW14400's and Laurent's/Nishibata's steel compositions in §§VII-VIII. The same reasoning

applies for the combination of Suehiro and GMW14400 with Laurent and Nishibata. EX-1003, 198.

#### **XIV. DISCRETIONARY CONSIDERATIONS**

Discretionary denial under *Advanced Bionics* is not warranted.

The references applied against claim 1—the Takagi-Cornette, Takagi-GMW14400, Suehiro-Cornette, and Suehiro-GMW14400 combinations—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 Takagi, Suehiro, Cornette, and GMW14400 during prosecution was erroneous, such that part 2 of the *Advanced Bionics* framework is not satisfied. Each of Takagi, Suehiro, Cornette, 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 evidenced herein by Cornette; the Applicant failed to note that Takagi's pre-coating thickness suggests a coating thickness greater than 30  $\mu\text{m}$ . EX-1002, 43-44. None of Takagi, Suehiro, Cornette, 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 Takagi's and Suehiro'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 Cornette's FIG. 22 shows a coating with a thickness greater than 30  $\mu\text{m}$ , or that GMW14400 motivates a thickness greater than 30  $\mu\text{m}$  and provides specific pre-coating thicknesses that provide such a thickness. The omission of these references from any applied rejection and failure to consider their teachings constitutes material error.

#### **XV. FEES**

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

#### **XVI. CONCLUSION**

The Challenged Claims should be canceled.

#### **XVII. 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, or reexamination certificates for the '602 Patent. The '602 patent is the subject of *inter partes* review IPR2024-01376 (PTAB), filed September 6, 2024. The '602 patent is also 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.

| Lead Counsel                                                                                                                                                                                                                                          | Backup 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 [IPR58281-0002IP2@fr.com](mailto:IPR58281-0002IP2@fr.com) (referencing No. 58281-0002IP2).

Respectfully submitted,

Dated December 23, 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 13,695 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated December 23, 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 December 23, 2024, a complete and entire copy of this Petition for *Inter partes* Review, Power of Attorney, and all supporting exhibits were provided via electronic service to:

[GDC-IPR-ArcelorMittal@gibsondunn.com](mailto:GDC-IPR-ArcelorMittal@gibsondunn.com)

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on December 24, 2024, a complete and entire copy of this Petition for *Inter partes* Review, Power of Attorney, and all supporting exhibits were provided to the Patent Owner via Fedex by serving the correspondence address of record as follows:

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