VINFAST

Direction Examination of

Dr. Stuart Brown

Certain High-Strength Aluminum or Aluminum Alloy-Coated Steel, and Automotive Products and Automobiles Containing Same

Inv. No. 337-TA-1402



RDX-002.1

POSCO-1058
POSCO v. ArcelorMittal
IPR2024-01377

Background



Dr. Stuart Brown

Veryst

Founder and Principal Emeritus
of Veryst Engineering, LLC

EDUCATION

Massachusetts Institute of Technology — Ph.D., Mechanical Engineering

Stanford University — M.S., Mechanical Engineering

Washington University in St. Louis — B.S., Mechanical Engineering

CX-0084C Brown Op. Rpt., Ex. 1

Background



Dr. Stuart Brown

PAST ROLES

Faculty

- Department of Materials Science and Engineering at the Massachusetts Institute of Technology (1987-1995)
- Research on hot forming

Consultant

- Worked with metal producers including Allegheny Ludlum Steel Corporation, Alcoa, U.S. Steel, Gibbs Die Casting, Nucor, and Thixomat
- Exponent & Veryst Engineering

CX-0084C Brown Op. Rpt., Ex. 1

Person of Skill in the Art

VinFast Definition

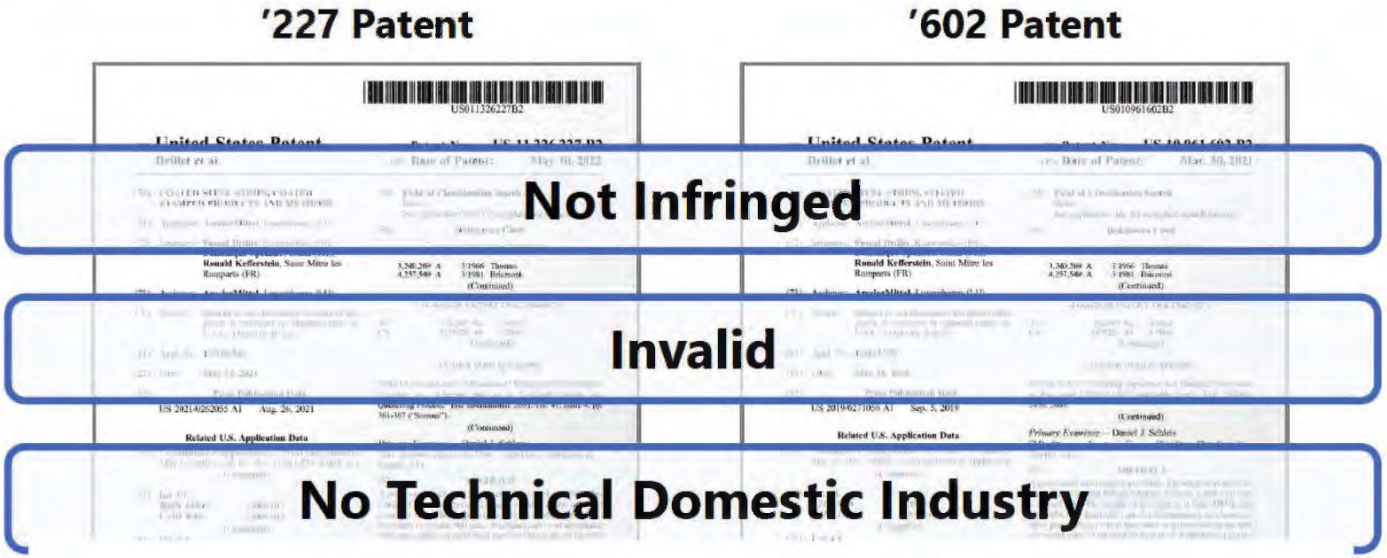
A POSITA as of the alleged priority dates of the Asserted Patents would have had at least an undergraduate degree in materials science, manufacturing engineering, mechanical engineering, or equivalent knowledge, training, or experience, with at least two years of experience working in metallurgy

ArcelorMittal Definition

A POSITA as a person with at least an undergraduate degree in materials science, manufacturing engineering, mechanical engineering, or equivalent knowledge, training, or experience, with at least two years of experience working on the development of steels

CX-0084C - Brown Op. Rpt. at ¶ 68; Fekete Op. Rpt at ¶ 38

Summary of Opinions



Materials Considered



- Asserted Patents and File Histories
- Hot Stamping Technical Specification
- Testing
- Scientific literature related to the technology at issue
- Prior Art references and publications
- Deposition Transcripts
- Fekete, Raabe, Bradley Expert Reports

CX-0084C - Brown Op. Rpt. at ¶¶ 15-21

Products-at-Issue



RDX-002.7

Products at Issue: VinFast VF 8 & VF 9

VinFast VF 8



VinFast VF 9



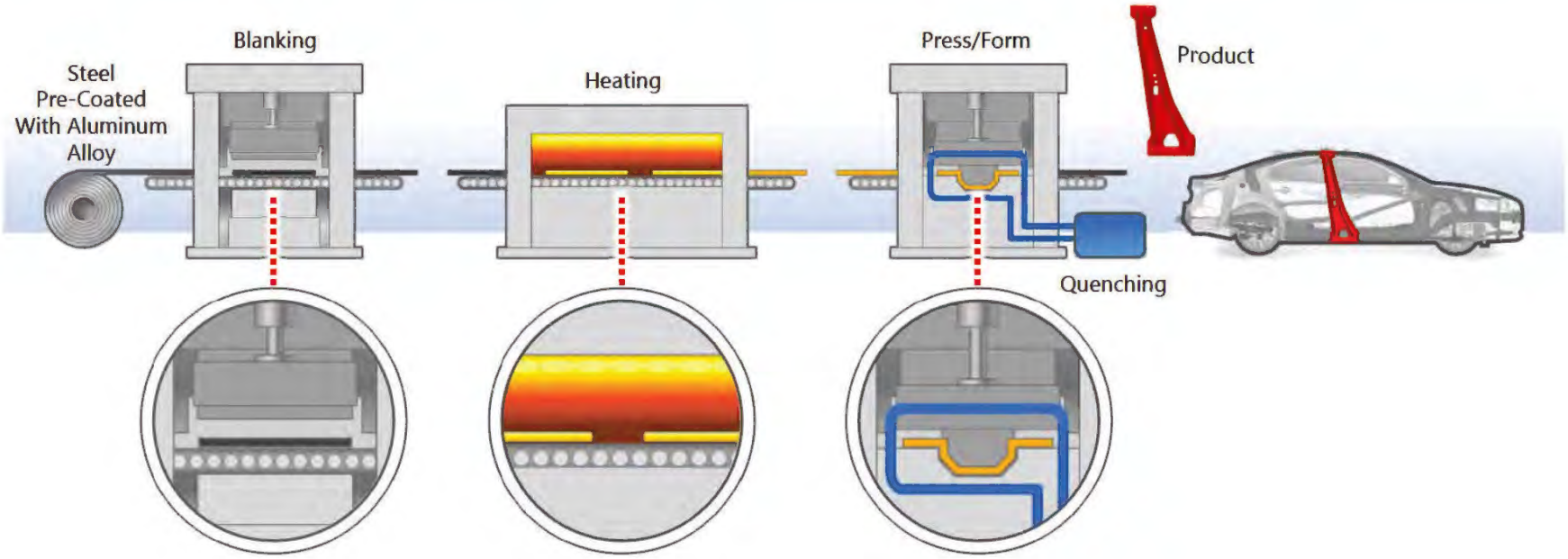
RX-1313 (VF8 – https://vinfastauto.us/vehicles/vf-8; VF9 – https://vinfastauto.us/vehicles/vf-9)

Hot Stamping of Precoated Steel



RDX-002.9

Hot Stamping Aluminum-Alloy Coated Steel

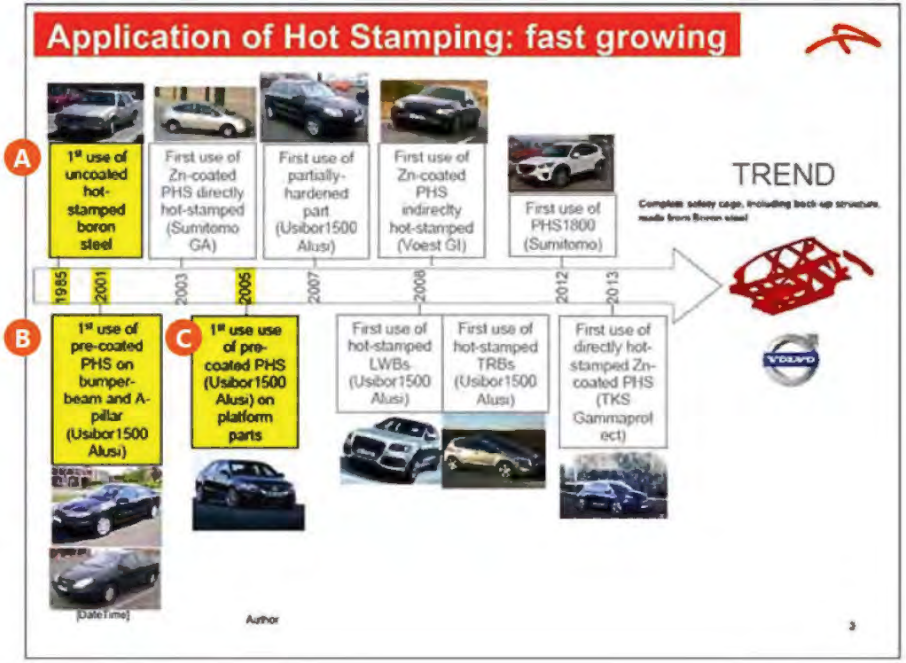


State of the Art

Hot-Stamping Aluminized Steel Used for Manufacturing Car Parts Known Long Before the Asserted Patents

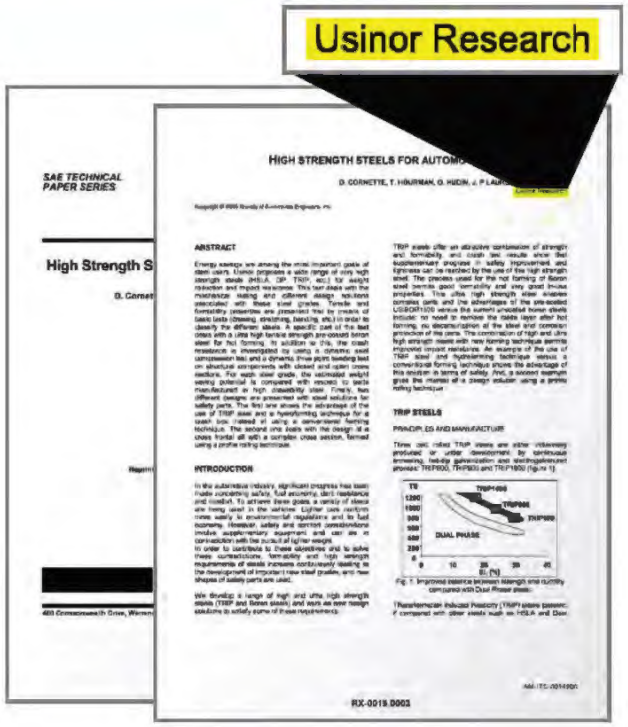


- **A** **1985:** 1st use of uncoated hot-stamped boron steel
- **B** **2001:** 1st use of pre-coated PHS on bumper-beam and A-pillar (Usibor 1500 Alusi)
- **C** **2005:** 1st use of pre-coated PHS (Usibor 1500 Alusi) on platform parts



CX-0563C.0004

Arcelor's Presentation of Hot Stamping USIBOR 1500



RX-0019 (Cornette)

2001-01-0078

HIGH STRENGTH STEELS FOR AUTOMOTIVE SAFETY PARTS

D. CORNETTE, T. HOURMAN, O. HUDIN, J. P LAURENT, A. REYNAERT
Usinor Research

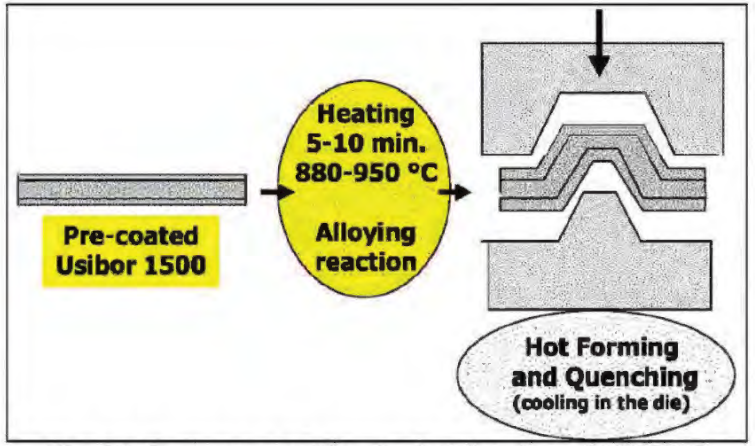
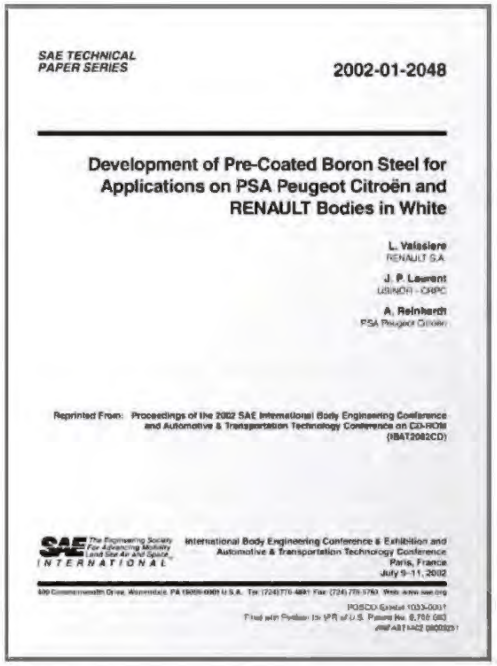


Fig. 21. Process used for the hot forming of USIBOR 1500 Pre-coated.

Arcelor's Presentation of Hot Stamping USIBOR 1500



SAE TECHNICAL PAPER SERIES 2002-01-2048

Development of Pre-Coated Boron Steel for Applications on PSA Peugeot Citroën and RENAULT Bodies in White

L. Vaissiere
RENAULT S.A.

J. P. Laurent
USINOR - CRPC

A. Reinhardt
PSA Peugeot Citroën

Reprinted From: Proceedings of the 2002 SAE International Body Engineering Conference and Automotive & Transportation Technology Conference on CD-ROM (IBAT2002CD)

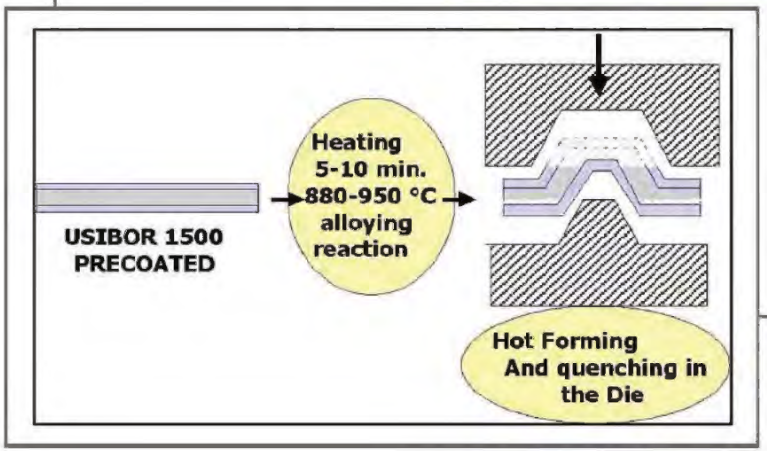
SAE INTERNATIONAL The Engineering Society For Advancing Mobility Land Sea Air and Space

International Body Engineering Conference & Exhibition and Automotive & Transportation Technology Conference
Paris, France
July 9–11, 2002

RX-0081 (Vaissiere) at .0008-.0009

2002-01-2048

Development of Pre-Coated Boron Steel for Applications on PSA Peugeot Citroën and RENAULT Bodies in White



L. Vaissiere
RENAULT S.A.

J. P. Laurent
USINOR - CRPC

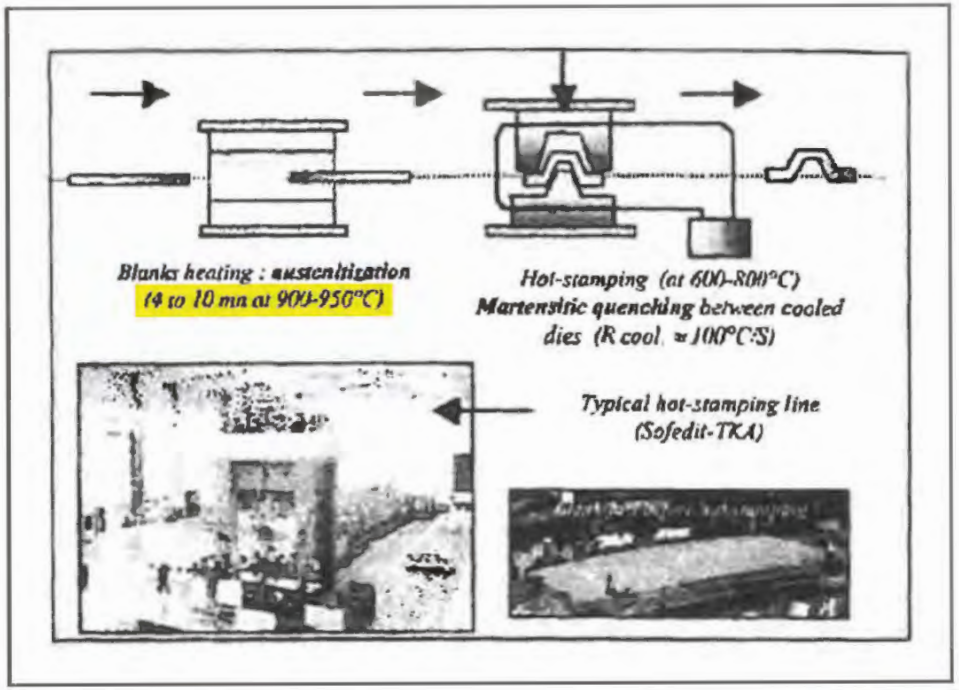
A. Reinhardt
PSA Peugeot Citroën

Arcelor's Presentation of Hot Stamping USIBOR 1500

Development of safety and structural automotive parts by hot-stamping : the "USIBOR 1500P" solution

R.KEFFERSTEIN (Arcelor-Auto / ARCELOR)

La Revue de Métallurgie - ATS - JSI 2004



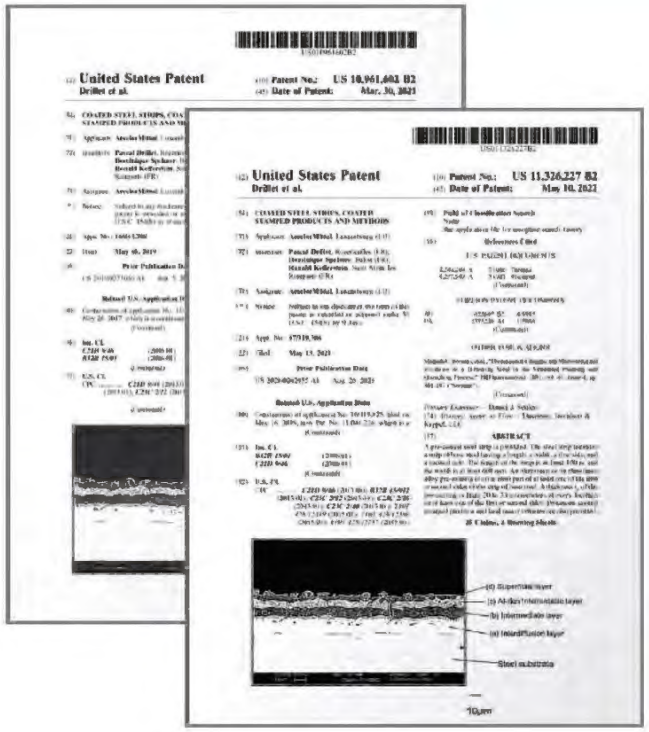
RX-1142.0003

Patents



RDX-002.15

Asserted Patents: The '602 & '227 Patents



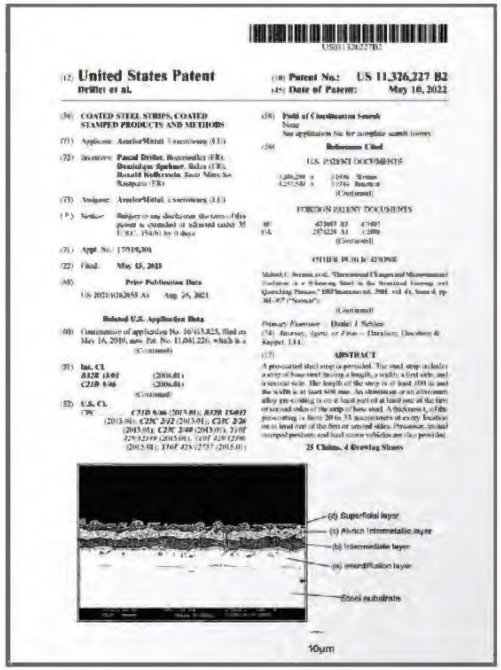
(10) **Patent No.: US 10,961,602 B2**
(45) **Date of Patent: Mar. 30, 2021**

(10) **Patent No.: US 11,326,227 B2**
(45) **Date of Patent: May 10, 2022**

(54) **COATED STEEL STRIPS, COATED STAMPED PRODUCTS AND METHODS**

JX-0001.0002 ('227 Patent);
JX-0002.0002 ('602 Patent)

Patent Overview: Background



(12) **United States Patent**
Drillet et al.

(10) **Patent No.: US 11,376,227 B2**
(45) **Date of Patent: May 10, 2022**

(54) **COATED STEEL STRIPS, COATED STAMPED PRODUCTS AND METHODS**

(71) Applicant: ArcelorMittal, Luxembourg (LU)

(72) Inventors: **Pascal Drillet**, Beaconsfield (FR); **Dominique Spehner**, Balen (FR); **Ronald Hoffstetter**, Sant' Mauro Torinese (TR)

(73) Assignee: ArcelorMittal, Luxembourg (LU)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 17/419,301

(22) Filed: May 15, 2020

(65) **Prior Publication Data**

US 2021/0262055 A1 Aug. 26, 2021

Related U.S. Application Data

(63) Continuation of application No. 16/615,825, filed as Nov. 16, 2018, now Pat. No. 11,041,226, which is a (Continued)

(51) **Int. Cl.**
B32B 15/01 (2006.01)
C23D 5/00 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***C23D 5/00*** (2013.01); ***B32B 15/013*** (2013.01); ***C23C 2/12*** (2013.01); ***C23C 2/26*** (2013.01); ***C23C 2/40*** (2013.01); ***Y10T 29/12458*** (2015.01); ***Y10T 428/12799*** (2015.01); ***Y10T 428/12757*** (2015.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,246,290 A 11/1917 Wyman
4,275,540 A 6/1981 Bourcier
(Continued)

FOREIGN PATENT DOCUMENTS

EP 423005 B2 4/1995
CA 2071226 A1 1/2000
(Continued)

OTHER PUBLICATIONS

Mahnič, C. Svenar, et al. "Dimensional Changes and Microstructural Evolution in a 9 Manganese Steel in the Intercritical Furnace and Quenching Process." IMF Transactions vol. 2001, vol. 41, Issue 4, pp. 161-167 ("Svenar").
(Continued)

Primary Examiner — Daniel J Schleis
(74) Attorney, Agent, or Firm — Davidson, Davidson & Kappel, LLC

(57) **ABSTRACT**

A pre-coated steel strip is provided. The steel strip includes a strip of base steel having a length, a width, a first side, and a second side. The length of the strip is at least 100 m and the width is at least 600 mm. An aluminum or an aluminum alloy pre-coating is on at least part of at least one of the first or second sides of the strip (“base steel”). A thickness t, of the pre-coating is from 20 to 35 micrometers at every location on at least one of the first or second sides. Processes, including stamped products, and load secure vehicles are also provided.

25 Claims, 4 Drawing Sheets

BACKGROUND OF THE INVENTION

In recent years the use of pre-coated steels in hot-stamping processes for the shaping of parts has become important, especially in the automotive industry. Fabrication of such parts may include the following main steps:

Pre-coating of a steel sheets, by hot dipping;

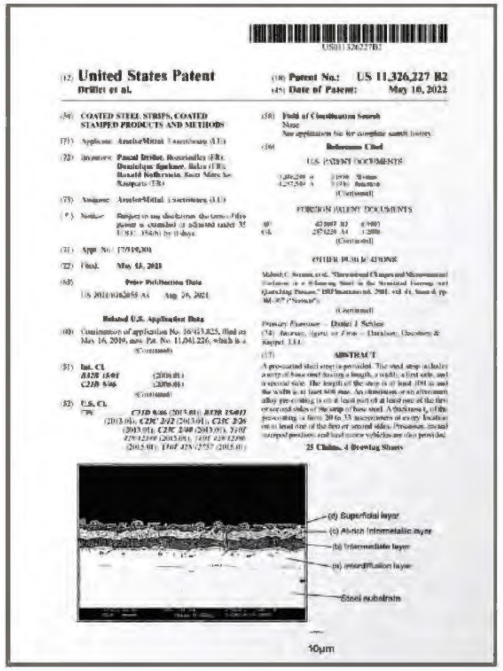
Trimming or cutting for obtaining blanks;

Heating the blanks in order to obtain alloying of the steel substrate with the pre-coating, as well as the austenitizing of the steel; and

Hot forming followed by rapid cooling of the part in order to obtain predominantly martensitic structures, See for Example U.S. Pat. No. 6,296,805, incorporated herein by reference.

JX-0001.0011 ('227 Patent) at 1:40-53

Purported Problem: Lack of Homogeneity and Resistance



(12) **United States Patent**
Drillet et al.

(10) Patent No.: US 11,326,227 B2
(45) Date of Patent: May 10, 2022

(54) COATED STEEL STRIPS, COATED STAMPED PRODUCTS AND METHODS

(71) Applicant: ArcelorMittal (LU)

(72) Inventors: Pascal Drillet, Beurieulles (FR); Dominique Spehner, Balza (FR); Ronald Hoffstetter, Sant Mein-les-Longwy (FR)

(73) Assignee: ArcelorMittal (Luxembourg) (LU)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 17/419,301

(22) Filed: May 13, 2021

(65) Prior Publication Data

US 2021/0262055 A1 Aug. 26, 2021

Related U.S. Application Data

(63) Continuation of application No. 16/453,825, filed on Jun. 26, 2019, now Pat. No. 11,041,226, which is a (Continued)

(51) Int. Cl.
B32B 15/01 (2006.01)
C23C 2/06 (2006.01)
(Continued)

(52) U.S. Cl.
CPC *C23C 2/06* (2013.01); *B32B 15/013* (2013.01); *C23C 2/12* (2013.01); *C23C 2/26* (2013.01); *C23C 2/40* (2013.01); *Y10T 428/12493* (2015.01); *Y10T 428/12799* (2015.01); *Y10T 428/2457* (2015.01)

(58) Field of Classification Search
None
See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

1,326,250 A 12/1919 Wynne
4,275,849 A 6/1981 Bakarian
(Continued)

FOREIGN PATENT DOCUMENTS

EP 42 095 B2 6/1985
GB 257,228 A 2/1926
(Continued)

OTHER PUBLICATIONS

Mahesh C. Somani, et al., "Thermal Cycles and Microstructural Evolution in a 0.6mass% Steel in the Simulated Heat-Affected Zone of Quenching Process," ISIJ International, vol. 39, 1999, vol. 41, Issue 4, pp. 367-373 ("Somani").
(Continued)

Primary Examiner — Daniel J Schleis
(74) Attorney, Agent, or Firm — Davidson, Davidson & Kappel, LLC

(57) ABSTRACT

A pre-coated steel strip is provided. The steel strip includes a strip of base steel having a length, a width, a first side, and a second side. The length of the strip is at least 100 m and the width is at least 600 mm. An intermetallic or an intermetallic pre-coating is on at least part of at least one of the first or second sides of the strip (Base steel: A thickness t, of the pre-coating is from 20 to 35 micrometers at every location on at least one of the first or second sides. Pre-coated stamped products and land motor vehicles are also provided.

25 Claims, 4 Drawing Sheets

exceeds the average thickness. While not bound by a particular theory, it is believed that if a pre-coating is locally too thick, intermetallic alloying is insufficient and the pre-coating melts, fouling the rollers. Thus, the inventors have discovered that the control of the homogeneity of the pre-coating thickness over the entire sheet within given tolerances is an important factor for obtaining the desired degree of intermetallic alloying, allowing one to improve the resistance to the subsequent melting of the coating during travel on rollers.

JX-0001.0011 ('227 Patent) at 2:54-63

Asserted Claims – '602 & '227 Patents

'602 Patent 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

'227 Patent Claim 1

[1pre]	A hot stamped coated steel product, which comprises:
[1a]	(a) a strip of base steel having a first side and a second side; and
[1b]	(b) a coating on at least one of said first side of said strip of base steel and said second side of said strip of base steel, wherein:
[1c]	(i) said coating results from interdiffusion between said base steel and an aluminum or aluminum alloy pre-coating, and
[1d]	(ii) wherein said coating comprises, proceeding from the base steel outwards:
[1e]	(a) an Interdiffusion layer,
[1f]	(b) an Intermediate layer,
[1g]	(c) an Intermetallic layer, and
[1h]	(d) a Superficial layer,
[1i]	wherein layers (a), (b), (c), and (d) each have a different mean composition from one another,
[1j]	wherein said coating of the hot stamped coated steel product has a thickness greater than 30 micrometers.

Asserted Claims

	'602 Patent	'227 Patent
Infringement	**1,** 2, 3, 7, 8, 9, 20, **21**, 22, **24**, 26	**1,** 2, 4, 5, 7, 8, 9, 10, 11, 13, 15, 16, 17, 24
Technical Domestic Industry	**1**, 2, 3, 4, 7, 8, 9, 10, 18, 20, **21**, 22, **24**, 26	**1**, 2, 4, 5, 7, 9, 10, 13, 15, 16, 17, 24

Claimed Layers Were Known



Dr. Pascal Drillet
Named Inventor

Q. The four-layer structure could be created through hot-stamping before the filing of the '602 and '227 patents; correct?

A. I have already answered your question, yes, it could happen. It was not done on purpose.

* * *

Q. Sir, the invention -- your invention is how you generate the four layers; correct?

A. How we generate, yes, yes, sir. I would say that.

* * *

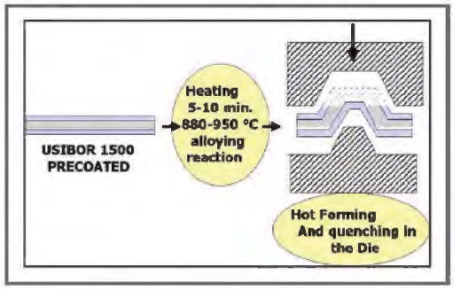
Q. Magna was able to create the claimed four-layer structure before December 2005, correct?

A. Yes

Trial Tr. 153:5-9; 154:20-23; 163:14-16

State of the Art

7/2002 Vaissiere (RX-0081)



7/2003 Suehiro II (RX-0022)

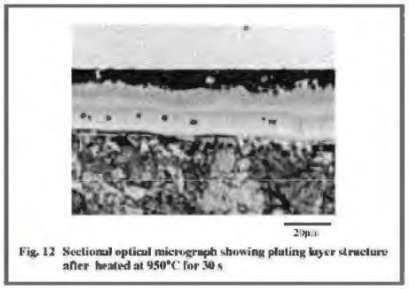
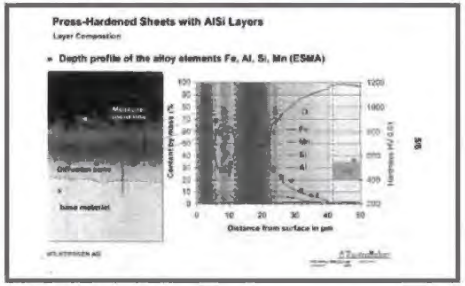
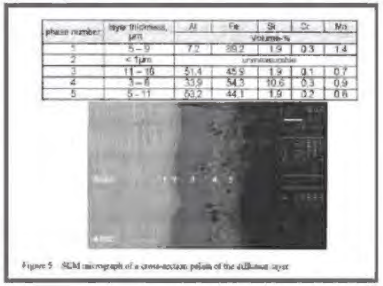


Fig. 12 Sectional optical micrograph showing plating layer structure after heated at 950°C for 30 s

1/2005 Lachmann (RX-0062)



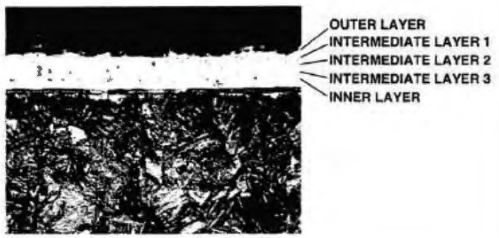
5/2006 Engels (RX-0063)



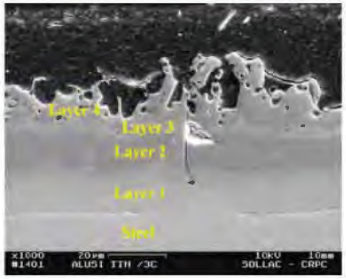
phase number	layer thickness, µm	Al	Fe	Si	Cr	Mn
		volume-%				
1	5 – 9	7.2	86.2	1.9	0.3	1.4
2	< 1µm	unanalysable				
3	11 – 16	51.4	45.9	1.4	0.1	0.7
4	3 – 6	53.9	54.3	10.6	0.3	0.9
5	5 – 11	53.2	44.1	1.9	0.2	0.6

Figure 5 SEM micrograph of a cross-section polish of the diffusion layer

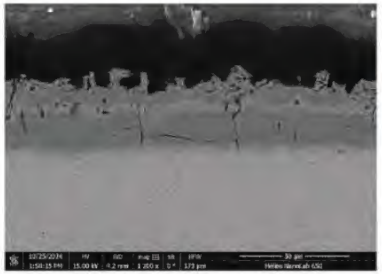
1/2004 Takagi (RX-0104)



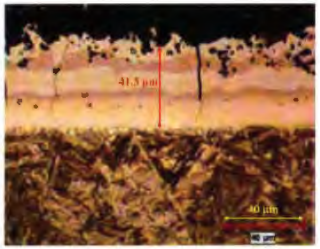
2001 Cornette (RX-0019)



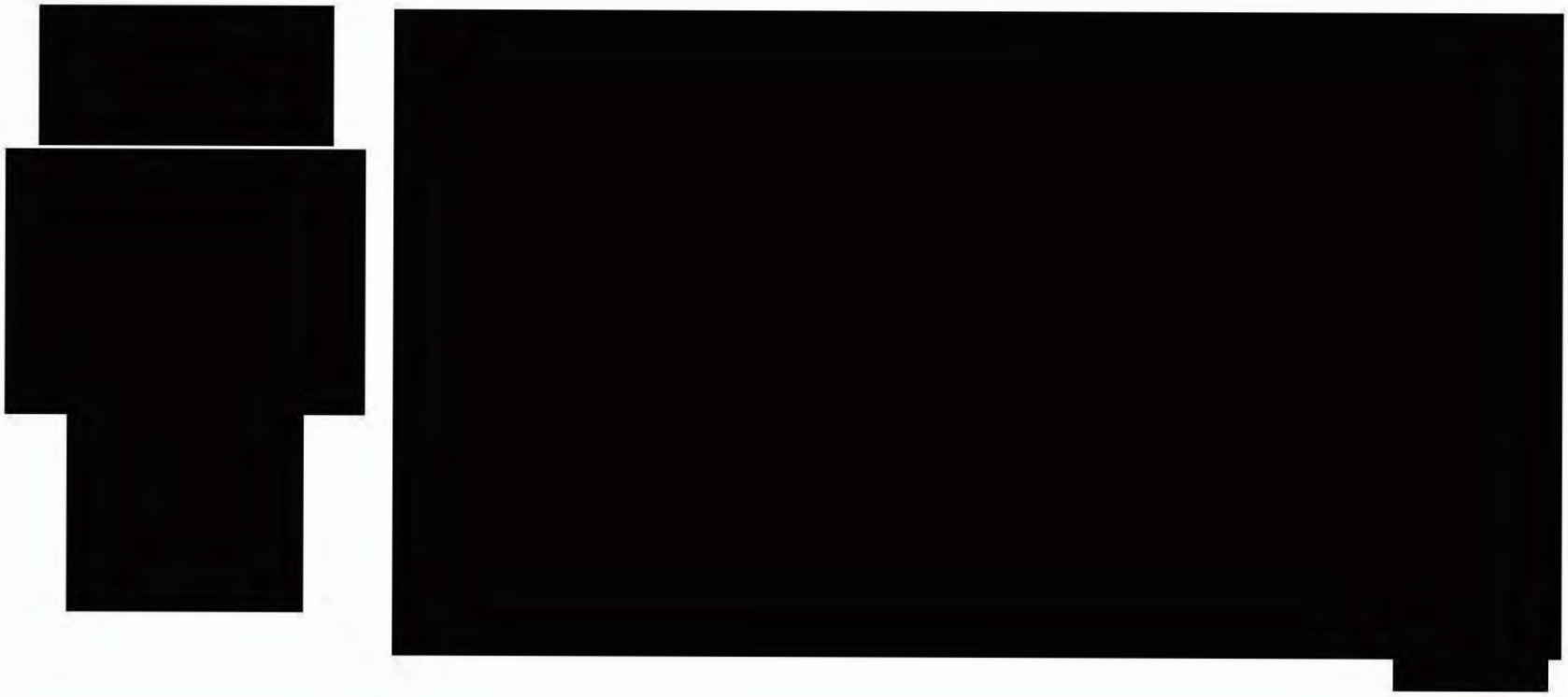
8/18/2005 2006 Passat (RX-0086)



5/2006 Hein (RX-0013)



2004: [redacted] Hot-Stamping of USIBOR 1500P [redacted] in the U.S.



Noninfringement

No Testing of VF 9

VinFast VF 8



VinFast VF 9



RX-1313 (VF8 – https://vinfastauto.us/vehicles/vf-8; VF9 – https://vinfastauto.us/vehicles/vf-9)

No Claimed Layer



Dr. James Fekete | ArcelorMittal Expert

64. The VF 8 and VF 9 each contain precoated steel products with a coating that next includes, proceeding from the base steel outwards, an intermediate layer having a second mean iron composition different from the first mean iron composition. To determine whether the SEM micrographs of the VinFast parts tested according to the protocol developed by Dr. Baskin and me, I compared the SEM micrographs taken of the VinFast parts with the four-layer structure depicted in Figure 1 of the Asserted Patents, which Mr. Drillet confirmed in deposition showed a four-layer structure. P. Drillet (Rough) Dep. Tr. 110:3-23 (confirming four-layer structure of image identical to Figure 1).

RX-1146C.00046 (Fekete Op. Rpt.) ¶ 64

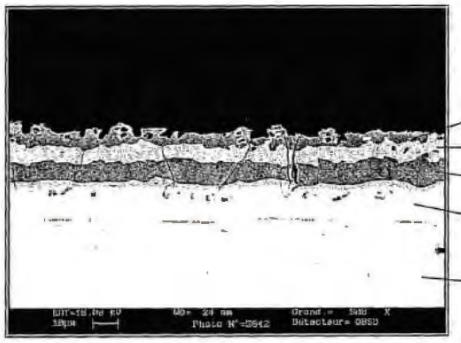
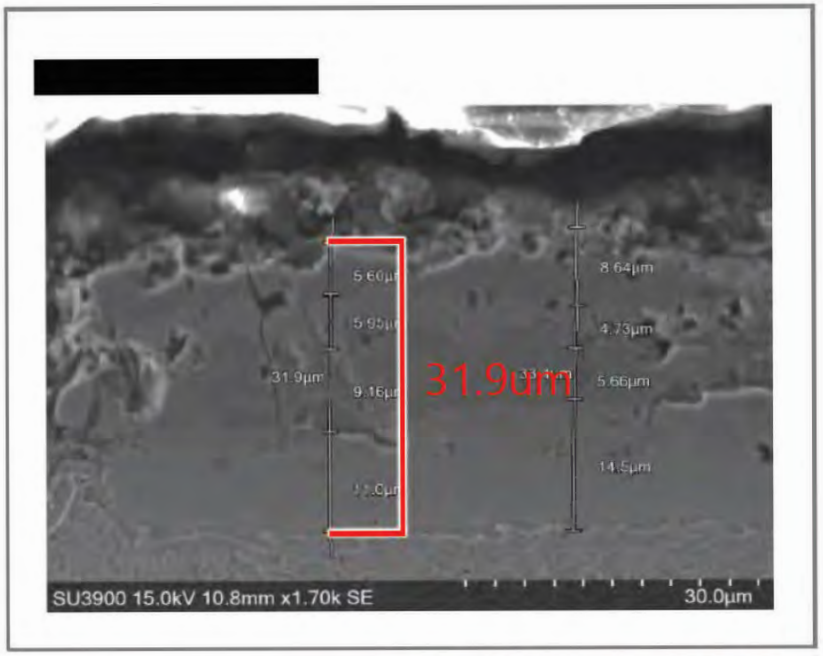


Fig. 1

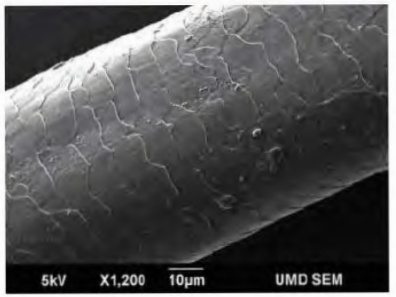
JX-0001.0007 ('227 Patent) at Fig. 1

No Claimed Layer



CX-0100C.0018 (Fekete Op. Rpt.) Ex. L

30 microns is half the width of a human hair





No Claimed Layer



Dr. Pascal Drillet
Named Inventor

Q. How do I know whether a band of intermetallic compound is a layer or a phase?

A. I can't say based on an image,.... A multilayer structure of coating has to be the same across the entire part.... It's not enough, one picture.

RX-1282C.0099 (Drillet Tr.) at 99:5-21

Noninfringement



RDX-002.28

Claim Construction

Patent	Claims	Claim Term	Agreed on Construction
'602	1, 20-22	mean iron composition	Plain and ordinary
'227	7		
'602	24, 25	mean aluminum composition	Plain and ordinary
'227	1	mean composition	Plain and ordinary
'602	2	quasi continuous	Occupying at least 90% of the level corresponding to the considered layer(s)

Claim Construction

Patent	Claims	Claim Term	Agreed On Construction If Not Indefinite
'602	1, 18, 21, 24	interdiffusion layer	Plain and ordinary
'227	1, 7		
'602	1, 12, 21, 24, 28	intermediate layer	Plain and ordinary
'227	1, 7, 22		
'602	1, 21, 24	intermetallic layer	Plain and ordinary
'227	1, 7		
'602	1, 21, 24	superficial layer	Plain and ordinary
'227	1, 7		
'602	2	level	Plain and ordinary

No Intermediate Layer, Intermetallic Layer, & Superficial Layer

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

No Claimed Layer



Dr. James Fekete | ArcelorMittal Expert

64. The VF 8 and VF 9 each contain precoated steel products with a coating that next includes, proceeding from the base steel outwards, an intermediate layer having a second mean iron composition different from the first mean iron composition. To determine whether the SEM micrographs of the VinFast parts tested according to the protocol developed by Dr. Baskin and me, I compared the SEM micrographs taken of the VinFast parts with the four-layer structure depicted in Figure 1 of the Asserted Patents, which Mr. Drillet confirmed in deposition showed a four-layer structure. P. Drillet (Rough) Dep. Tr. 110:3-23 (confirming four-layer structure of image identical to Figure 1).

RX-1146C.0046 (Fekete Op. Rpt.) at ¶ 64

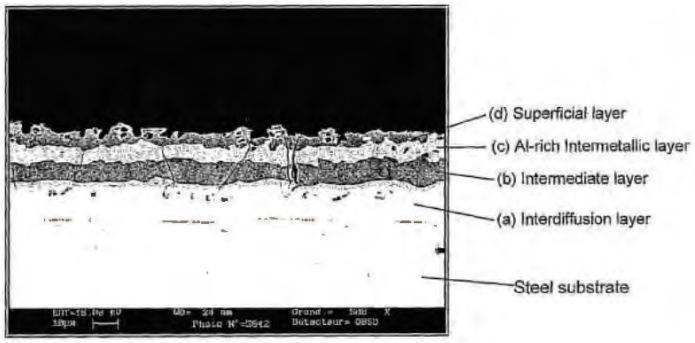


Fig. 1

JX-0001.0007 ('227 Patent) at Fig. 1

One SEM Per Physical Part



No Claimed Layer



Dr. Pascal Drillet
Named Inventor

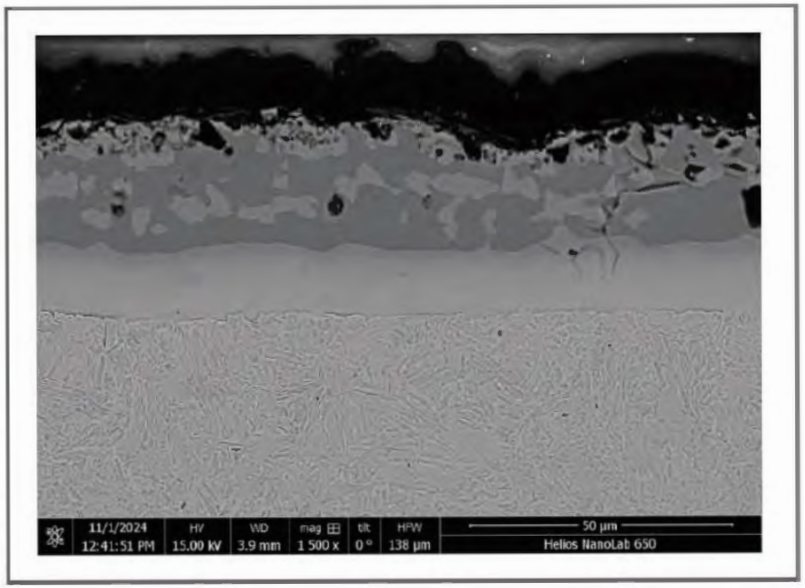
Q. How do I know whether a band of intermetallic compound is a layer or a phase?

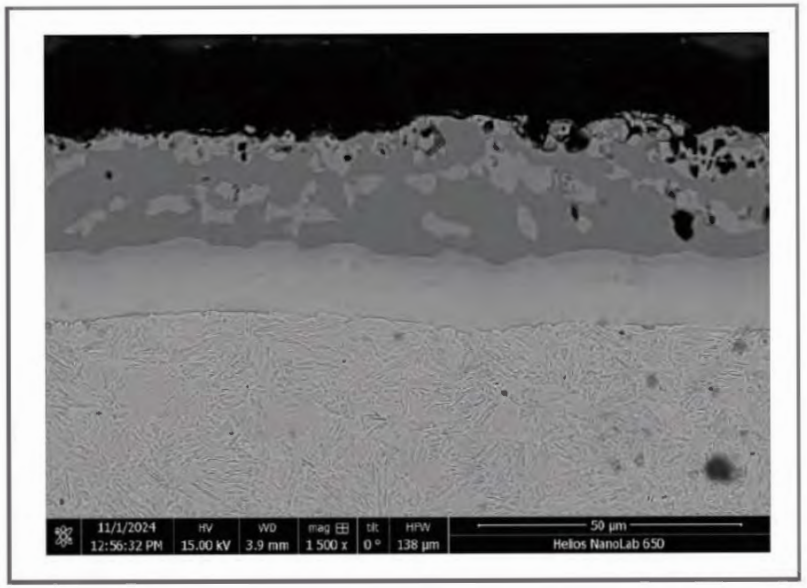
A. I can't say based on an image,.... A multilayer structure of coating has to be the same across the entire part.... It's not enough, one picture.

RX-1282C.0099 (Drillet Tr.) at 99:5 – 100:24

No Claimed Layer

Dr. Bradley's Test Results for VinFast Parts

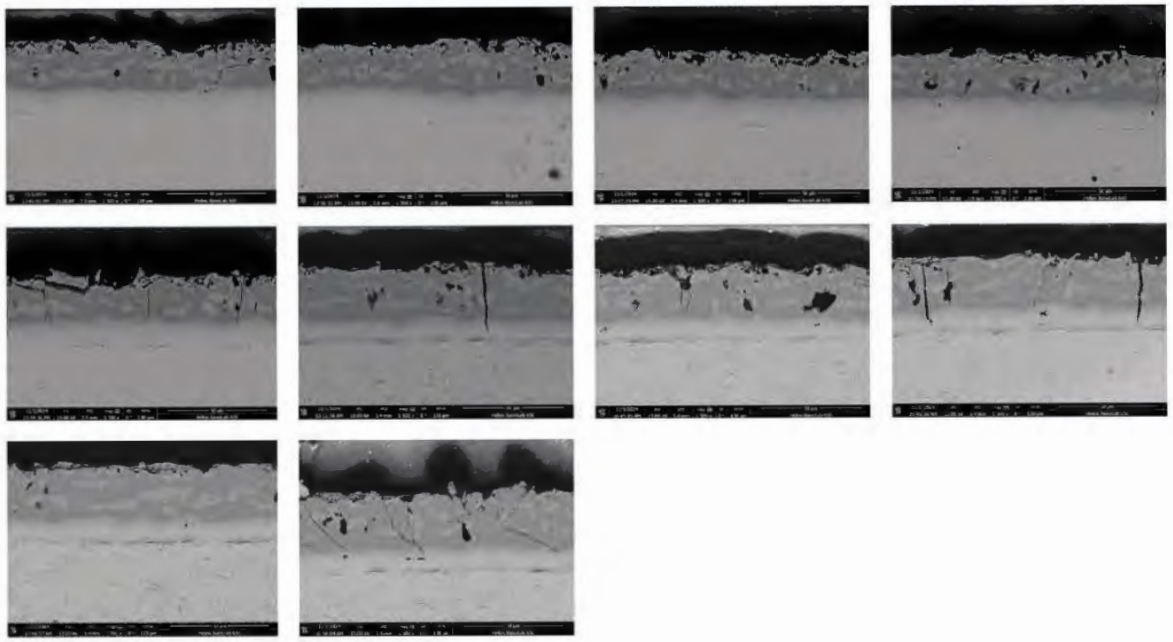




Bradley Testing Rpt., ¶ 54; RX-0147C; RX-0148C

No Claimed Layer

SEM Image #	VinFast P/N
RX-0147C	[redacted]
RX-0148C	[redacted]
RX-0149C	[redacted]
RX-0150C	[redacted]
RX-0151C	[redacted]
RX-0144C	[redacted]
RX-0145C	[redacted]
RX-0146C	[redacted]
RX-0142C	[redacted]
RX-0143C	[redacted]



CX-0086C.0021-.0025, .0027-.0031 - Bradley Testing Rpt., ¶¶ 54, 56

Noninfringement

'602 Patent, 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, 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:	
[1c]	(a) an interdiffusion layer having a first mean iron composition,	
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✗
[1e]	(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	✗
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,	✗
[1g]	wherein the coating has a thickness greater than 30 micrometers.	

Asserted Claims – '602 Patent

'602 Patent, Claim 21

[21pre]	A precoated steel product comprising	
[21a]	a strip of base steel having a first side and a second side; and	
[21b]	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,	
[21c]	(a) an interdiffusion layer having a first mean iron composition,	
[21d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✕
[21e]	(c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third mean iron concentration being higher than the second mean iron composition, and	✕
[21f]	(d) a superficial layer having a fourth mean iron composition different from the first, second and third mean iron compositions,	✕
[21g]	wherein the coating has a thickness greater than 30 micrometers.	

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising	
[24a]	a strip of base steel having a first side and a second side; and	
[24b]	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,	
[24c]	(a) an interdiffusion layer having a first mean aluminum Composition,	
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,	✕
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and	✕
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;	✕
[24g]	wherein the coating has a thickness greater than 30 micrometers.	

Asserted Claims – '227 Patent

'227 Patent, Claim 1

[1pre]	A hot stamped coated steel product, which comprises:	
[1a]	(a) a strip of base steel having a first side and a second side; and	
[1b]	(b) a coating on at least one of said first side of said strip of base steel and said second side of said strip of base steel, wherein:	
[1c]	(i) said coating results from interdiffusion between said base steel and an aluminum or aluminum alloy pre-coating, and	
[1d]	(ii) wherein said coating comprises, proceeding from the base steel outwards:	
[1e]	(a) an Interdiffusion layer,	
[1f]	(b) an Intermediate layer,	✗
[1g]	(c) an Intermetallic layer, and	✗
[1h]	(d) a Superficial layer,	✗
[1i]	wherein layers (a), (b), (c), and (d) each have a different mean composition from one another,	
[1j]	wherein said coating of the hot stamped coated steel product has a thickness greater than 30 micrometers.	

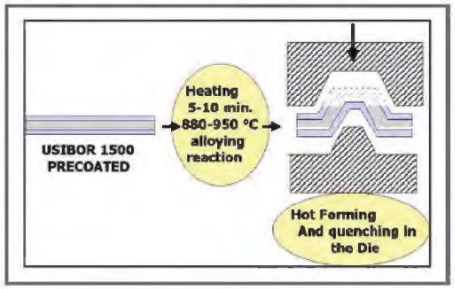
Invalidity



RDX-002.40

State of the Art

7/2002 Vaissiere (RX-0081)



7/2003 Suehiro II (RX-0022)

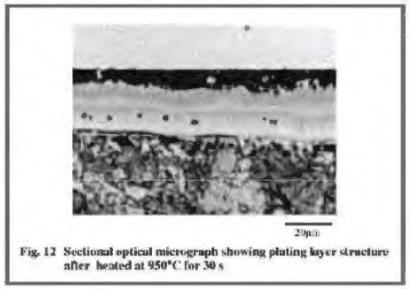
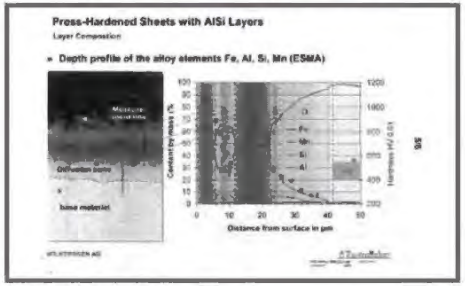
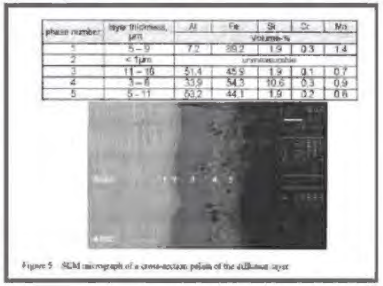


Fig. 12 Sectional optical micrograph showing plating layer structure after heated at 950°C for 30 s

1/2005 Lachmann (RX-0062)



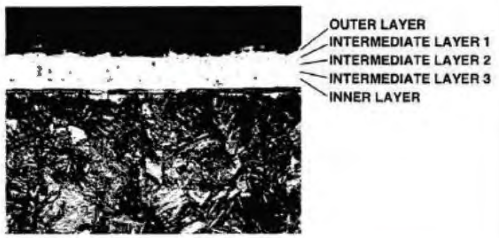
5/2006 Engels (RX-0063)



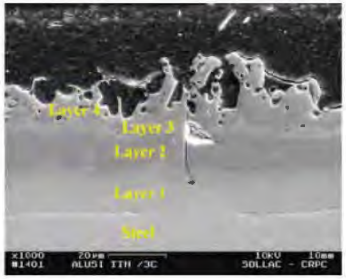
phase number	layer thickness, μm	Al	Fe	Si	Cr	Mn
		volume-%				
1	5 – 9	7.2	86.2	1.9	0.3	1.4
2	< 1μm	unanalysable				
3	11 – 16	51.4	45.9	1.4	0.1	0.7
4	3 – 6	33.9	54.3	10.6	0.3	0.9
5	5 – 11	63.2	44.1	1.9	0.2	0.6

Figure 5 SEM micrograph of a cross-section polish of the diffusion layer

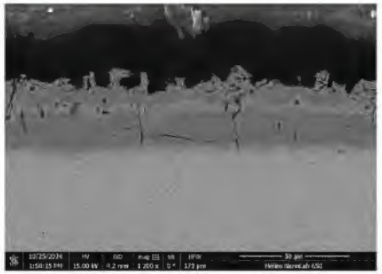
1/2004 Takagi (RX-0104)



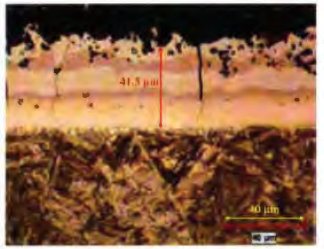
2001 Cornette (RX-0019)



8/18/2005 2006 Passat (RX-0086)



5/2006 Hein (RX-0013)



Cornette

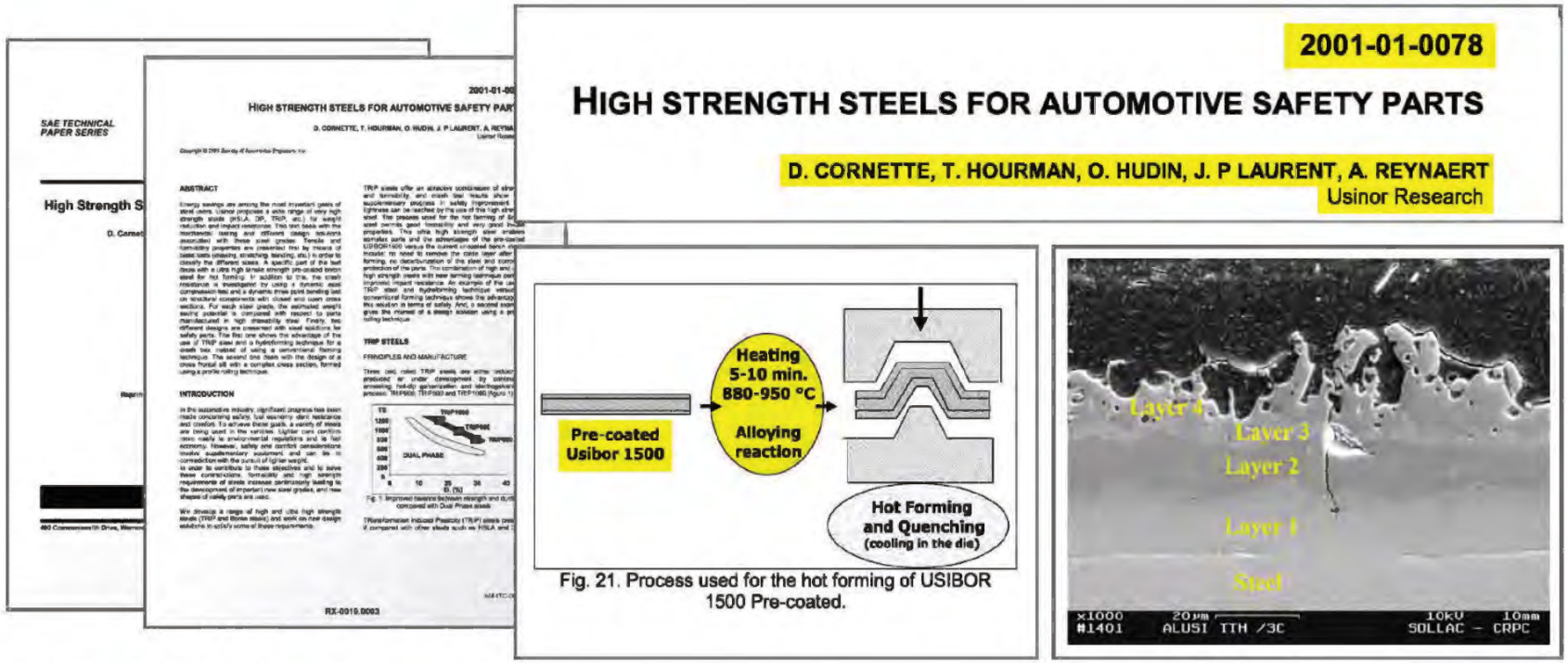


Fig. 21. Process used for the hot forming of USIBOR 1500 Pre-coated.

RX-0019.0003, .0009, .0010 (Cornette)

Vaissiere



SAE TECHNICAL PAPER SERIES

2002-01-2048

Development of Pre-Coated Boron Steel for Applications on PSA Peugeot Citroën and RENAULT Bodies in White

L. Vaissiere

J. P. Laurent

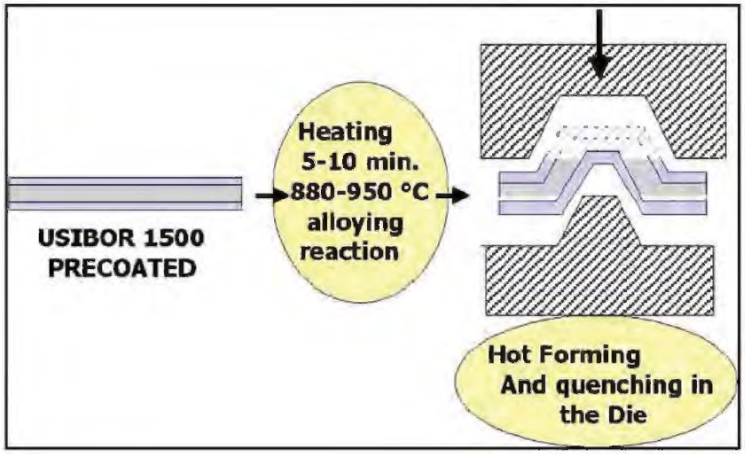
A. Reinhardt

Reprinted From: Proceedings of the 2002 SAE International Body Engineering Conference and Automotive & Transportation Technology Conference on CD-ROM (IBAT2002CD)

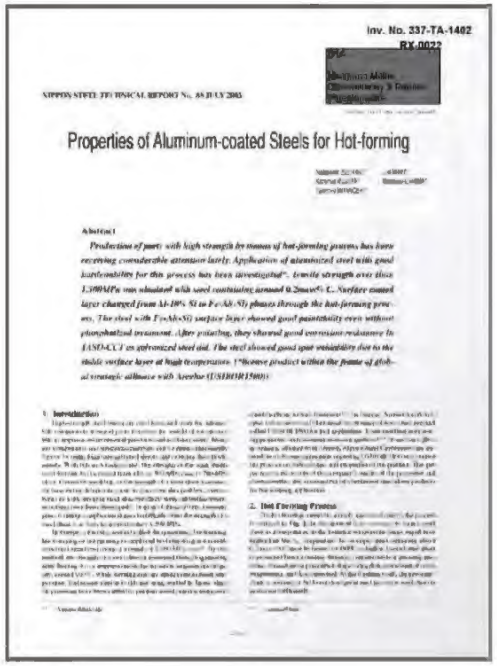
International Body Engineering Conference & Exhibition and Automotive & Transportation Technology Conference
Paris, France
July 9-11, 2002

RX-0081 (Vaissiere) at .0008-.0009

The pre-coated USIBOR 1500, optimized for the stability of its quenchability, is transformed, at the end of forming, into pure martensite thus giving very high mechanical characteristics to then finished part : YS~1000MPa, TS~1500MPa.



Suehiro


Inv. No. 337-TA-1402
RX-0022

NIPPON STEEL TECHNICAL REPORT No. 88 JULY 2003

Properties of Aluminum-coated Steels for Hot-forming

Abstract

Production of parts with high strength by means of hot-forming process has been receiving considerable attention lately. Application of aluminized steel with good hardenability for this process has been investigated. Tensile strength over than 1,500MPa was obtained with steel containing around 0.2mass% C. Surface coated layer changed from Al-10% Si to Fe-Al(-Si) phases through the hot-forming process. The steel with Fe-Al(-Si) surface layer showed good paintability even without phosphatized treatment. After painting, they showed good corrosion resistance in JASO-CCT as galvanized steel did. The steel showed good spot weldability due to the stable surface layer at high temperature. (*license product within the frame of global strategic alliance with Arcelor (USIBOR1500))*

Properties of Aluminum-coated Steels for Hot-forming

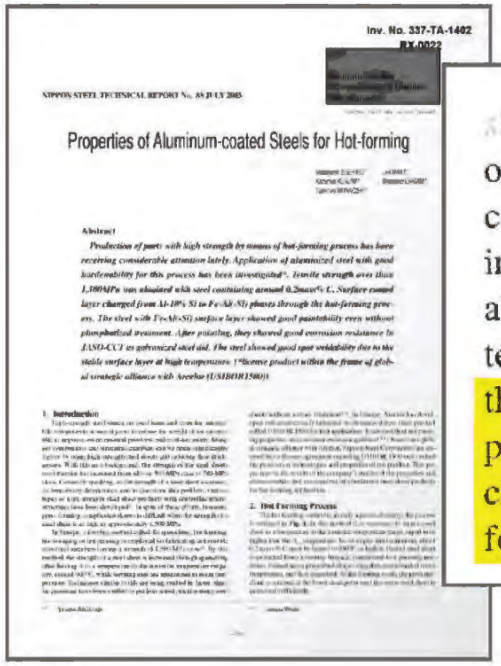
NIPPON STEEL TECHINICAL REPORT No. 88 JULY 2003

Abstract

Production of parts with high strength by means of hot-forming process has been receiving considerable attention lately. Application of aluminized steel with good hardenability for this process has been investigated*. Tensile strength over than 1,500MPa was obtained with steel containing around 0.2mass% C. Surface coated layer changed from Al-10% Si to Fe-Al(-Si) phases through the hot-forming process. The steel with Fe-Al(-Si) surface layer showed good paintability even without phosphatized treatment. After painting, they showed good corrosion resistance in JASO-CCT as galvanized steel did. The steel showed good spot weldability due to the stable surface layer at high temperature. (*license product within the frame of global strategic alliance with Arcelor (USIBOR1500))

RX-0022.0001 (Suehiro II)

Suehiro



Inv. No. 337-TA-1402
RX-0022

NIPPON STEEL TECHNICAL REPORT No. 88 JULY 2005

Properties of Aluminum-coated Steels for Hot-forming

Abstract

Production of parts with high strength by means of hot-forming process has been receiving considerable attention lately. Application of aluminized steel with good hardenability for this process has been investigated. Tensile strength over than 1,300MPa was obtained with steel containing around 0.2mass% C. Surface coated layer changed from Al-10% Si to Fe-Al-Si phases through the hot-forming process. The steel with Fe-Al-Si surface layer showed good paintability even without phosphatized treatment. After painting, they showed good corrosion resistance in JASO-CCT as galvanized steel did. The steel showed good spot weldability due to the stable surface layer at high temperature. *License product within the frame of global strategic alliance with Arcelor (USIBOR1500).*

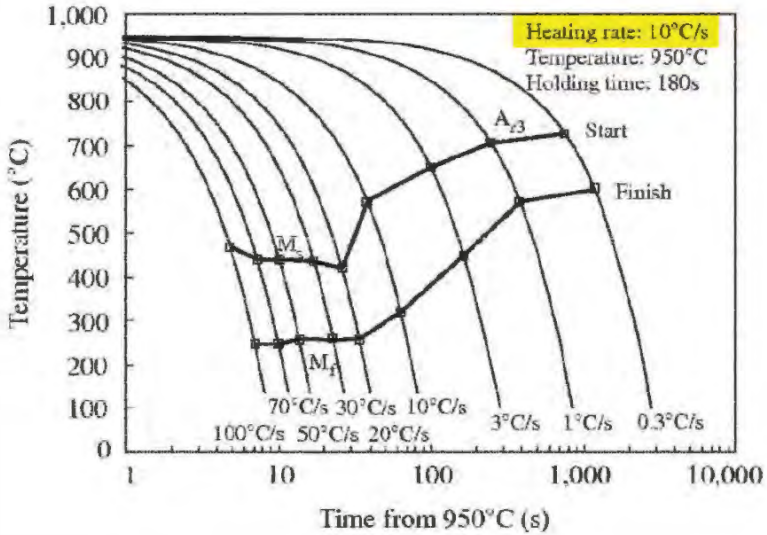
1. Introduction

2. Hot Forming Process

sheets without surface treatment[1, 2]. In Europe, Arcelor has developed and commercially launched an aluminized steel sheet product called USIBOR 1500 for that application. It has excellent hot-pressing properties and corrosion resistance qualities[2, 5-6]. Based on a global strategic alliance with Arcelor, Nippon Steel Corporation has entered into a license agreement regarding USIBOR 1500 and studied the production technologies and properties of the product. This paper reports the results of the company's studies of the properties and characteristics that are required of aluminized steel sheet products for hot forming application.

RX-0022.0001 (Suehiro II)

Suehiro



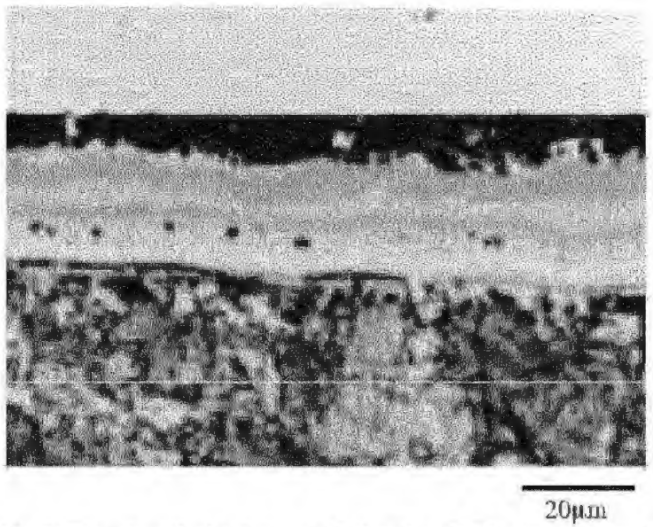
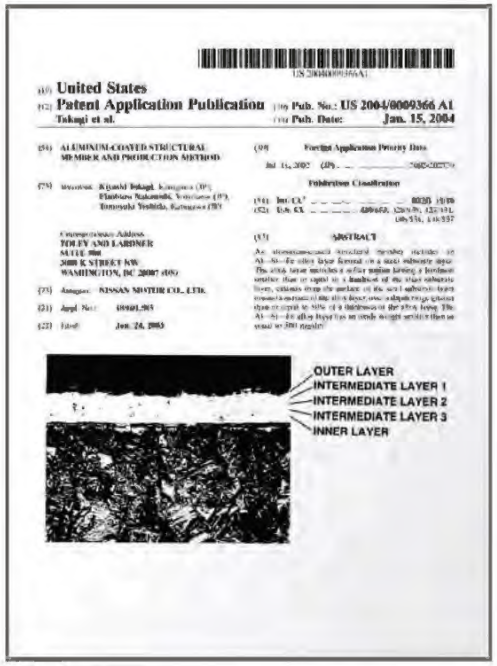


Fig. 12 Sectional optical micrograph showing plating layer structure after heated at 950°C for 30 s

RX-0022.0002, .0004 (Suehiro II)

Takagi



(12) **United States**
Patent Application Publication (10) Pub. No.: US 2004/0009366 A1
Takagi et al. (43) Pub. Date: Jan. 15, 2004

(54) ALUMINUM-COATED STRUCTURAL MEMBER AND PRODUCTION METHOD

(57) ABSTRACT

OUTER LAYER
INTERMEDIATE LAYER 1
INTERMEDIATE LAYER 2
INTERMEDIATE LAYER 3
INNER LAYER

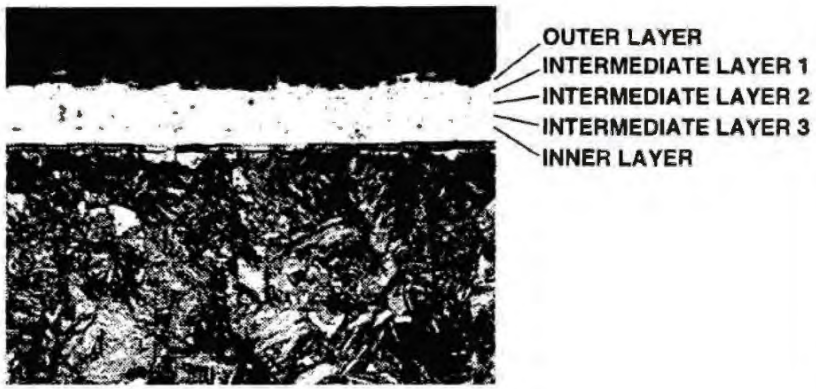
(54) **ALUMINUM-COATED STRUCTURAL MEMBER AND PRODUCTION METHOD**

(43) **Pub. Date: Jan. 15, 2004**

(73) Assignee: **NISSAN MOTOR CO., LTD.**

RX-0104.0001 (Takagi)

Takagi



RX-0104.0003 (Takagi) at Fig. 1

[0006] According to another aspect of the invention, a production method of an aluminum-coated structural member comprises: a first method element of heating a hot-dip aluminum-coated steel sheet at a heating rate in a range of 1~10° C./sec; a second method element of holding the hot-dip aluminum steel sheet at a raised temperature in a temperature range of 900~950° C. for a duration in a range of 2~8 minutes; a third method element of cooling the hot-dip aluminum-coated steel sheet to a temperature in a temperature range of 700~800° C. at a cooling rate in a range of 5~15° C./sec; a fourth method element of forming the hot-dip aluminum-coated steel sheet into a predetermined shape in the temperature range of 700~800° C.; and a fifth method element of cooling the hot-dip aluminum-coated

RX-0104.0007 (Takagi) at [0006]

Engels



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Sheet M

Edited by
Mathias Liewald

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INFO

135

Controlling and Monitoring of the Hot-Stamping Process of Boron-Alloyed Heat-Treated Steels

Dr.-Ing. R. Engels, Dipl.-Ing. O. Schaltzer, cand.-Ing. C. Müller-Bollenhagen
Interautive Systems Europe GmbH, Bergneustadt, Germany

Abstract

Due to steadily rising crash requirements to be met by modern automotive structures, the application of ultra high strength materials has increased. Hot-stamping is an approach to produce these structural parts. High material strengths may lead to wear problems during the trimming operations following the hot-stamping process. Depending on part geometries, the trimming operation can be integrated into the hot-stamping process. The desired mechanical and surface properties call for an analysis of the effects of process parameters on the above-mentioned part requirements. Accordingly, the feasibility analysis during prototyping has to be distinguished from the analysis of heat treatment and from the analysis of the quenching behavior inside the die. Besides standard destructive testing methods, the magnetic inductive approach seems to be apt for testing the mechanical and technological properties of the parts.

1 Introduction

While an increase in crash requirements can be observed, strong efforts are being made at the same time to reduce the weight of BIWs. It is due to this paradoxon that super-high strength materials are increasingly used for structural and security parts in body construction. Besides conventional cold stamping methods, hot-stamping of boron-alloyed steels (22MnB5) is used to produce the components mentioned above. These boron steels belong to the group of martensitic steels which stand out for their good hardenability at low cooling rates. They allow tensile strengths R_m of up to 1600 MPa, which come along with good toughness properties. Typical fields of application for this technology are e.g. A- and B-pillar reinforcements, roof rails, side-rail members and beams for crash management systems.

Given the required mechanical and surface properties, particularly when dealing with aluminized parent material, the effects of process parameters on the above-mentioned

POSCO Exhibit 1041-0007
Filed with Petition for IPR of U.S. Patent No. 9,708,663
VHFAST1402-00002261

RX-0063.0007

RX-0063 (Engels) at 0002, .0015-.0016

Papers of the
International Conference on "New Developments in Sheet Metal Forming"
in Leinfelden-Echterdingen (near Stuttgart) - Germany, on May, 9th and 10th 2006.
Conference Chairman: Prof. Dr.-Ing. Mathias Liewald MBA

3.1 Heat Treatment

Thus, these are the parameters which have to be taken into account when setting the temperature profile:

- the heating rate,
- the total processing time,
- the maximum austenitizing temperature and
- the material thickness.

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

Engels



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Sheet M

Edited by
Mathias Liewald

135

Controlling and Monitoring of the Hot-Stamping Process of Boron-Alloyed Heat-Treated Steels

Dr.-Ing. H. Engels, Dipl.-Ing. O. Schalm, cand.-Ing. C. Müller-Bollenhagen
Inmotive Systems Europe OmbH, Bergneustadt, Germany

Abstract

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1 Introduction

While an increase in crash requirements can be observed, strong efforts are being made at the same time to reduce the weight of BIWs. It is due to this paradoxon that super-high strength materials are increasingly used for structural and security parts in body construction. Besides conventional cold stamping methods, hot-stamping of boron-alloyed steels (22MnB5) is used to produce the components mentioned above. These boron steels belong to the group of martensitic steels which stand out for their good hardenability at low cooling rates. They allow tensile strengths R_m of up to 1600 MPa, which come along with good toughness properties. Typical fields of application for this technology are e.g. A- and B-pillar reinforcements, roof rails, side-rail members and beams for crash management systems.

Given the required mechanical and surface properties, particularly when dealing with aluminized parent material, the effects of process parameters on the above-mentioned

POSCO Exhibit 1041-0007
Filed with Petition for IPR of U.S. Patent No. 9,708,683
VHFAST1402-00002285

RX-0063.0007

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



RX-0063 (Engels) at .0016

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New Developme
Sheet Metal For

Edited by
Mathias Liewald

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DEUTSCHE GESEL
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163

Hot Stamping of USIBOR 1500 P: Part and Process Analysis Based on Numerical Simulation

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Abstract

The amount of ultra high strength hot-stamped boron steel is rapidly increasing in automotive bodies-in-white. Indeed, this material and the related hot stamping technology allow reaching strength levels (1500 MPa) which are far above those of best-in-class cold stamping steels. Moreover, the traditional balance between high strength, low formability and high springback is outruled by hot stamping.

General market trends of hot stamping are discussed and an overview of the main parameters defining the process window of hot stamping is given. A test device has been set up to determine the formability limits of USIBOR 1500 P in hot stamping. The methodology for FE-analysis of hot stamping is presented and the flow chart of a typical feasibility study, as realized by Arcelor for its customers, is described.

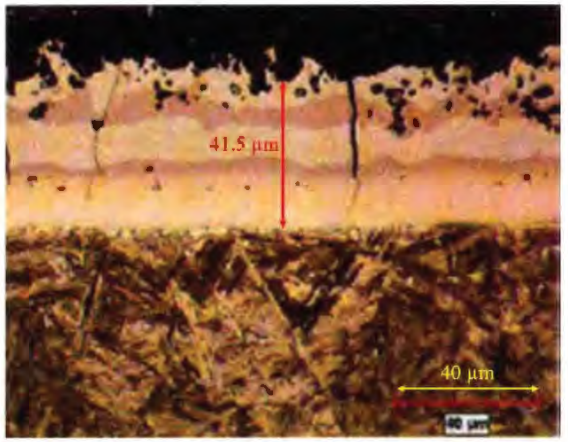
1 Hot Stamping of USIBOR 1500 P

1.1 Process Description

The principle of operation of hot-stamping is intimately linked with the opportunities offered by the chemical composition of boron steels (Figure 1), resulting in a robust process window for quenching and martensitic transformation. Hot-stamping consists in heating blanks until complete austenitization (900°C to 950°C, during 4 to 10 minutes). The blanks (Figure 7) are then transferred very quickly on a press for the stamping. At high temperature (650°C to 850°C), the material has an excellent formability and thus quite complex shapes can be formed in a single stroke.

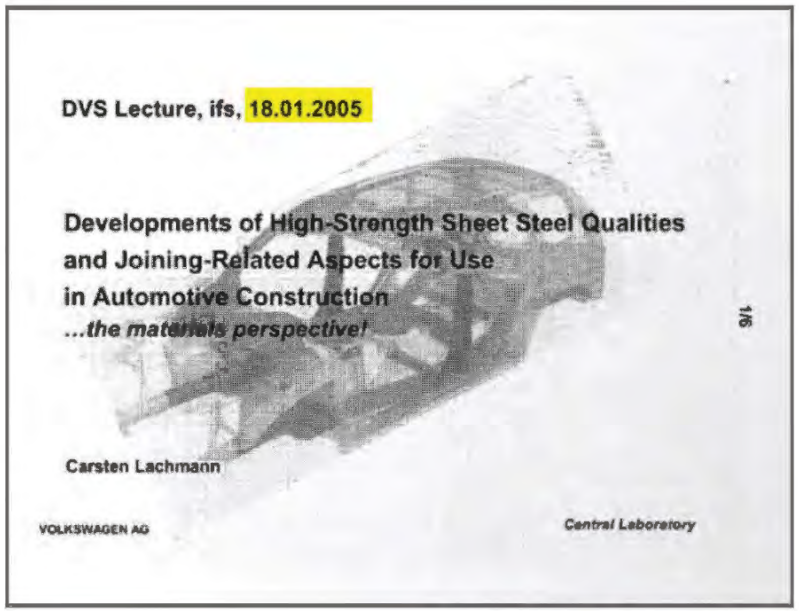
Papers of the
International Conference on "New Developments in Sheet Metal Forming"
in Leinfelden-Echterdingen (near Stuttgart) - Germany, on May, 9th and 10th 2006.

Dr.-Ing. P. Hein; Dipl.-Ing. R. Kefferstein
Arcelor Flat Carbon Steel Europe

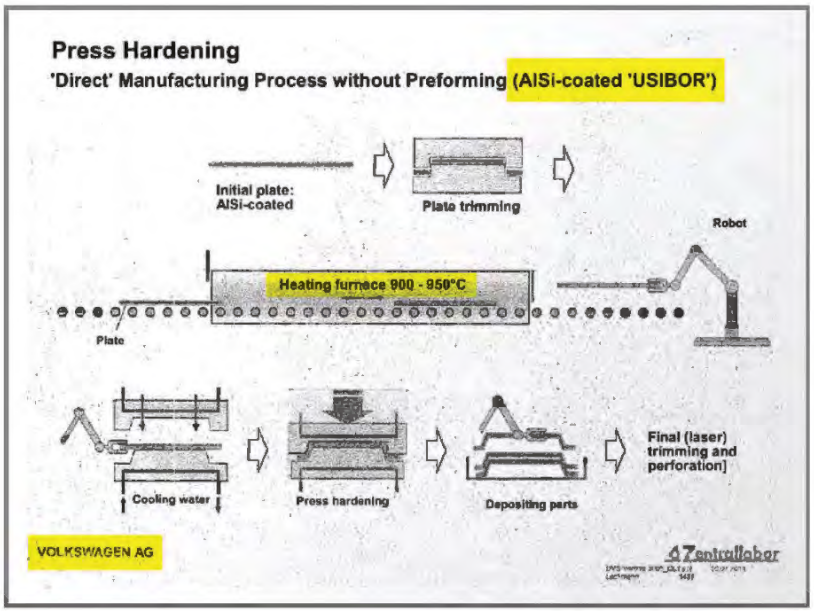


RX-0013 (Hein) at 0001-0003, .0004

Lachmann



RX-0062.0003 (Lachmann English)



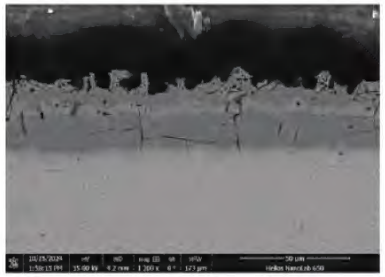
RX-0062.0004 (Lachmann English)

Passat 2006

The following assemblies are manufactured from ultra-high-strength, hot-formed steel panels:

- The front bumper cross member
- The cross members in the footwell area
- Inner sills
- The centre tunnel
- The A-pillar/roof frame area
- The B-pillar

RX-0008.0010 (The Passat 2006 Service Training)



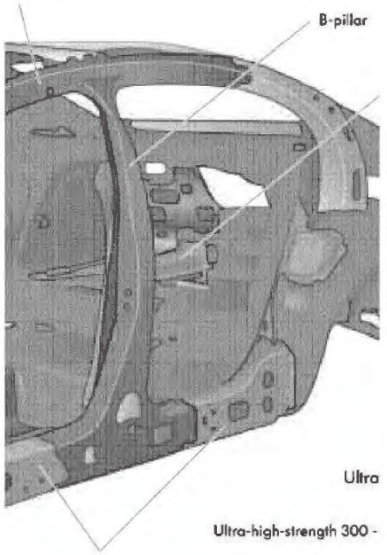
RX-0086



RX-0085.0002-.0004 (Bartosek Decl. re Teardown of 2006 VW Passat) ¶ 4



RX-0085.0006 (Bartosek Decl. re Teardown of 2006 VW Passat) ¶ 7



RX-0008.0011

Passat

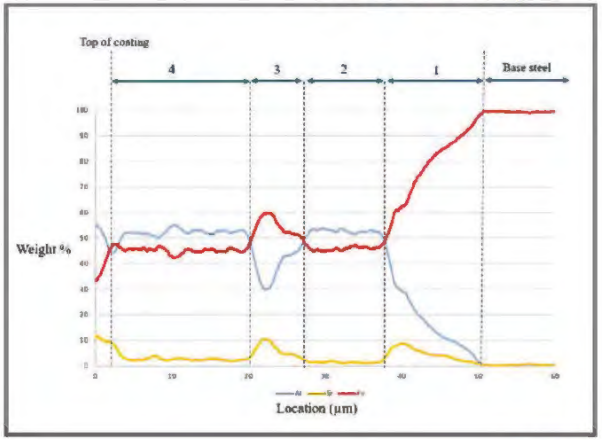


RDX-002.54

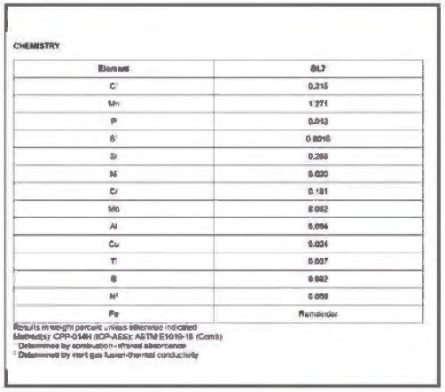
Invalidity – 2006 Passat



RX-0085.0002-.0004 (Bartosek Decl. re Teardown of 2006 VW Passat) ¶ 4



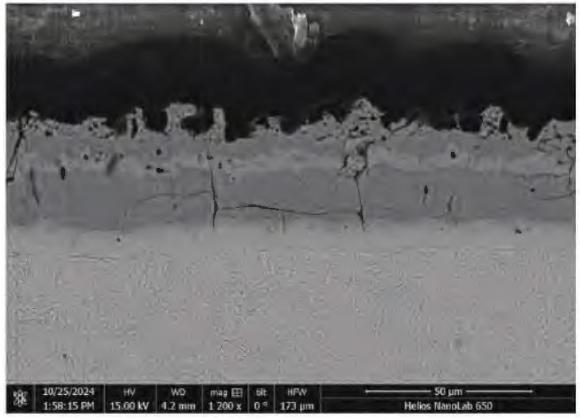
RX-173


CHEMISTRY

Element	8L7
C	0.215
Mn	1.271
P	0.012
S	0.0016
Si	0.288
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.056
Cu	0.024
Ti	0.007
B	0.002
N²	0.008
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-0146H (ICP-AES); ASTM E1019-18 (Comb)
¹ Determined by combustion - infrared absorbance
² Determined by inert gas fusion-thermal conductivity

RX-0087.0002



RX-0086

Position #	1	2	3	4	5	6	7	Avg
Entire coating	40.0	37.1	33.4	41.9	37.7	36.0	39.2	37.9
Region D	13.9	7.0	6.3	12.0	7.3	7.2	11.2	9.3
Region C	1.0	4.3	4.5	4.6	4.0	4.0	4.8	3.9
Region B	14.9	17.2	13.6	14.8	16.7	16.0	14.4	15.4
Region A	10.2	8.6	9.0	10.5	9.7	8.8	8.8	9.4

RX-0086; RPX-001

Invalidity – 2006 Passat

Multiple publications that confirm **hot stamping USIBOR** for Passat/VolksWagen.

Thanks to its many advantages (corrosion, no shot-blasting, no protective atmosphere in the furnaces, no post-coating…), the precoated solution, Usibor 1500 P, is more and more specified and used in the new European and US cars. For example, Usibor 1500 P is used for the pillars and sills of the new VW Passat (Figure 9 and Figure 10) and of the Mercedes Class S, for A-pillars of Landrover cars, bumper-beams of the Ford Mustang… A similar trend can be observed in Japan.



Figure 9. Hot-stamped parts made in Usibor 1500 P in the VW Passat (source: VW)

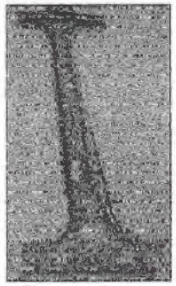
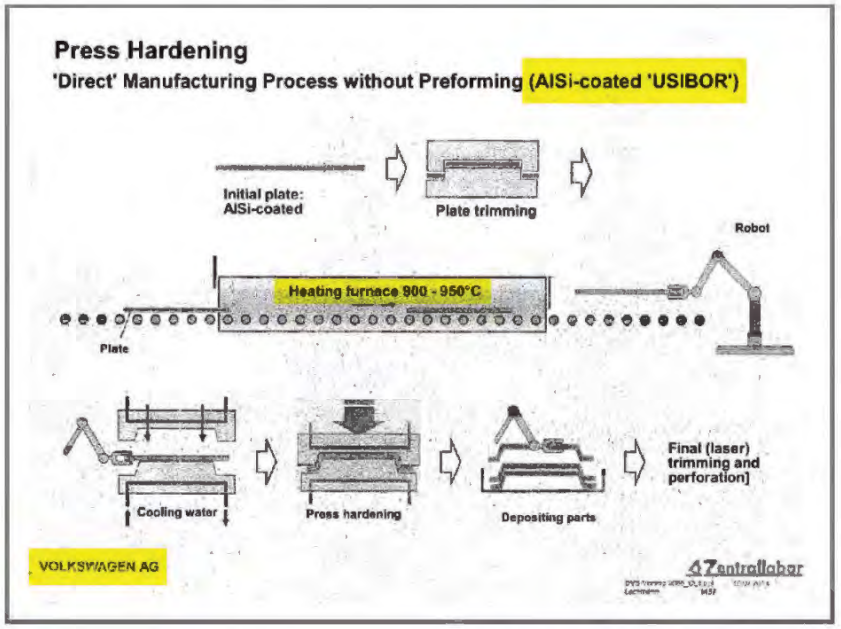


Figure 10. B-pillar of the VW Passat

RX-0013.0005 (Hein 2006)



RX-0062.0004 (Lachmann English)

Invalidity – 2006 Passat



RX-0085.0002 (Bartosek Decl. re Teardown of 2006 VW Passat) ¶ 4

CARFAX Detailed History

Owner 1
Purchased: 2005

Low mileage! This owner drove less than the industry average of 15,000 miles per year.

Personal Lease Vehicle
12,408 mi/yr

Date	Mileage	Source	Comments
Not Reported		NICB	**Vehicle manufactured and shipped to original dealer**
08/16/2005		Riverbank Volkswagen Stamford, CT 203-327-2500	**Vehicle offered for sale**
08/19/2005	2	Riverbank Volkswagen Stamford, CT 203-327-2500	**Vehicle serviced** -Pre-delivery inspection completed

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RX-0059.0002

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'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

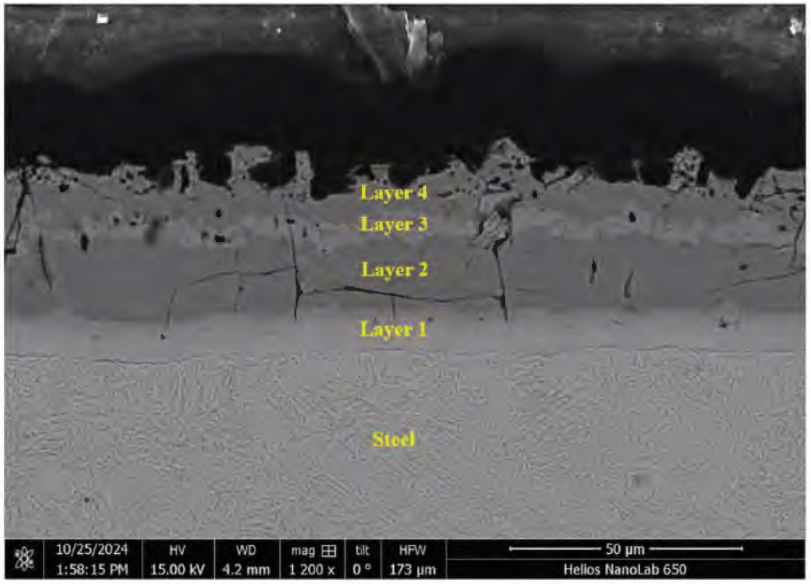


RX-0085.0006 (Bartosek Decl. re Teardown of 2006 VW Passat) ¶ 7

Invalidity – 2006 Passat

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
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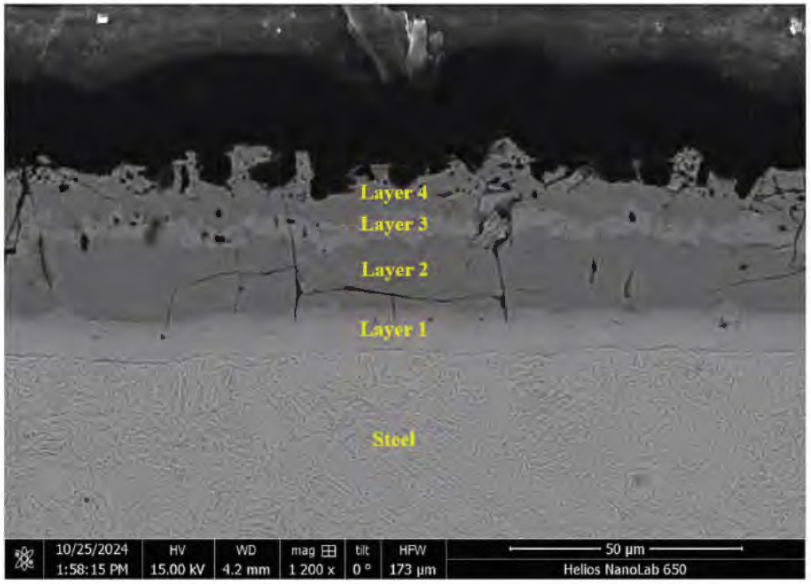


CX-0083C.0014 (Bradley Passat Rpt. ¶ 32) (annotation added); RX-0086

Invalidity – 2006 Passat

'602 Patent, Claim 1

[1pre]	A precoated steel product comprising
[1a]	a strip of base steel having a first side and a second side; and
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[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

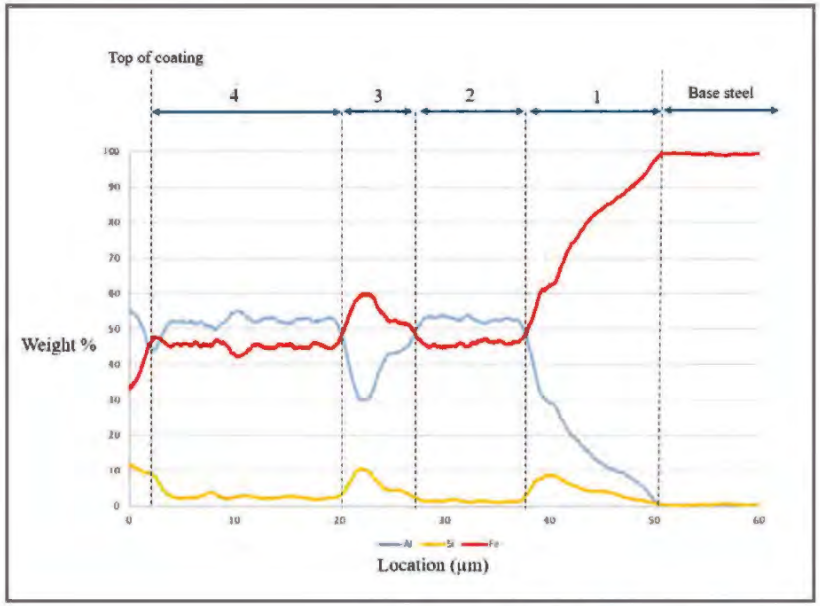


CX-0083C.0014 (Bradley Passat Rpt. ¶ 32) (annotation added); RX-0086

Invalidity – 2006 Passat

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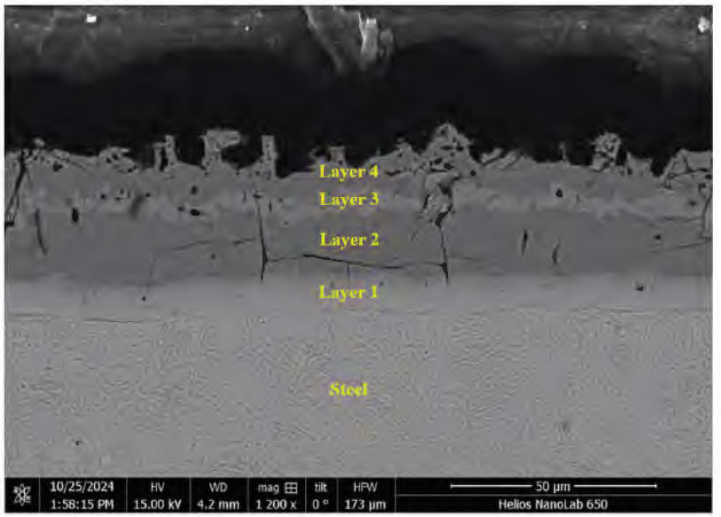


CX-0083C.0019 (Bradley Passat Rpt. ¶ 40)

Invalidity – 2006 Passat

'602 Patent, 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, 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:
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[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
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Mean iron composition (%)

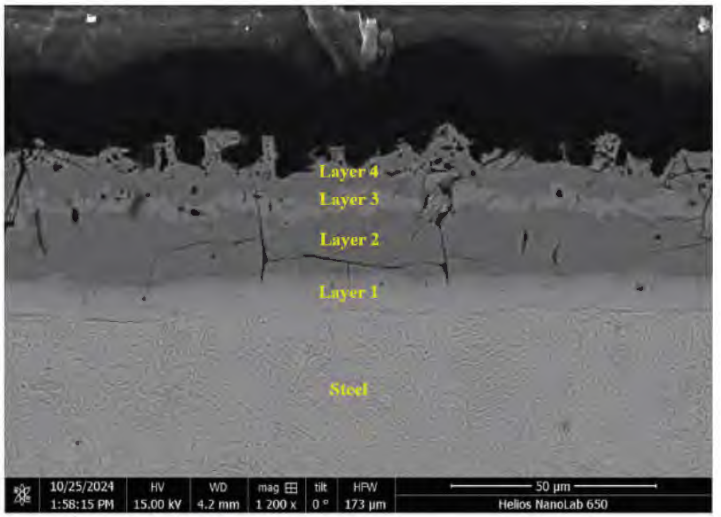
Layer 1	Layer 2	Layer 3	Layer 4
83.3	45.6	61.5	45.0

CX-0083C.0014 (Bradley Passat Rpt. ¶ 32) (annotation added); RX-0086

Invalidity – 2006 Passat

'602 Patent, Claim 1

[1pre]	A precoated steel product comprising
[1a]	a strip of base steel having a first side and a second side; and
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Mean iron composition (%)

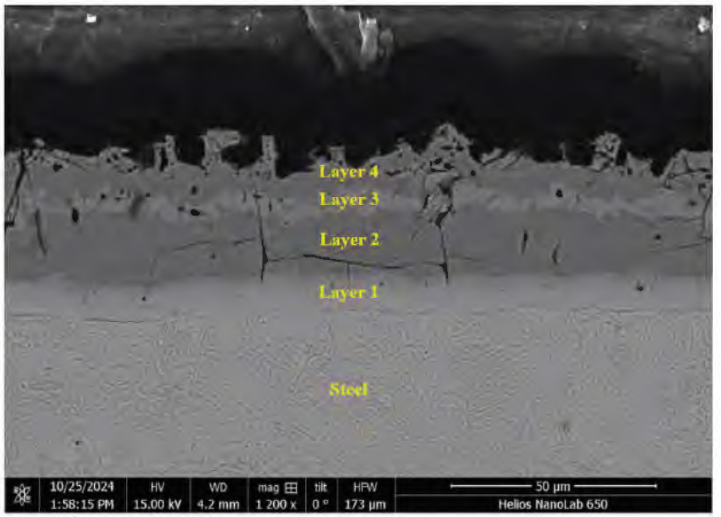
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CX-0083C.0014 (Bradley Passat Rpt. ¶ 32) (annotation added); RX-0086

Invalidity – 2006 Passat

'602 Patent, Claim 1

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[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
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Mean iron composition (%)

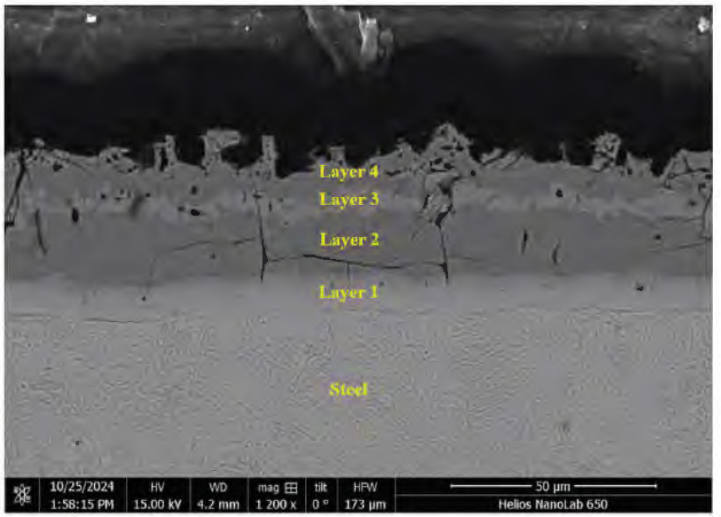
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CX-0083C.0014 (Bradley Passat Rpt. ¶ 32) (annotation added); RX-0086

Invalidity – 2006 Passat

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.



Mean iron composition (%)

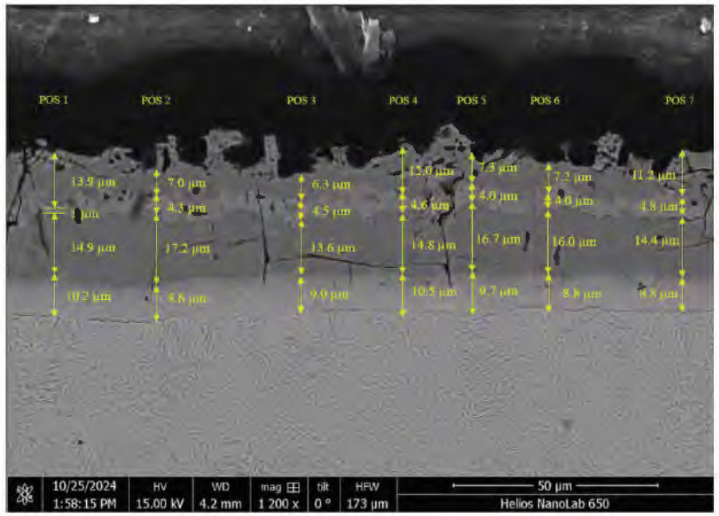
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Invalidity – 2006 Passat

'602 Patent, Claim 1

[1pre]	A precoated steel product comprising
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[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.



Coating (µm)

Pos. 1	Pos. 2	Pos. 3	Pos. 4	Pos. 5	Pos. 6	Pos. 7	Avg
40.0	37.1	33.4	41.9	37.7	36.0	39.2	37.9

CX-0083C.0014-.0015 (Bradley Passat Rpt. ¶ 33) (annotation added); RX-0086

Summary

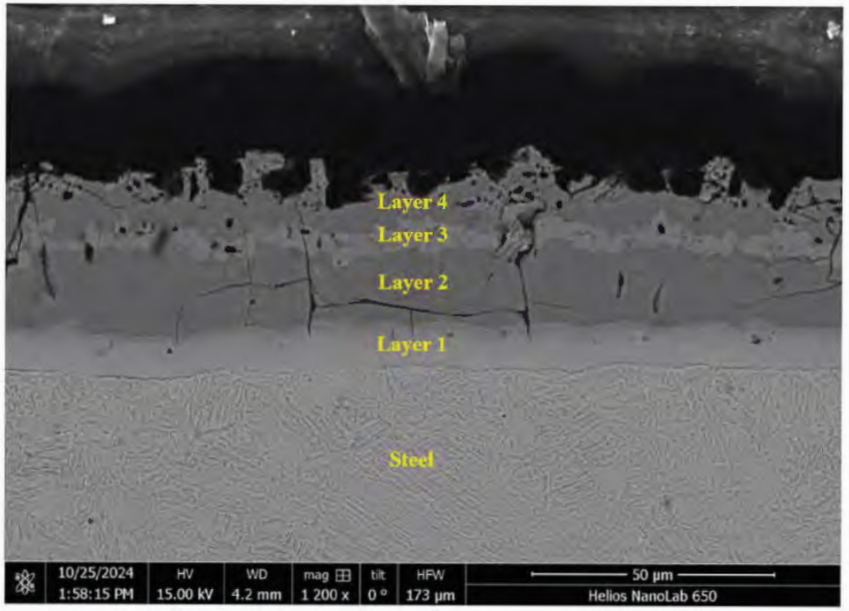
'602 Patent, Claim 1

[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, 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:	✓
[1c]	(a) an interdiffusion layer having a first mean iron composition,	✓
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✓
[1e]	(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	✓
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,	✓
[1g]	wherein the coating has a thickness greater than 30 micrometers.	✓

Invalidity – 2006 Passat

'602 Patent, Claim 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.



CX-0083C.0014-.0015 (Bradley Passat Rpt. ¶ 33) (annotation added); RX-0086

Invalidity – 2006 Passat

'602 Patent, Claim 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.

CHEMISTRY

Element	BL7
C[1]	0.215
Mn	1.271
P	0.012
S[1]	0.0016
Si	0.268
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

CHEMISTRY

Element	BL7
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Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

CHEMISTRY

Element	BL7
C[1]	0.215
Mn	1.271
P	0.012
S[1]	0.0016
Si	0.268
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

CHEMISTRY

Element	BL7
C[1]	0.215
Mn	1.271
P	0.012
S[1]	0.0016
Si	0.268
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
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Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
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CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

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Cu	0.024
Ti	0.037
B	0.002
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Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
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CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

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Cu	0.024
Ti	0.037
B	0.002
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Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

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Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

CHEMISTRY

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Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

CHEMISTRY

Element	BL7
C[1]	0.215
Mn	1.271
P	0.012
S[1]	0.0016
Si	0.268
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

CHEMISTRY

Element	BL7
C[1]	0.215
Mn	1.271
P	0.012
S[1]	0.0016
Si	0.268
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

CHEMISTRY

Element	BL7
C[1]	0.215
Mn	1.271
P	0.012
S[1]	0.0016
Si	0.268
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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.

CHEMISTRY

Element	BL7
C[1]	0.215
Mn	1.271
P	0.012
S[1]	0.0016
Si	0.268
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 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."

'602 Patent, Claim 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.

CHEMISTRY

Element	BL7
C[1]	0.215
Mn	1.271
P	0.012
S[1]	0.0016
Si	0.268
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'602 Patent, Claim 9

The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 15 micrometers.

'602 Patent, Claim 10

The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 10 micrometers.

'602 Patent, Claim 18

The precoated steel product as recited in claim 1 wherein the interdiffusion layer has a thickness of from 1 micron to 15 microns.

'602 Patent, Claim 26

The precoated steel product as recited in claim 24 wherein the layer (a) has a thickness less than 15 micrometers.

Position #	1	2	3	4	5	6	7	Avg
Entire coating	40.0	37.1	33.4	41.9	37.7	36.0	39.2	37.9
Region D	13.9	7.0	6.3	12.0	7.3	7.2	11.2	9.3
Region C	1.0	4.3	4.5	4.6	4.0	4.0	4.8	3.9
Region B	14.9	17.2	13.6	14.8	16.7	16.0	14.4	15.4
Region A	10.2	8.6	9.0	10.5	9.7	8.8	8.8	9.4

CX-0083C.0014-.0015 (Bradley Passat Rpt. ¶ 33) (annotation added); RX-0086

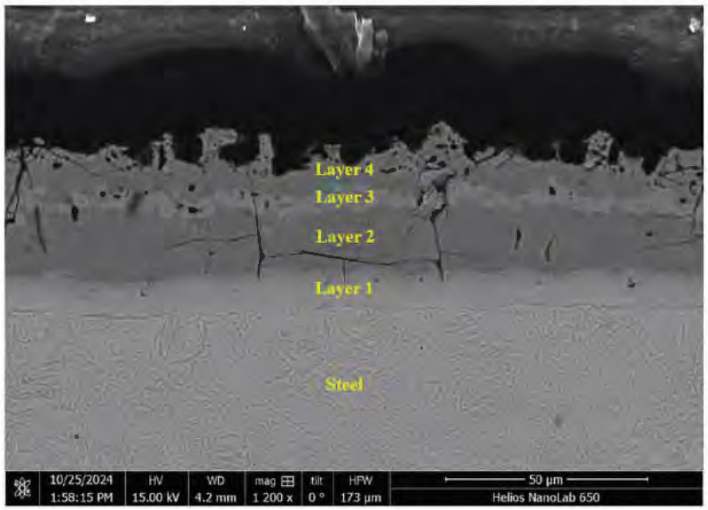
Invalidity – 2006 Passat

'602 Patent, Claim 20

"[t]he precoated steel product as recited in claim 1 wherein the fourth mean iron composition is lower than the third mean iron composition.

'602 Patent, Claim 22

The precoated steel product as recited in claim 21 wherein the fourth mean iron composition is lower than the third mean iron composition.



Mean iron composition (%)

Layer 1	Layer 2	Layer 3	Layer 4
83.3	45.6	61.5	45.0

CX-0083C.0014-0015, .0017-.0019 (Bradley Passat Rpt. ¶¶ 33, 38-39); RX-0086

Invalidity – 2006 Passat

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

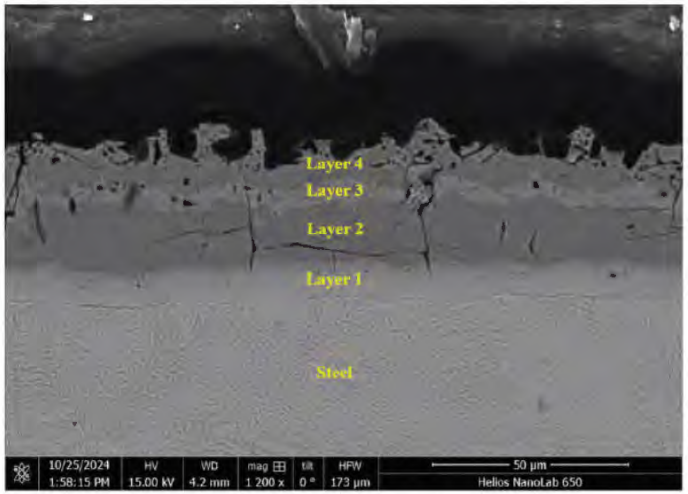
'602 Patent, Claim 21

[21pre]	A precoated steel product comprising
[21a]	a strip of base steel having a first side and a second side; and
[21b]	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,
[21c]	(a) an interdiffusion layer having a first mean iron composition,
[21d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[21e]	(c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third mean iron concentration being higher than the second mean iron composition, and
[21f]	(d) a superficial layer having a fourth mean iron composition different from the first, second and third mean iron compositions,
[21g]	wherein the coating has a thickness greater than 30 micrometers.

Invalidity – 2006 Passat

'602 Patent, Claim 21

[21pre]	A precoated steel product comprising
[21a]	a strip of base steel having a first side and a second side; and
[21b]	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,
[21c]	(a) an interdiffusion layer having a first mean iron composition,
[21d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[21e]	(c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third mean iron concentration being higher than the second mean iron composition, and
[21f]	(d) a superficial layer having a fourth mean iron composition different from the first, second and third mean iron compositions,
[21g]	wherein the coating has a thickness greater than 30 micrometers.



Mean iron composition (%)

Layer 1	Layer 2	Layer 3	Layer 4
83.3	45.6	61.5	45.0

CX-0083C.0014-0015, .0017-.0019 (Bradley Passat Rpt. ¶¶ 33, 38-39); RX-0086

Invalidity – 2006 Passat

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

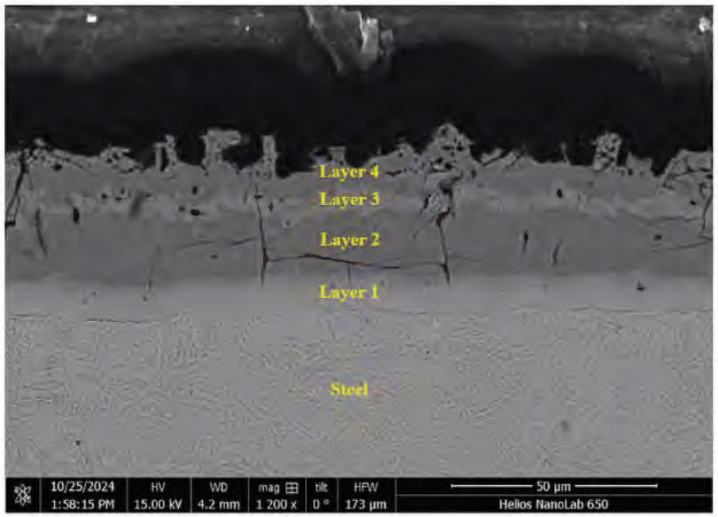
'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.

Invalidity – 2006 Passat

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.



Mean aluminum composition (%)

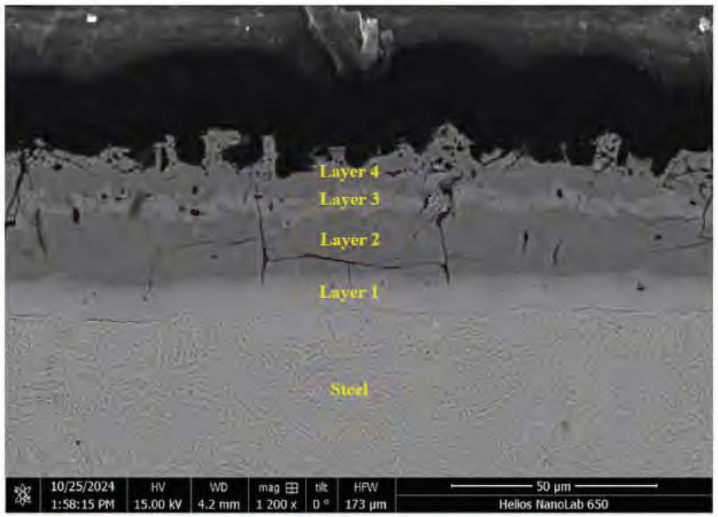
Layer 1	Layer 2	Layer 3	Layer 4
12.6	53.0	29.2	52.4

CX-0083C.0014 (Bradley Passat Rpt. ¶ 32) (annotation added); RX-0086

Invalidity – 2006 Passat

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.



Mean aluminum composition (%)

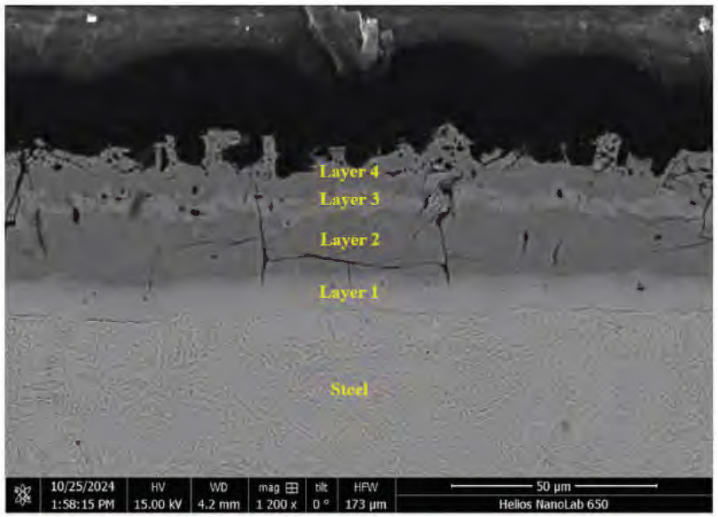
Layer 1	Layer 2	Layer 3	Layer 4
12.6	53.0	29.2	52.4

CX-0083C.0014 (Bradley Passat Rpt. ¶ 32) (annotation added); RX-0086

Invalidity – 2006 Passat

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.



Mean aluminum composition (%)

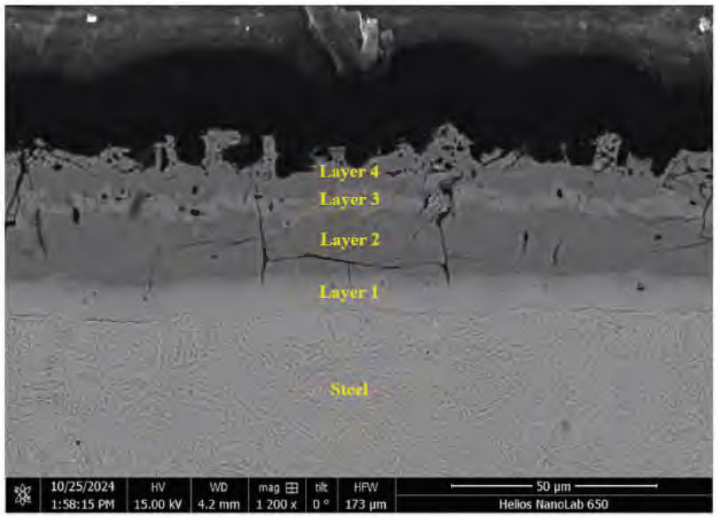
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CX-0083C.0014 (Bradley Passat Rpt. ¶ 32) (annotation added); RX-0086

Invalidity – 2006 Passat

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.



Mean aluminum composition (%)

Layer 1	Layer 2	Layer 3	Layer 4
12.6	53.0	29.2	52.4

CX-0083C.0014 (Bradley Passat Rpt. ¶ 32) (annotation added); RX-0086

Summary

'602 Patent, 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, 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:	✓
[1c]	(a) an interdiffusion layer having a first mean iron composition,	✓
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✓
[1e]	(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	✓
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,	✓
[1g]	wherein the coating has a thickness greater than 30 micrometers.	✓

Summary

'602 Patent, Claim 21

[21pre]	A precoated steel product comprising	✓
[21a]	a strip of base steel having a first side and a second side; and	✓
[21b]	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,	✓
[21c]	(a) an interdiffusion layer having a first mean iron composition,	✓
[21d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✓
[21e]	(c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third mean iron concentration being higher than the second mean iron composition, and	✓
[21f]	(d) a superficial layer having a fourth mean iron composition different from the first, second and third mean iron compositions,	✓
[21g]	wherein the coating has a thickness greater than 30 micrometers.	✓

Summary

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising	✓
[24a]	a strip of base steel having a first side and a second side; and	✓
[24b]	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,	✓
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,	✓
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,	✓
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and	✓
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;	✓
[24g]	wherein the coating has a thickness greater than 30 micrometers.	✓

Summary

Claim 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	The precoated steel product as recited in claim 1 wherein the base steel includes the following components by weight based on total weight: 0.15%<carbon<0.5%; 0.5%<manganese<3%; 0.1%<silicon<0.5%; 0.01%<chromium<1%; titanium<0.2%; aluminum<0.1%; phosphorus<0.1%; sulfur<0.05%; 0.0005%<boron<0.08%; and further comprises iron and impurities inherent in processing.	✓
Claim 4	The precoated steel product as recited in claim 1 wherein the base steel comprises the following components by weight based on total weight: 0.20%<carbon<0.5%; 0.8%<manganese<1.5%; 0.1%<silicon<0.35%; 0.01%<chromium<1%; titanium<0.1%; aluminum<0.1%; phosphorus<0.05%; sulfur<0.03%; 0.0005%<boron<0.01%; and further comprises iron and impurities inherent in processing.	✓
Claim 7	The precoated steel product as recited in claim 1 wherein a ratio of titanium to nitrogen in the base steel in weight % is in excess of 3.42."	✓
Claim 8	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.	✓

Summary

Claim 9	The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 15 micrometers.	✓
Claim 10	The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 10 micrometers.	✓
Claim 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 20	"[t]he precoated steel product as recited in claim 1 wherein the fourth mean iron composition is lower than the third mean iron composition.	✓
Claim 22	The precoated steel product as recited in claim 21 wherein the fourth mean iron composition is lower than the third mean iron composition.	✓
Claim 26	The precoated steel product as recited in claim 24 wherein the layer (a) has a thickness less than 15 micrometers.	✓

Invalidity – 2006 Passat

'602 Patent, 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, 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:
[1c]	(a) an **interdiffusion layer** having a first mean iron composition,
[1d]	(b) an **intermediate layer** having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a **superficial layer** having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

'227 Patent, Claim 1

[1pre]	A hot stamped coated steel product, which comprises:
[1a]	(a) a strip of base steel having a first side and a second side; and
[1b]	(b) a coating on at least one of said first side of said strip of base steel and said second side of said strip of base steel, wherein:
[1c]	(i) said coating results from interdiffusion between said base steel and an aluminum or aluminum alloy pre-coating, and
[1d]	(ii) wherein said coating comprises, proceeding from the base steel outwards:
[1e]	(a) an **Interdiffusion layer**,
[1f]	(b) an **Intermediate layer**,
[1g]	(c) an **Intermetallic layer**, and
[1h]	(d) a **Superficial layer**,
[1i]	wherein layers (a), (b), (c), and (d) each have a different mean composition from one another,
[1j]	wherein said coating of the hot stamped coated steel product has a thickness greater than 30 micrometers.

Invalidity – 2006 Passat

'227 Patent, Claim 1

[1pre]	A hot stamped coated steel product, which comprises:
[1a]	(a) a strip of base steel having a first side and a second side; and
[1b]	(b) a coating on at least one of said first side of said strip of base steel and said second side of said strip of base steel, wherein:
[1c]	(i) said coating results from interdiffusion between said base steel and an aluminum or aluminum alloy pre-coating, and
[1d]	(ii) wherein said coating comprises, proceeding from the base steel outwards:
[1e]	(a) an **Interdiffusion layer**,
[1f]	(b) an **Intermediate layer**,
[1g]	(c) an **Intermetallic layer**, and
[1h]	(d) a **Superficial layer**,
[1i]	wherein layers (a), (b), (c), and (d) each have a different mean composition from one another,
[1j]	wherein said coating of the hot stamped coated steel product has a thickness greater than 30 micrometers.

Mean iron composition (%)

Layer 1	Layer 2	Layer 3	Layer 4
83.3	45.6	61.5	45.0

Mean aluminum composition (%)

Layer 1	Layer 2	Layer 3	Layer 4
12.6	53.0	29.2	52.4

CX-0083C.0014-0015, .0017-.0019 (Bradley Passat Rpt. ¶¶ 33, 38-39); RX-0086

Invalidity – 2006 Passat

'227 Patent, Claim 2

The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness that is less than half of said thickness of the coating.

Position #	1	2	3	4	5	6	7	Avg
Entire coating	40.0	37.1	33.4	41.9	37.7	36.0	39.2	37.9
Region D	13.9	7.0	6.3	12.0	7.3	7.2	11.2	9.3
Region C	1.0	4.3	4.5	4.6	4.0	4.0	4.8	3.9
Region B	14.9	17.2	13.6	14.8	16.7	16.0	14.4	15.4
Region A	10.2	8.6	9.0	10.5	9.7	8.8	8.8	9.4

CX-0083C.0014-.0015 (Bradley Passat Rpt. ¶ 33) (annotation added); RX-0086

Invalidity – 2006 Passat

'227 Patent, Claim 4

The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness of 17 micrometers or less.

'227 Patent, Claim 5

The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness of 15 micrometers or less.

Position #	1	2	3	4	5	6	7	Avg
Entire coating	40.0	37.1	33.4	41.9	37.7	36.0	39.2	37.9
Region D	13.9	7.0	6.3	12.0	7.3	7.2	11.2	9.3
Region C	1.0	4.3	4.5	4.6	4.0	4.0	4.8	3.9
Region B	14.9	17.2	13.6	14.8	16.7	16.0	14.4	15.4
Region A	10.2	8.6	9.0	10.5	9.7	8.8	8.8	9.4

CX-0083C.0014-.0015 (Bradley Passat Rpt. ¶ 33) (annotation added); RX-0086

Invalidity – 2006 Passat

'227 Patent, Claim 7

The hot stamped coated steel product according to claim 1, wherein the interdiffusion layer has a first mean iron composition, the intermediate layer has a second mean iron composition less than the first mean iron composition; wherein the intermetallic layer has a third mean iron composition, the third mean iron composition less than the first mean iron composition and greater than the second mean iron composition, and the superficial layer has a fourth mean iron composition, the fourth mean iron composition being less than the third mean iron composition.

Mean iron composition (%)

Layer 1 (Interdiffusion Layer)	Layer 2 (Intermediate Layer)	Layer 3 (Intermetallic Layer)	Layer 4 (Superficial Layer)
83.3	45.6	61.5	45.0

CX-0083C.0014-0015, .0017-.0019 (Bradley Passat Rpt. ¶¶ 33, 38-39); RX-0086

Invalidity – 2006 Passat

'227 Patent, Claim 8

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (b).

'227 Patent, Claim 11

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness: that is greater than a thickness of layer (b); that is greater than a thickness of layer (c); and that is greater than a thickness of layer (d).

Position #	1	2	3	4	Avg
Entire coating	35.4	33.7	32.0	36.3	34.4
Region D	9.0	10.1	9.3	8.4	**9.2**
Region C	7.0	6.2	5.6	7.9	**6.7**
Region B	11.8	7.0	8.1	9.0	**9.0**
Region A	7.6	10.4	9.0	11.0	**9.5**

CX-0083C.0016-.0017 (Bradley Passat Rpt. ¶¶ 36-37) (annotation added); RX-0174

Invalidity – 2006 Passat

'227 Patent, Claim 9

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (c).

'227 Patent, Claim 10

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (d).

'227 Patent, Claim 13

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is more than twice a thickness of layer (c).

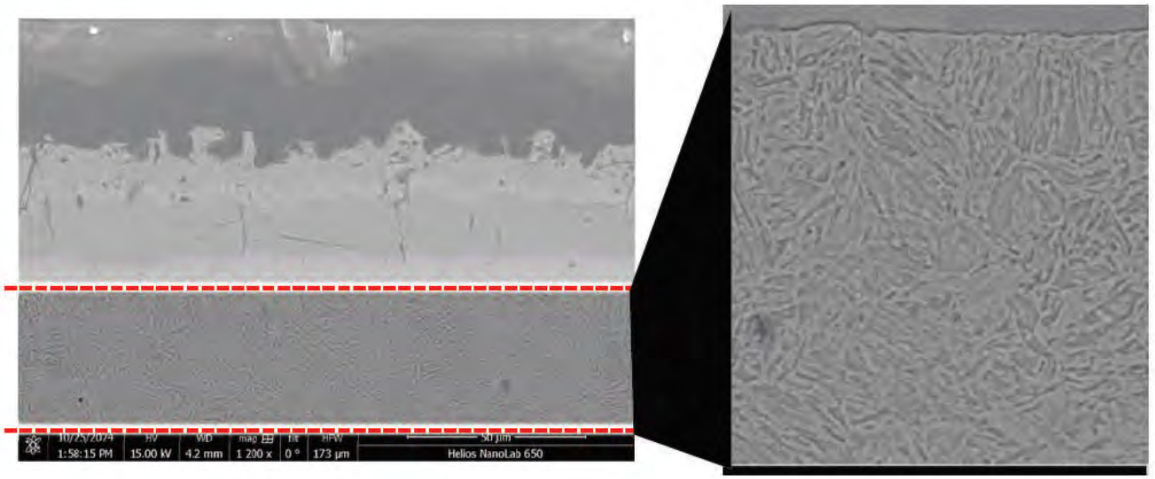
Position #	1	2	3	4	5	6	7	Avg
Entire coating	40.0	37.1	33.4	41.9	37.7	36.0	39.2	37.9
Region D	13.9	7.0	6.3	12.0	7.3	7.2	11.2	9.3
Region C	1.0	4.3	4.5	4.6	4.0	4.0	4.8	3.9
Region B	14.9	17.2	13.6	14.8	16.7	16.0	14.4	15.4
Region A	10.2	8.6	9.0	10.5	9.7	8.8	8.8	9.4

CX-0083C.0014-.0015 (Bradley Passat Rpt. ¶ 33) (annotation added); RX-0086

Invalidity – 2006 Passat

'227 Patent, Claim 15

The hot stamped coated steel product according to claim 1, wherein the hot stamped coated steel product is fully martensitic.



CX-0083C.0020 (Bradley Passat Rpt. ¶ 41) (annotation added); RX-0086

Invalidity – 2006 Passat

'227 Patent, Claim 16

The hot stamped coated steel product according to claim 1, wherein the base steel consists of 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%;

a remainder being iron and impurities inherent in processing.

'602 Patent, Claim 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.

Invalidity – 2006 Passat

'227 Patent, Claim 17

The hot stamped coated steel product according to claim 1, wherein the base steel consists of the following components by weight based on total weight:

- 0.15%<carbon<0.25%,
- 0.8%<manganese<1.8%,
- 0.10%<silicon<0.35%,
- 0.01%<chromium<0.5%,
- titanium<0.1%,
- aluminum<0.1%,
- phosphorus<0.1%,
- sulfur<0.05%,
- 0.002%<boron<0.005%,

a remainder being iron and impurities inherent in processing.

CHEMISTRY

Element	BL7
C[1]	0.215
Mn	1.271
P	0.012
S[1]	0.0016
Si	0.268
Ni	0.020
Cr	0.191
Mo	0.002
Al	0.034
Cu	0.024
Ti	0.037
B	0.002
N[2]	0.006
Fe	Remainder

Results in weight percent unless otherwise indicated
Method(s): CPP-014H (ICP-AES); ASTM E1019-18 (Comb)
[1] Determined by combustion-infrared absorbance
[2] Determined by inert gas fusion-thermal conductivity

CX-0083C.0021-0022 (Bradley Passat Rpt. ¶ 44); RX-0087.0002

Invalidity – 2006 Passat

'227 Patent, Claim 24

The hot stamped coated steel product according to claim 1, wherein the hot stamped coated steel product has a mechanical strength in excess of 1000 MPa.



Dr. John Bradley
VinFast Testing Expert

"Therefore, the tensile strength of the VW 2006 BL7 sample is 1,434.11 MPa, and the yield strength of the VW 2006 BL7 sample is 1082.48 MPa."

CX-0083C.0022-.0022 (Bradley Passat Rpt. ¶¶ 46-48); RX-0087.0001; RX-0095.0063.

Summary

'227 Patent Claim 1

[1pre]	A hot stamped coated steel product, which comprises:	✓
[1a]	(a) a strip of base steel having a first side and a second side; and	✓
[1b]	(b) a coating on at least one of said first side of said strip of base steel and said second side of said strip of base steel, wherein:	✓
[1c]	(i) said coating results from interdiffusion between said base steel and an aluminum or aluminum alloy pre-coating, and	✓
[1d]	(ii) wherein said coating comprises, proceeding from the base steel outwards:	✓
[1e]	(a) an Interdiffusion layer,	✓
[1f]	(b) an Intermediate layer,	✓
[1g]	(c) an Intermetallic layer, and	✓
[1h]	(d) a Superficial layer,	✓
[1i]	wherein layers (a), (b), (c), and (d) each have a different mean composition from one another,	✓
[1j]	wherein said coating of the hot stamped coated steel product has a thickness greater than 30 micrometers.	✓

Summary

Claim 2	The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness that is less than half of said thickness of the coating.	✓
Claim 4	The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness of 17 micrometers or less.	✓
Claim 5	The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness of 15 micrometers or less.	✓
Claim 7	The hot stamped coated steel product according to claim 1, wherein the interdiffusion layer has a first mean iron composition, the intermediate layer has a second mean iron composition less than the first mean iron composition; wherein the intermetallic layer has a third mean iron composition, the third mean iron composition less than the first mean iron composition and greater than the second mean iron composition, and the superficial layer has a fourth mean iron composition, the fourth mean iron composition being less than the third mean iron composition.	✓
Claim 8	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (b).	✓
Claim 9	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (c).	✓
Claim 10	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (d).	✓

Summary

Claim 11	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness: that is greater than a thickness of layer (b); that is greater than a thickness of layer (c); and that is greater than a thickness of layer (d).	✓
Claim 13	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is more than twice a thickness of layer (c).	✓
Claim 15	The hot stamped coated steel product according to claim 1, wherein the hot stamped coated steel product is fully martensitic.	✓
Claim 16	The hot stamped coated steel product according to claim 1, wherein the base steel consists of 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%; a remainder being iron and impurities inherent in processing.	✓
Claim 17	The hot stamped coated steel product according to claim 1, wherein the base steel consists of the following components by weight based on total weight: 0.15%<carbon<0.25%, 0.8%<manganese<1.8%, 0.10%<silicon<0.35%, 0.01%<chromium<0.5%, titanium<0.1%, aluminum<0.1%, phosphorus<0.1%, sulfur<0.05%, 0.002%<boron<0.005%, a remainder being iron and impurities inherent in processing.	✓
Claim 24	The hot stamped coated steel product according to claim 1, wherein the hot stamped coated steel product has a mechanical strength in excess of 1000 MPa.	✓

Lachmann



RDX-002.110

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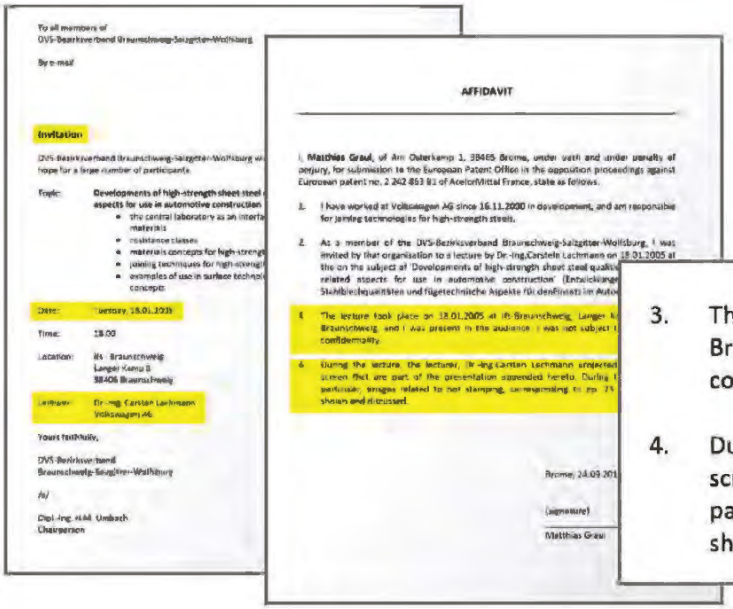
Developments of High-Strength Sheet Steel Qualities and Joining-Related Aspects for Use in Automotive Construction
...the materials perspective!

Carsten Lachmann

18.01.2005

RX-0062 (English); RX-0005 (German)

Invalidity – Lachmann



AFFIDAVIT

Invitation

* * *

Date: Tuesday, 18.01.2005

* * *

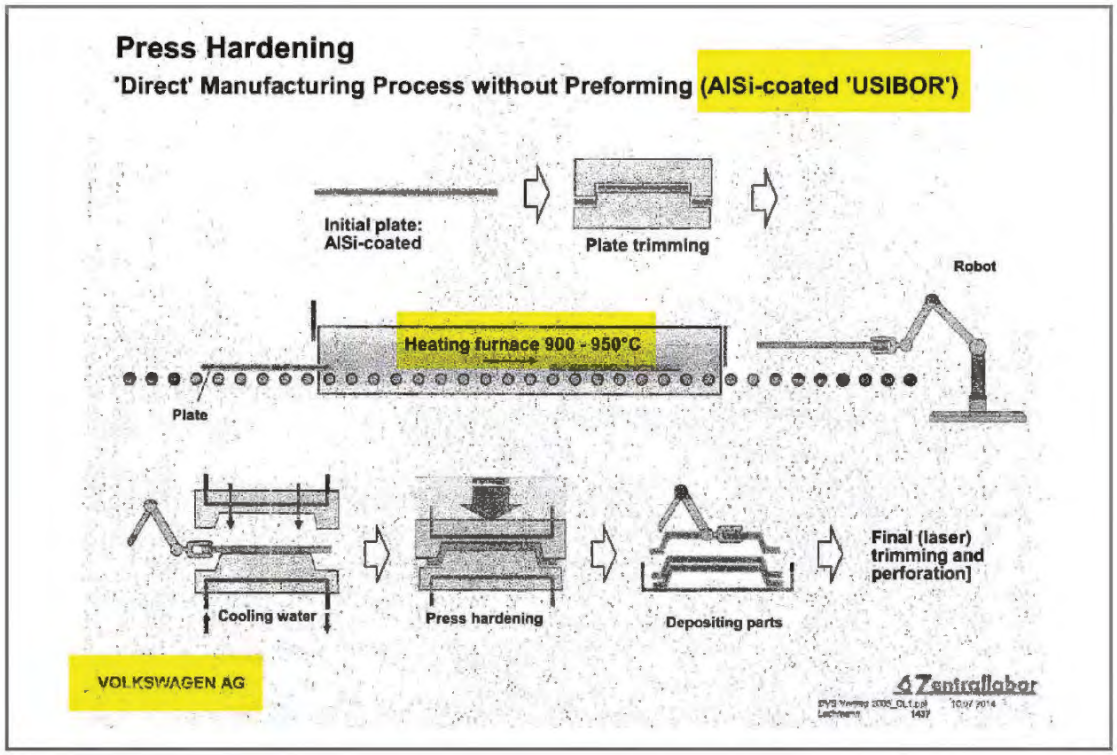
Lecturer: Dr.-Ing. Carsten Lachmann
Volkswagen AG

3. The lecture took place on 18.01.2005 at Ifs-Braunschweig, Langer Kamp 8, 38106 Braunschweig, and I was present in the audience. I was not subject to any duty of confidentiality.

4. During the lecture, the lecturer, Dr.-Ing.Carsten Lachmann projected images on a screen that are part of the presentation appended hereto. During the lecture, in particular, images related to hot stamping, corresponding to pp. 23 et seq., were shown and discussed.

RX-0062.0001 – .0003 (English)

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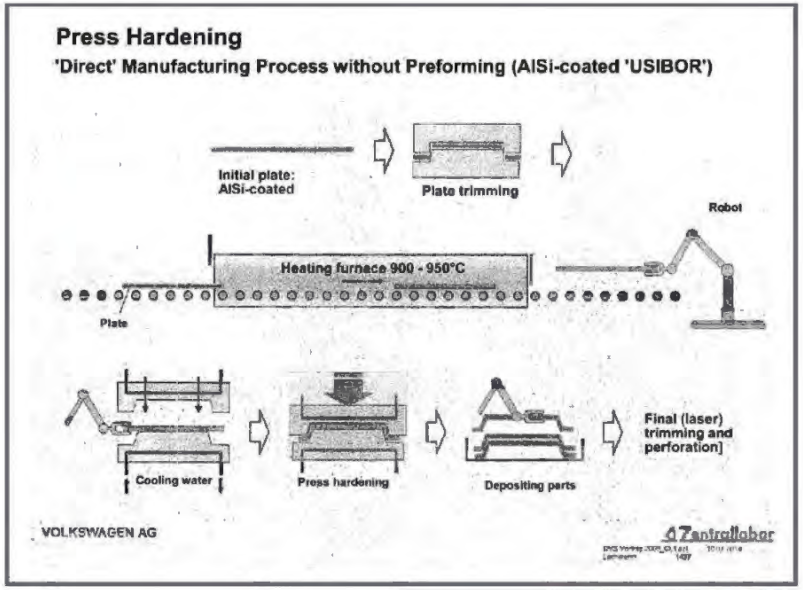


RX-0062.0004 (English)

Invalidity – Lachmann

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

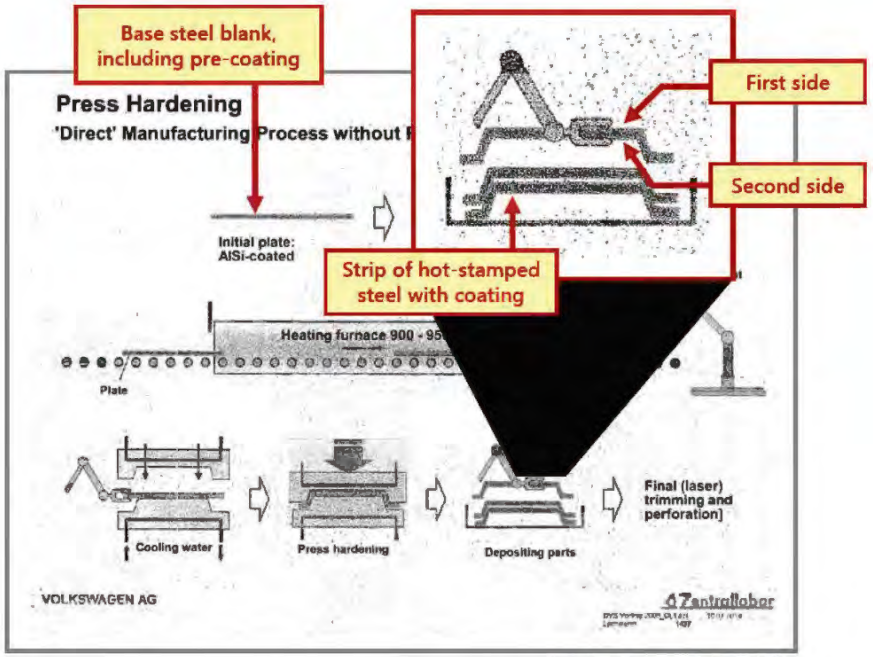


RX-0062.0004 (English)

Invalidity – Lachmann

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

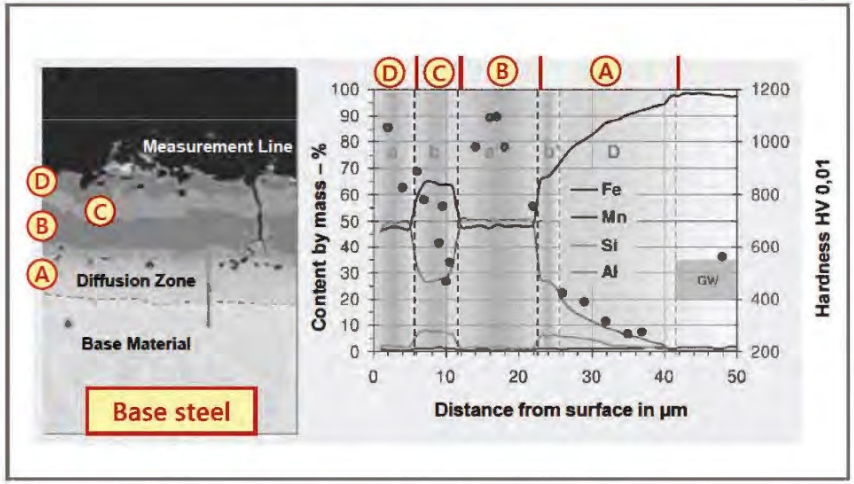


RX-0062.0004 (English)

Invalidity – Lachmann

'602 Patent, Claim 1

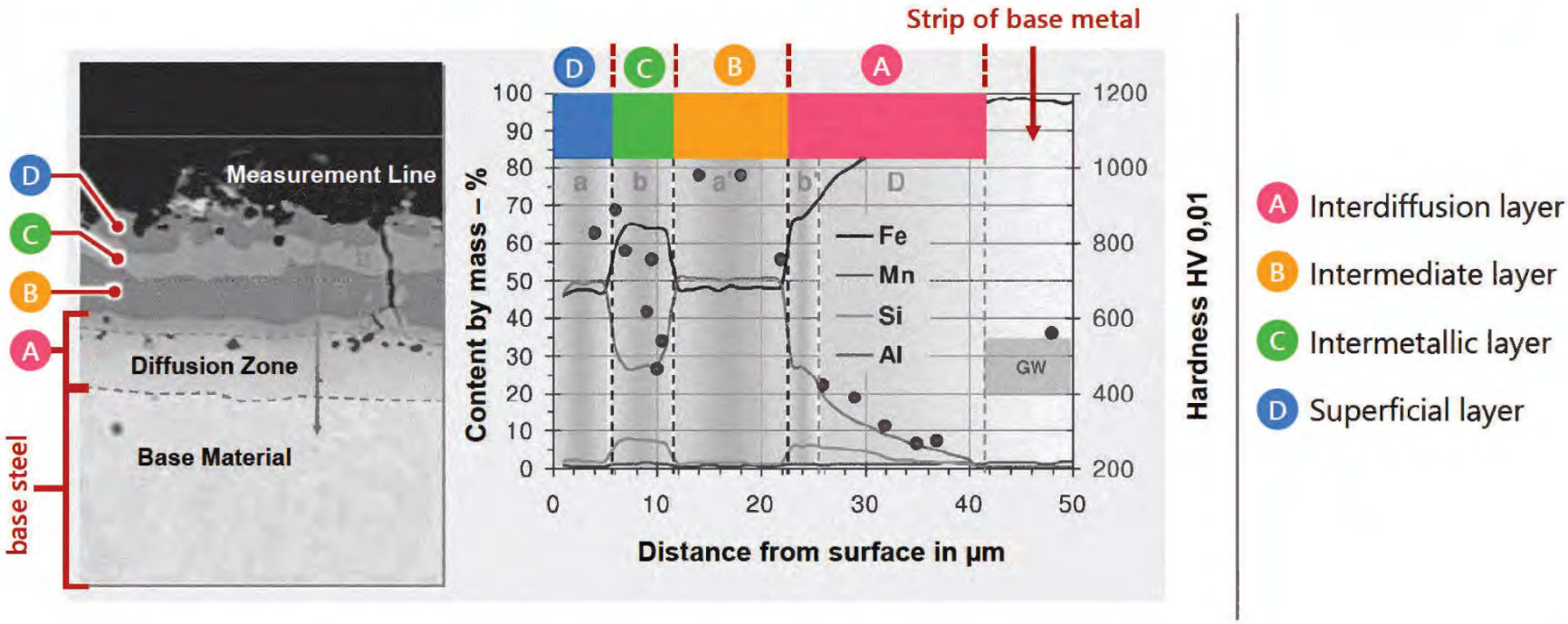
[1pre]	A precoated steel product comprising
[1a]	a strip of base steel having a first side and a second side; and
[1b]	a coating on at least one of the first side of the strip of base steel and the second side of the strip of base steel, wherein the coating results from interdiffusion between the base steel, and an aluminum or aluminum alloy pre-coating, and wherein the coating includes, proceeding from the base steel outwards:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.



A. Interdiffusion layer
B. Intermediate layer
C. Intermetallic layer
D. Superficial layer

RX-0062.0007 (English)

Invalidity – Lachmann

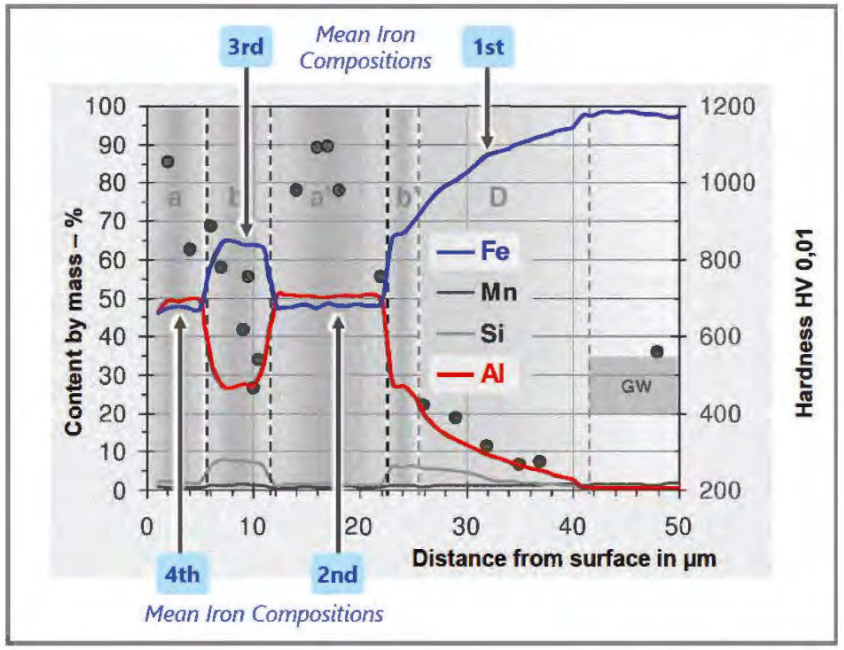


RX-0062.0007 (English) (annotated)

Invalidity – Lachmann

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

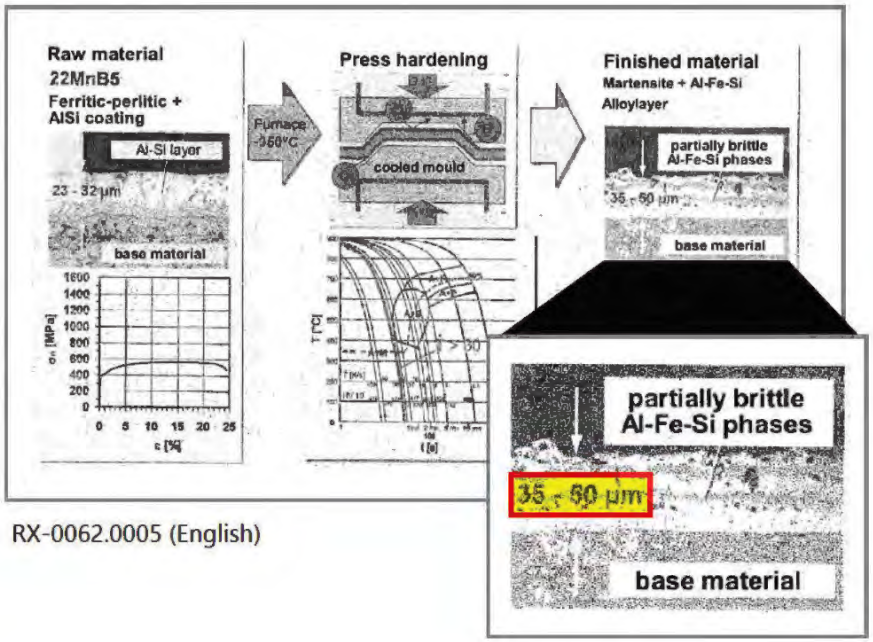


RX-0062.0007 (English)

Invalidity – Lachmann

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

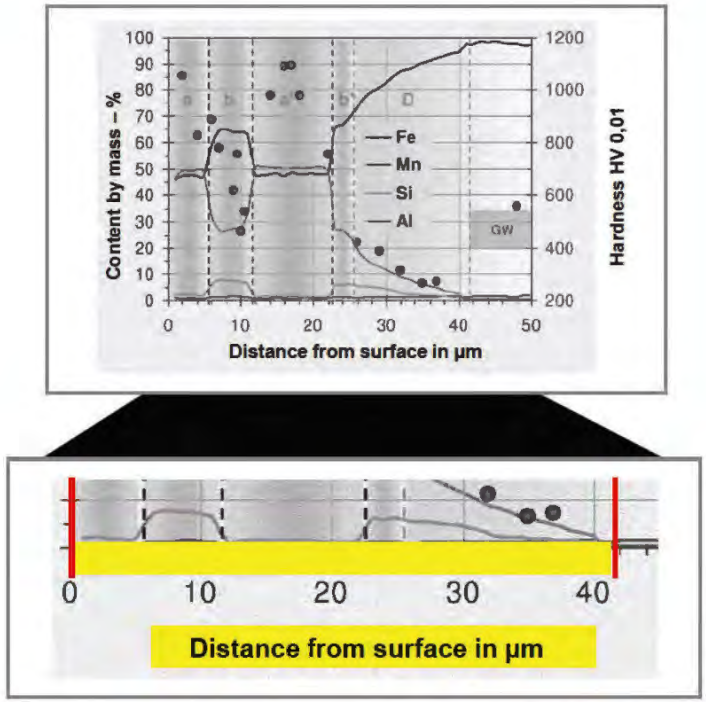


RX-0062.0005 (English)

Invalidity – Lachmann

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.



RX-0062.0007 (English)

Summary

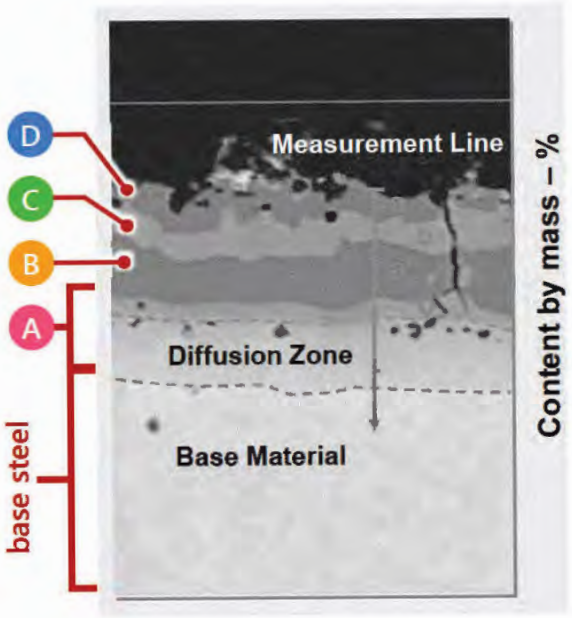
'602 Patent, Claim 1

[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, 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:	✓
[1c]	(a) an interdiffusion layer having a first mean iron composition,	✓
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✓
[1e]	(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	✓
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,	✓
[1g]	wherein the coating has a thickness greater than 30 micrometers.	✓

Invalidity – Lachmann

'602 Patent, Claim 2

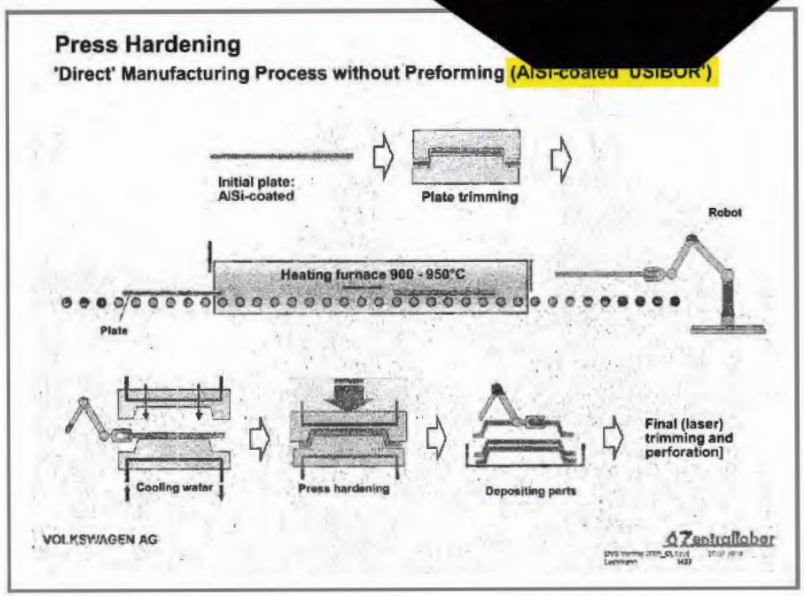
The precoated steel product as recited in claim 1 wherein the layers (c) and (d) are quasi continuous by occupying at least 90% of a level corresponding to each of the layers (c) and (d) and wherein less than 10% of layer (c) is present at an extreme surface of the product.



RX-0062.0007 (English)

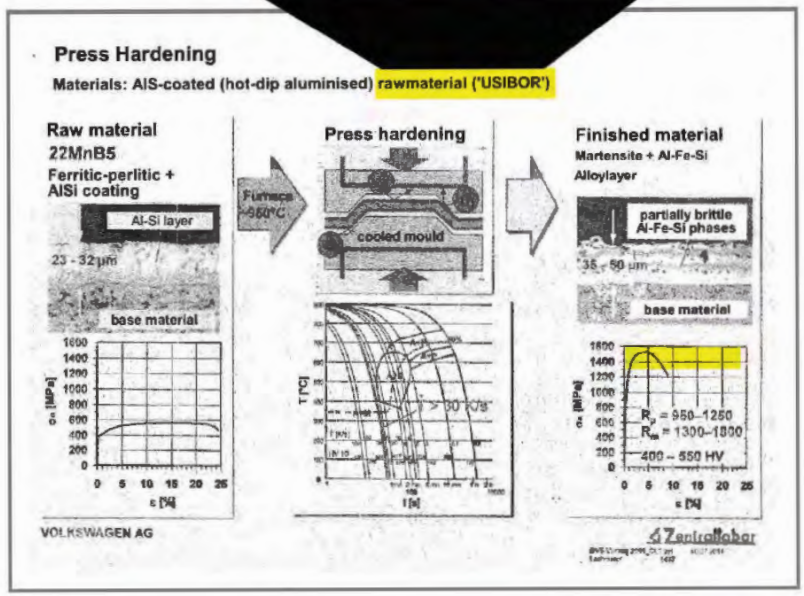
Claim 3: Lachman Uses USIBOR 1500

(AlSi-coated 'USIBOR')



RX-0062.0004 (English)

rawmaterial ('USIBOR')



RX-0062.0005 (English)

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi Global product file

As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

See also RX-0048; RX-0044.0020; RX-0081; CX-0890C

Invalidity – Lachmann (Usibor 1500)

2-1 Chemical analysis and coating.

USIBOR 1500 is a carbon/manganese steel micro-alloyed with boron.

	C	Mn	Si	S	Cr	Al	B	Ti
Mini	200	1100	150		150	20	2	20
Maxi	250	1350	350	8	300	60	4	50

Chemical analysis in thousandths of a %.

CHEMICAL COMPOSITION OF THE BASE MATERIAL

USIBOR 1500 is a carbon-manganese steel microalloyed with boron.

Table III. Chemical composition of pre-coated boron steel in thousandths of percent

	C	Mn	Si	S	Cr	Al	B	Ti
Min.	200	1100	150		150	20	2	20
Max.	250	1350	350	8	300	60	4	50

	C	Mn	P	S	Si	Al	Cr	N	Ti	B
Mini	0.2	1.1			0.15	0.02	0.15		0.02	0.002
Maxi	0.25	1.35	0.025	0.008	0.35	0.06	0.3	0.009	0.05	0.004

Table 2.1: Chemical composition of Usibor 1500 (% mass)

Chemicol composition

Cold rolled steel | Hot rolled steel

22MnB5		Ductibor® 480		Ductibor® 500	
Max. C (%)	0.25	Max. C (%)	0.1	Max. C (%)	0.1
Max. Si (%)	0.4	Max. Si (%)	0.5	Max. Si (%)	0.5
Max. Mn (%)	1.4	Max. Mn (%)	1.9	Max. Mn (%)	1.9
Max. P (%)	0.03	Max. P (%)	0.03	Max. P (%)	0.03
Max. S (%)	0.01	Max. S (%)	0.025	Max. S (%)	0.025
Al (%)	0.01 - 0.1	Al (%)	0.015 - 0.2	Al (%)	0.015 - 0.2
Max. B (%)	0.005	Max. B (%)	0.001	Max. B (%)	0.001
Max. Ti + Nb (%)	0.12	Max. Ti + Nb (%)	0.24	Max. Ti + Nb (%)	0.24
Max. Cr + Mo (%)	1	Max. Cr + Mo (%)		Max. Cr + Mo (%)	

Ductibor® 1000		Usibor® 1500		Usibor® 2000	
Max. C (%)	0.12	Max. C (%)	0.25	Max. C (%)	0.37
Max. Si (%)	0.4	Max. Si (%)	0.4	Max. Si (%)	0.7
Max. Mn (%)	2	Max. Mn (%)	1.4	Max. Mn (%)	1.4
Max. P (%)	0.3	Max. P (%)	0.03	Max. P (%)	0.03
Max. S (%)	0.01	Max. S (%)	0.01	Max. S (%)	0.01
Al (%)	0.01 - 0.1	Al (%)	0.01 - 0.1	Al (%)	0.01 - 0.06
Max. B (%)	0.01	Max. B (%)	0.005	Max. B (%)	0.005
Max. Ti + Nb (%)	0.12	Max. Ti + Nb (%)	0.12	Max. Ti + Nb (%)	0.12
Max. Cr + Mo (%)	0.6	Max. Cr + Mo (%)	1	Max. Cr + Mo (%)	1.4

USIBOR 1500P is a 22MnB5 manganese-boron precoated steel for hot stamping. It contains added carbon, manganese, chromium and boron for good hardenability between hot stamping tools after austenitizing in furnaces. At the same time, it contains silicon (solid solution hardening) and titanium (to trap N, thus avoiding the formation of B nitrides). The chemical composition is shown in Table 1:

Table 1: Chemical composition of USIBOR 1500P

	mini	max	
C	2000	2500	ppm
Mn	11000	13500	ppm
P		250	ppm
S		80	ppm
If	1500	3500	ppm
Al	200	600	ppm
Ti	200	500	ppm
N		90	ppm
Cr	1500	3000	ppm
B	20	40	ppm

RX-0048; RX-0044.0020; RX-0081 (Vaissiere); RX-0019 (Cornette); CX-0890C

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi Global product file

As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi
Global product file
As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi Global product file

As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi
Global product file
As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi
Global product file
As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi Global product file

As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi Global product file

As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi Global product file

As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann (Usibor 1500)

'602 Patent, Claim 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.

Usibor®1500 Alusi
Global product file
As coated specification
Update January 2021

1) Chemical Composition (wgt %)

C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file")

Invalidity – Lachmann in View of Laurent

'602 Patent, Claim 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.

'602 Patent, Claim 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.

> Titanium, 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.

RX-0109.0003 (Laurent at 4:25-28)

Invalidity – Lachmann in View of Laurent



(12) **United States Patent**
Laurent et al.

(10) **Patent No.: US 6,296,805 B1**
(45) **Date of Patent: Oct. 2, 2001**

(54) COATED HOT- AND COLD-ROLLED STEEL SHEET COMPRISING A VERY HIGH RESISTANCE AFTER THERMAL TREATMENT

(10) **Patent No.: US 6,296,805 B1**

(54) **COATED HOT- AND COLD-ROLLED STEEL SHEET COMPRISING A VERY HIGH RESISTANCE AFTER THERMAL TREATMENT**

(45) **Date of Patent: Oct. 2, 2001**

RX-0109.0001 (Laurent)

Invalidity – Lachmann in View of Laurent



United States Patent
Laurent et al.

Patent No.: US 6,296,805 B1
Date of Patent: Oct. 2, 2001

(54) COATED HOT AND COLD ROLLED STEEL SHEET COMPRISING A VERY HIGH RESISTANCE AFTER THERMAL TREATMENT

(75) Inventors: Jean-Pierre Laurent, Isbes; Jean-Paul Hoonaert, Flobecq; Dominique Spehner, Seclin; Jacques Heirwe, Salon de Provence; all of (FR)

(73) Assignee: Sollac, Puteaux (FR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/350,100

(22) Filed: Jul. 9, 1999

(30) Foreign Application Priority Data

(51) Int. Cl.[7] C21D 8/02; B32B 15/01; C22C 38/16

(52) U.S. Cl. 428/659; 428/699; 148/531; 148/537

(58) Field of Search 428/659, 699; 420/104, 146/537, 531

(56) References Cited

U.S. PATENT DOCUMENTS

FOREIGN PATENT DOCUMENTS

OTHER PUBLICATIONS

16 Claims, No Drawings

The subject of the invention is a hot-rolled steel sheet, which then can be cold-rolled, coated, the steel in the sheet having the following composition by 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<0.01%

sulfur<0.05%

0.0005%<boron<0.08%, the remainder being iron and impurities inherent in processing, the sheet ensuring a very high mechanical resistance after thermal treatment and the aluminum-based coating ensuring a high resistance to corrosion.

RX-0109.0002 (Laurent) at 1:47-66

Invalidity – Lachmann in View of Cornette

'602 Patent, Claim 9

The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 15 micrometers.

'602 Patent, Claim 10

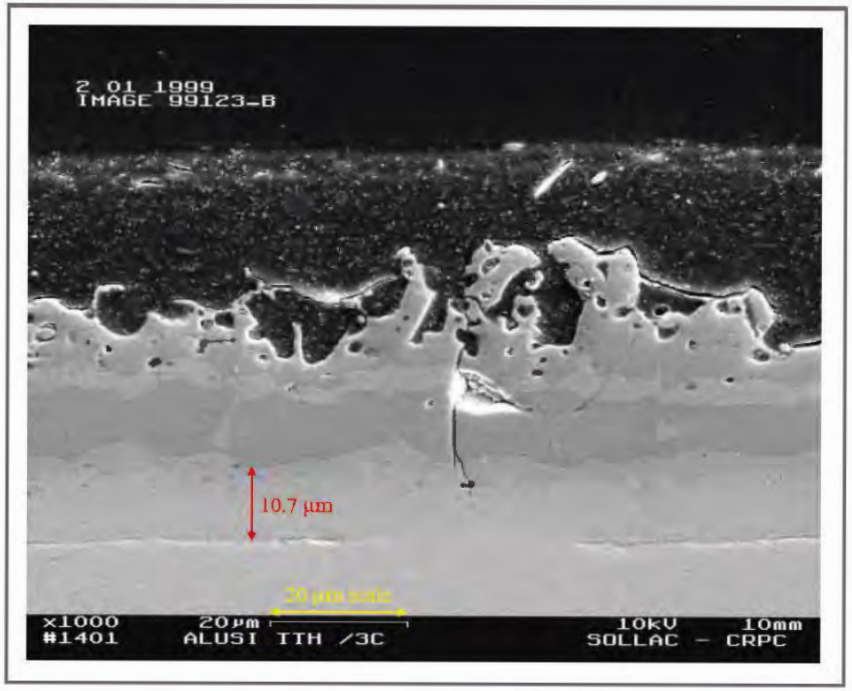
The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 10 micrometers.

'602 Patent, Claim 18

The precoated steel product as recited in claim 1 wherein the interdiffusion layer has a thickness of from 1 micron to 15 microns.

'602 Patent, Claim 26

The precoated steel product as recited in claim 24 wherein the layer (a) has a thickness less than 15 micrometers.



RX-0019.0010 (Cornette) at FIG. 22

Invalidity – Lachmann in View of Cornette

2001

D. CORNETTE, T. HOURMAN, O. HUDIN, J. P LAURENT, A. REYNAERT
Usinor Research

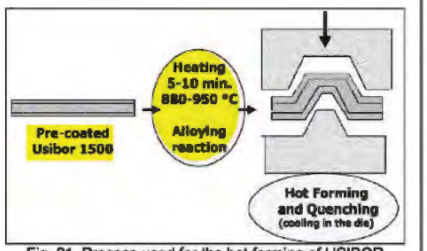
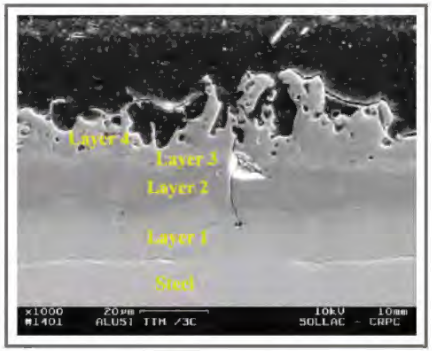


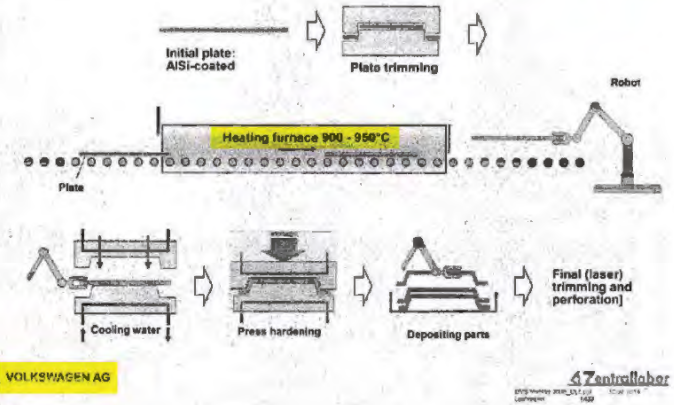
Fig. 21. Process used for the hot forming of USIBOR 1500 Pre-coated.



RX-0019 (Cornette)

2005

Press Hardening
'Direct' Manufacturing Process without Preforming (AlSi-coated 'USIBOR')



RX-0062.0004 (English)

Cornette



SAE TECHNICAL PAPER SERIES

High Strength S

2001-01-0078

HIGH STRENGTH STEELS FOR AUTOMOTIVE SAFETY PARTS

ABSTRACT

INTRODUCTION

TRIP STEELS

PRINCIPLES AND MANUFACTURE

DUAL PHASE

RX-0019.0003

High Strength Steels for Automotive Safety Parts

SAE 2001 World Congress
Detroit, Michigan
March 5-8, 2001

2001-01-0078

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RX-0019 (Cornette) at 1-2

RX-0103.0001 (Declaration of Mel DeSart)

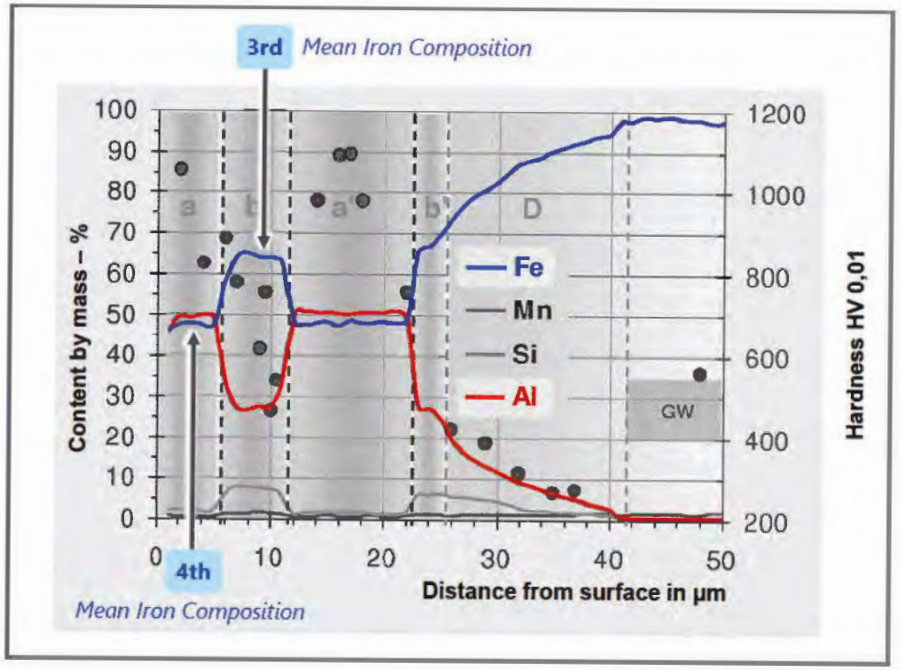
Invalidity – Lachmann

'602 Patent, Claim 20

"[t]he precoated steel product as recited in claim 1 wherein the fourth mean iron composition is lower than the third mean iron composition.

'602 Patent, Claim 22

The precoated steel product as recited in claim 21 wherein the fourth mean iron composition is lower than the third mean iron composition.



RX-0062.0007 (English)

Invalidity – Lachmann

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

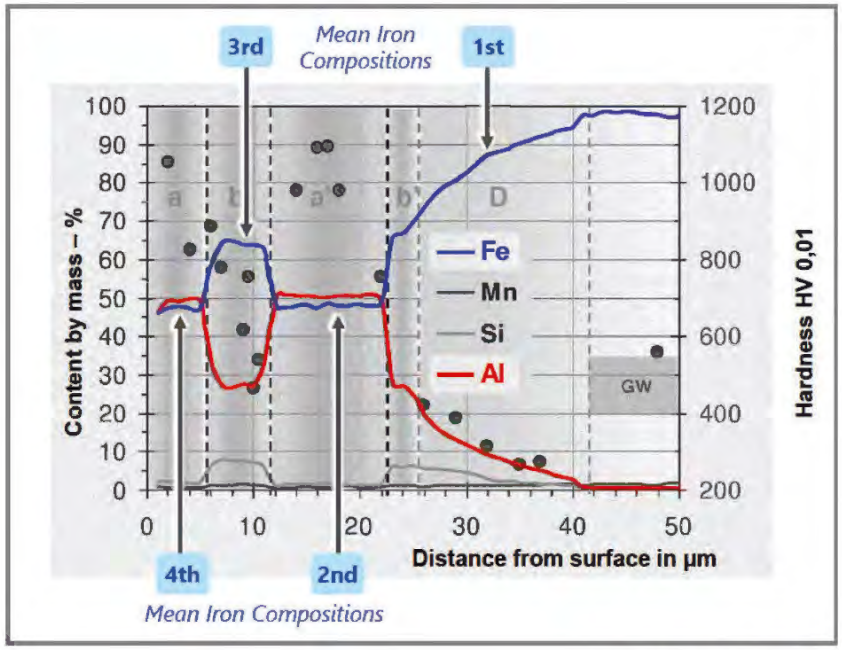
'602 Patent, Claim 21

[21pre]	A precoated steel product comprising
[21a]	a strip of base steel having a first side and a second side; and
[21b]	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,
[21c]	(a) an interdiffusion layer having a first mean iron composition,
[21d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[21e]	(c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third mean iron concentration being higher than the second mean iron composition, and
[21f]	(d) a superficial layer having a fourth mean iron composition different from the first, second and third mean iron compositions,
[21g]	wherein the coating has a thickness greater than 30 micrometers.

Invalidity – Lachmann

'602 Patent, Claim 21

[21pre]	A precoated steel product comprising
[21a]	a strip of base steel having a first side and a second side; and
[21b]	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,
[21c]	(a) an interdiffusion layer having a first mean iron composition,
[21d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[21e]	(c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third mean iron concentration being higher than the second mean iron composition, and
[21f]	(d) a superficial layer having a fourth mean iron composition different from the first, second and third mean iron compositions,
[21g]	wherein the coating has a thickness greater than 30 micrometers.



RX-0062.0007 (English)

Invalidity – Lachmann

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

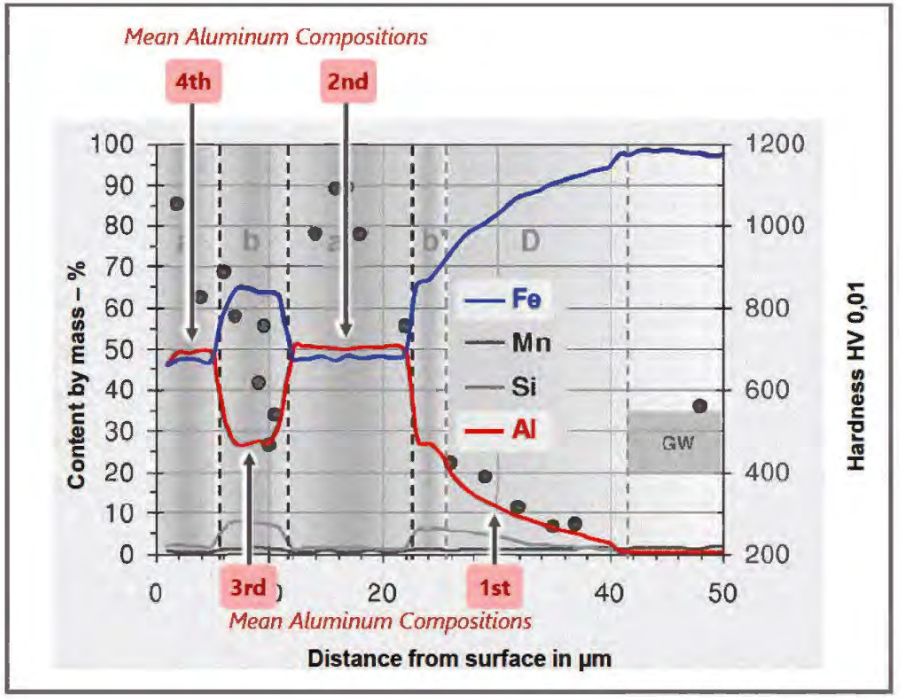
'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.

Invalidity – Lachmann

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.

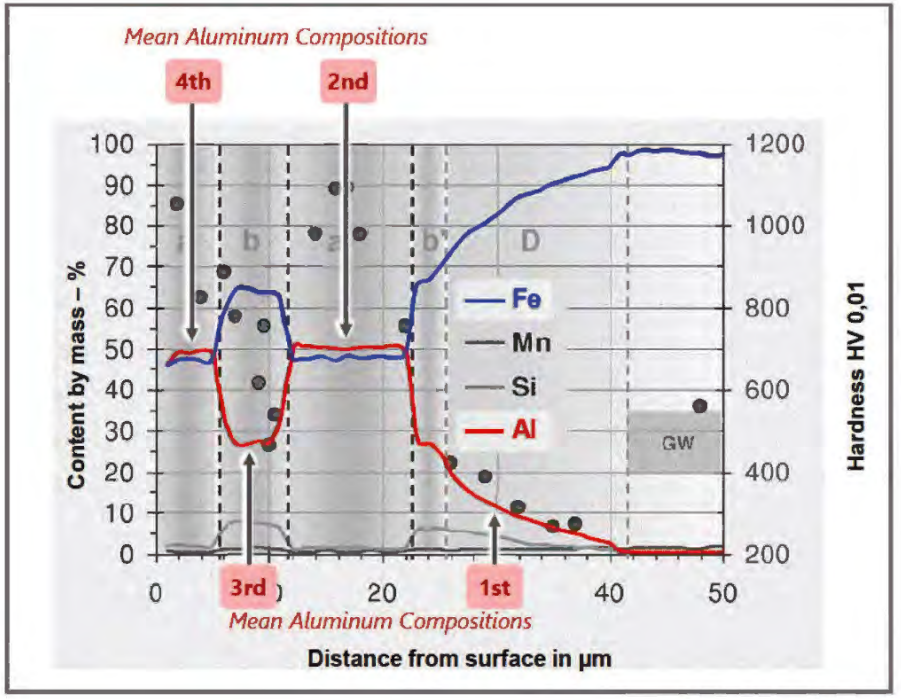


RX-0062.0007 (English)

Invalidity – Lachmann

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.

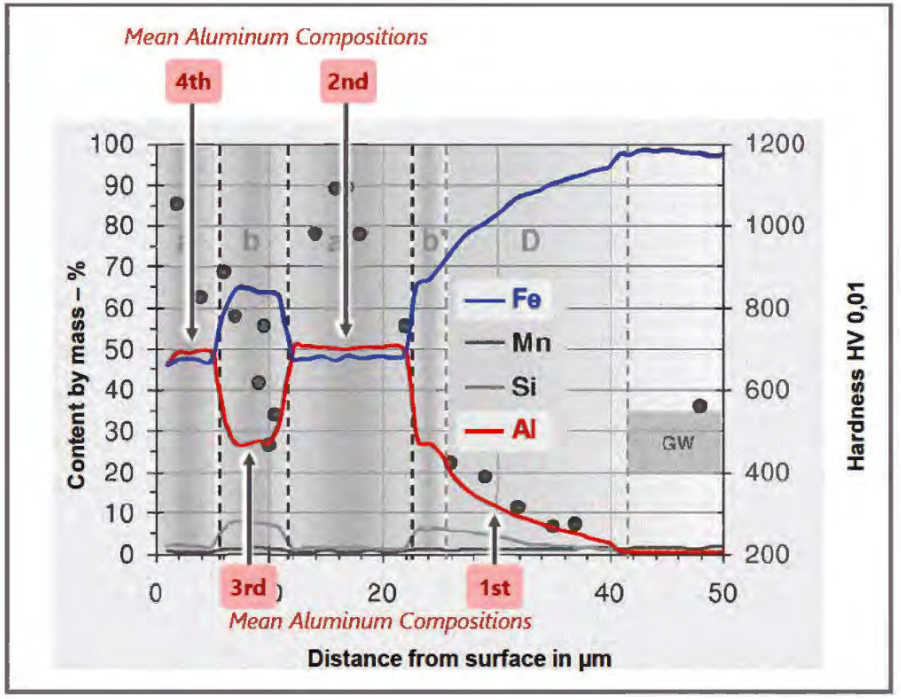


RX-0062.0007 (English)

Invalidity – Lachmann

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.

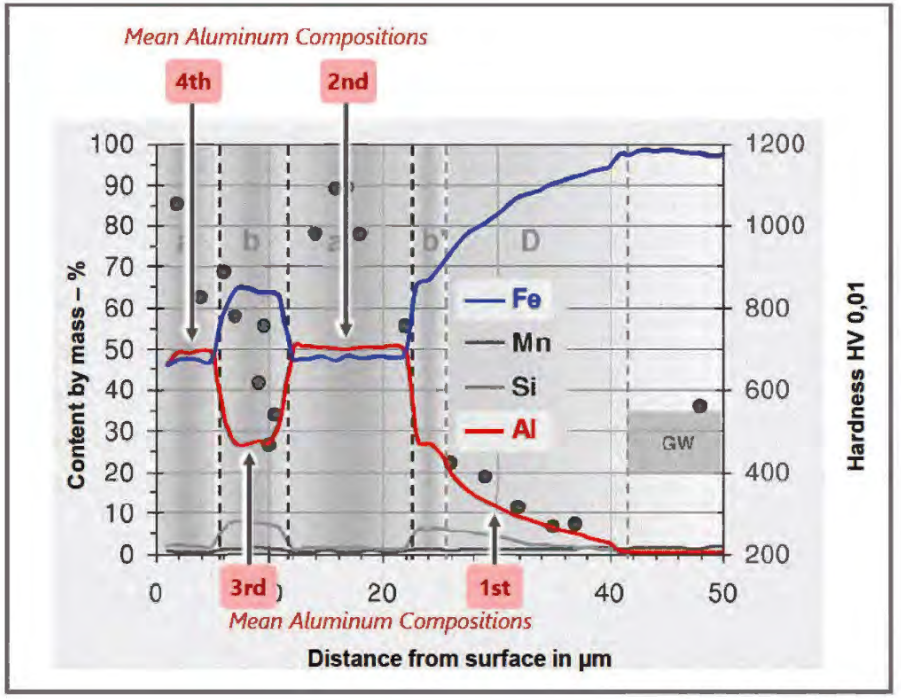


RX-0062.0007 (English)

Invalidity – Lachmann

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising
[24a]	a strip of base steel having a first side and a second side; and
[24b]	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,
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;
[24g]	wherein the coating has a thickness greater than 30 micrometers.



RX-0062.0007 (English)

Summary

'602 Patent, 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, 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:	✓
[1c]	(a) an interdiffusion layer having a first mean iron composition,	✓
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✓
[1e]	(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	✓
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,	✓
[1g]	wherein the coating has a thickness greater than 30 micrometers.	✓

Summary

'602 Patent, Claim 21

[21pre]	A precoated steel product comprising	✓
[21a]	a strip of base steel having a first side and a second side; and	✓
[21b]	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,	✓
[21c]	(a) an interdiffusion layer having a first mean iron composition,	✓
[21d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✓
[21e]	(c) an intermetallic layer having a third mean iron composition different from the first and second mean iron compositions, the third mean iron concentration being higher than the second mean iron composition, and	✓
[21f]	(d) a superficial layer having a fourth mean iron composition different from the first, second and third mean iron compositions,	✓
[21g]	wherein the coating has a thickness greater than 30 micrometers.	✓

Summary

'602 Patent, Claim 24

[24pre]	A precoated steel product comprising	✓
[24a]	a strip of base steel having a first side and a second side; and	✓
[24b]	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,	✓
[24c]	(a) an interdiffusion layer having a first mean aluminum composition,	✓
[24d]	(b) an intermediate layer having a second mean aluminum composition different from the first mean aluminum composition,	✓
[24e]	(c) an intermetallic layer having a third mean aluminum composition different from the first and second mean aluminum compositions, and	✓
[24f]	(d) a superficial layer having a fourth mean aluminum composition different from the first, second and third mean aluminum compositions, the second mean aluminum composition being greater than the third mean aluminum composition;	✓
[24g]	wherein the coating has a thickness greater than 30 micrometers.	✓

Summary

Claim 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	The precoated steel product as recited in claim 1 wherein the base steel includes the following components by weight based on total weight: 0.15%<carbon<0.5%; 0.5%<manganese<3%; 0.1%<silicon<0.5%; 0.01%<chromium<1%; titanium<0.2%; aluminum<0.1%; phosphorus<0.1%; sulfur<0.05%; 0.0005%<boron<0.08%; and further comprises iron and impurities inherent in processing.	✓
Claim 4	The precoated steel product as recited in claim 1 wherein the base steel comprises the following components by weight based on total weight: 0.20%<carbon<0.5%; 0.8%<manganese<1.5%; 0.1%<silicon<0.35%; 0.01%<chromium<1%; titanium<0.1%; aluminum<0.1%; phosphorus<0.05%; sulfur<0.03%; 0.0005%<boron<0.01%; and further comprises iron and impurities inherent in processing.	✓
Claim 7	The precoated steel product as recited in claim 1 wherein a ratio of titanium to nitrogen in the base steel in weight % is in excess of 3.42.	✓
Claim 8	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.	✓

Summary

Claim 9	The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 15 micrometers.	✓
Claim 10	The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 10 micrometers.	✓
Claim 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 20	"[t]he precoated steel product as recited in claim 1 wherein the fourth mean iron composition is lower than the third mean iron composition.	✓
Claim 22	The precoated steel product as recited in claim 21 wherein the fourth mean iron composition is lower than the third mean iron composition.	✓
Claim 26	The precoated steel product as recited in claim 24 wherein the layer (a) has a thickness less than 15 micrometers.	✓

Asserted Claims – '227 Patent

'602 Patent, 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, 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:
[1c]	(a) an interdiffusion layer having a first mean iron composition,
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,
[1e]	(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
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,
[1g]	wherein the coating has a thickness greater than 30 micrometers.

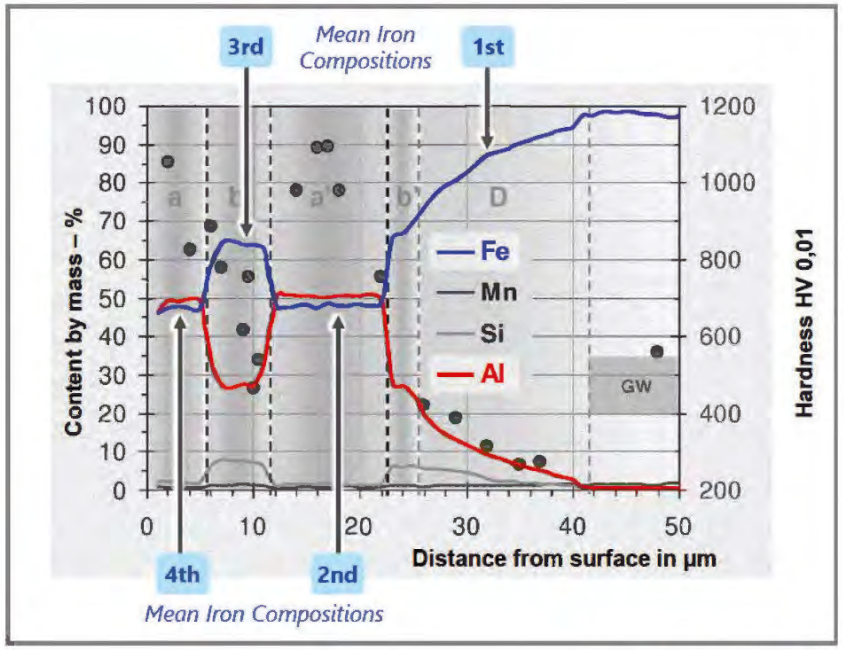
'227 Patent, Claim 1

[1pre]	A hot stamped coated steel product, which comprises:
[1a]	(a) a strip of base steel having a first side and a second side; and
[1b]	(b) a coating on at least one of said first side of said strip of base steel and said second side of said strip of base steel, wherein:
[1c]	(i) said coating results from interdiffusion between said base steel and an aluminum or aluminum alloy pre-coating, and
[1d]	(ii) wherein said coating comprises, proceeding from the base steel outwards:
[1e]	(a) an Interdiffusion layer,
[1f]	(b) an Intermediate layer,
[1g]	(c) an Intermetallic layer, and
[1h]	(d) a Superficial layer,
[1i]	wherein layers (a), (b), (c), and (d) each have a different mean composition from one another,
[1j]	wherein said coating of the hot stamped coated steel product has a thickness greater than 30 micrometers.

Invalidity – Lachmann

'227 Patent, Claim 1

[1pre]	A hot stamped coated steel product, which comprises:
[1a]	(a) a strip of base steel having a first side and a second side; and
[1b]	(b) a coating on at least one of said first side of said strip of base steel and said second side of said strip of base steel, wherein:
[1c]	(i) said coating results from interdiffusion between said base steel and an aluminum or aluminum alloy pre-coating, and
[1d]	(ii) wherein said coating comprises, proceeding from the base steel outwards:
[1e]	(a) an Interdiffusion layer,
[1f]	(b) an Intermediate layer,
[1g]	(c) an Intermetallic layer, and
[1h]	(d) a Superficial layer,
[1i]	wherein layers (a), (b), (c), and (d) each have a different mean composition from one another,
[1j]	wherein said coating of the hot stamped coated steel product has a thickness greater than 30 micrometers.

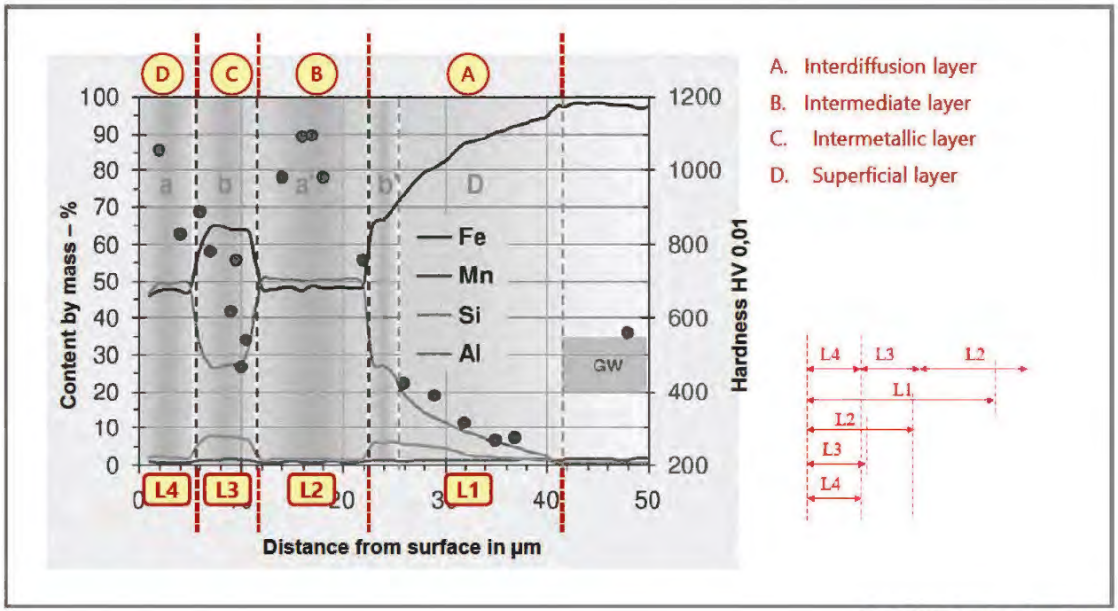


RX-0062.0007 (English)

Invalidity – Lachmann

'227 Patent, Claim 2

The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness that is less than half of said thickness of the coating.



RX-0062.0007 (English)

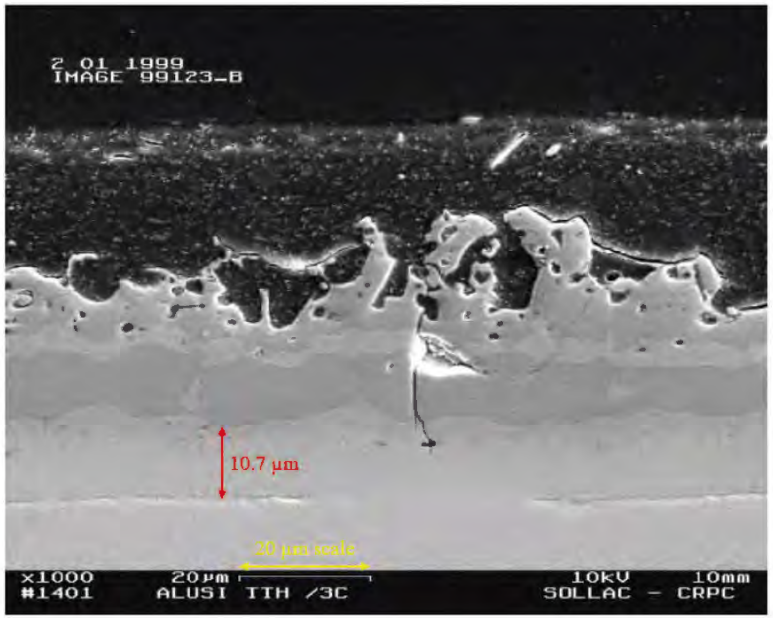
Invalidity – Lachmann in View of Cornette

'227 Patent, Claim 4

The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness of 17 micrometers or less.

'227 Patent, Claim 5

The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness of 15 micrometers or less.

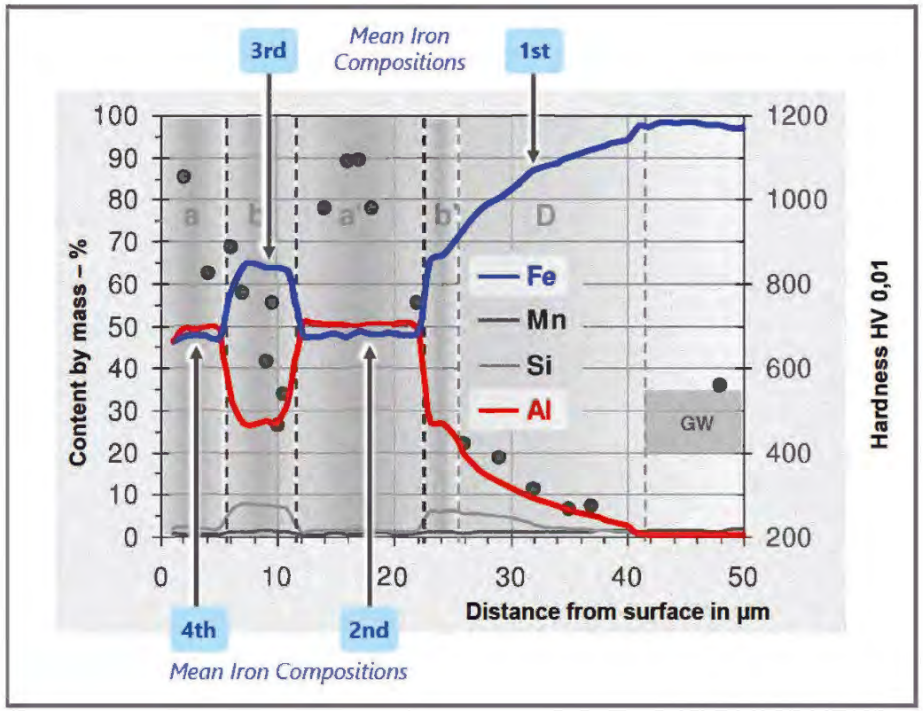


RX-0019.0010 (Cornette) FIG. 22

Invalidity – Lachmann

'227 Patent, Claim 7

The hot stamped coated steel product according to claim 1, wherein the interdiffusion layer has a first mean iron composition, the intermediate layer has a second mean iron composition less than the first mean iron composition; wherein the intermetallic layer has a third mean iron composition, the third mean iron composition less than the first mean iron composition and greater than the second mean iron composition, and the superficial layer has a fourth mean iron composition, the fourth mean iron composition begin less than the third mean iron composition.

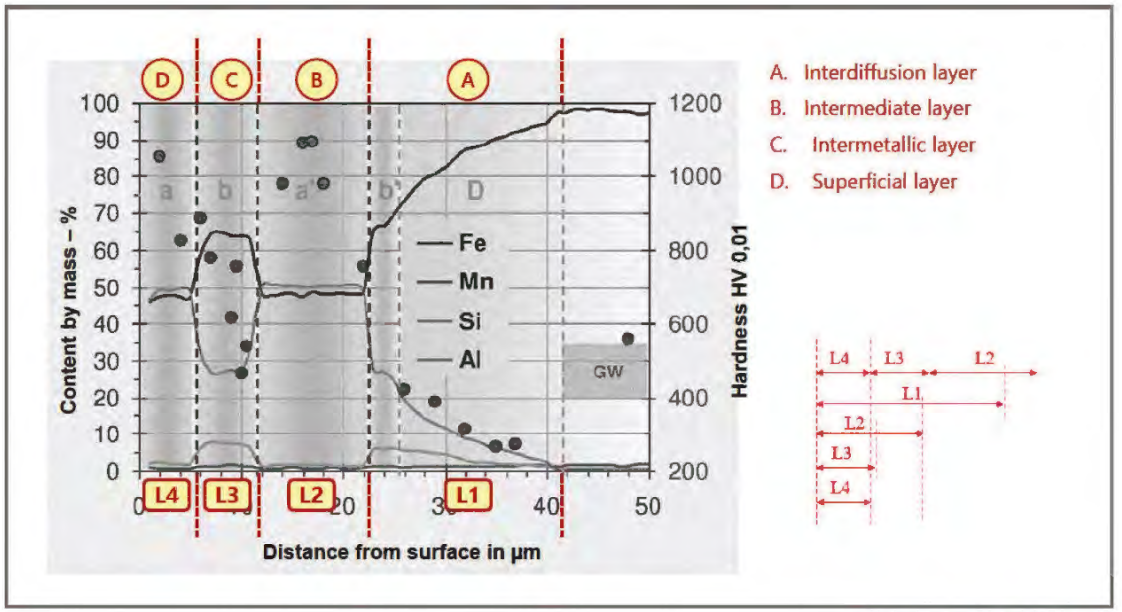


RX-0062.0007 (English)

Invalidity – Lachmann

'227 Patent, Claim 8

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (b).



RX-0062.0007 (English)

Invalidity – Lachmann

'227 Patent, Claim 9

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (c).

'227 Patent, Claim 10

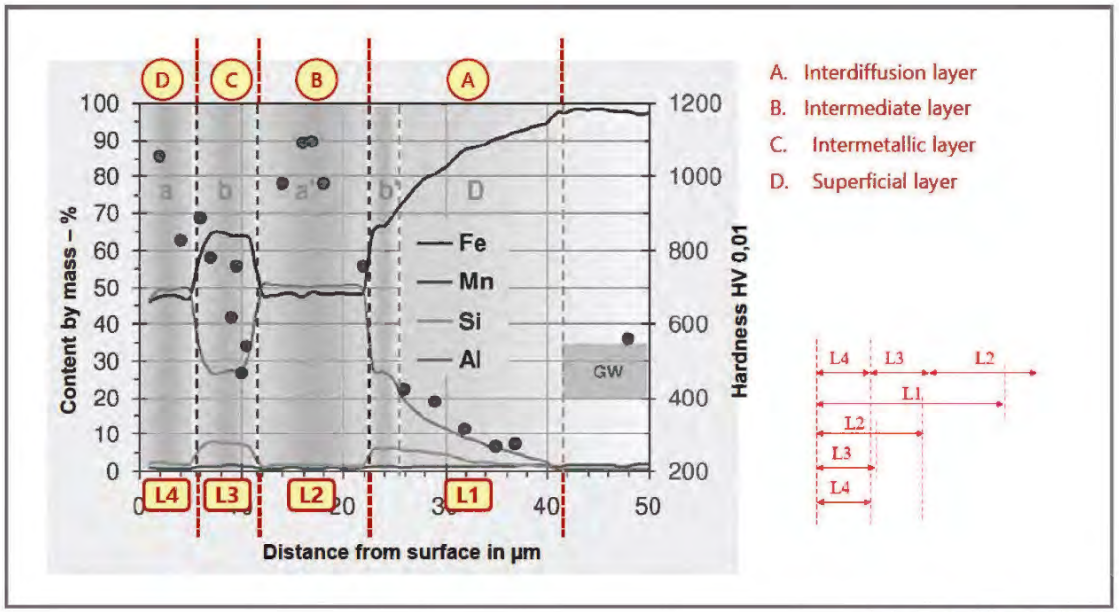
The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (d).

'227 Patent, Claim 11

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness: that is greater than a thickness of layer (b); that is greater than a thickness of layer (c); and that is greater than a thickness of layer (d).

'227 Patent, Claim 13

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is more than twice a thickness of layer (c).

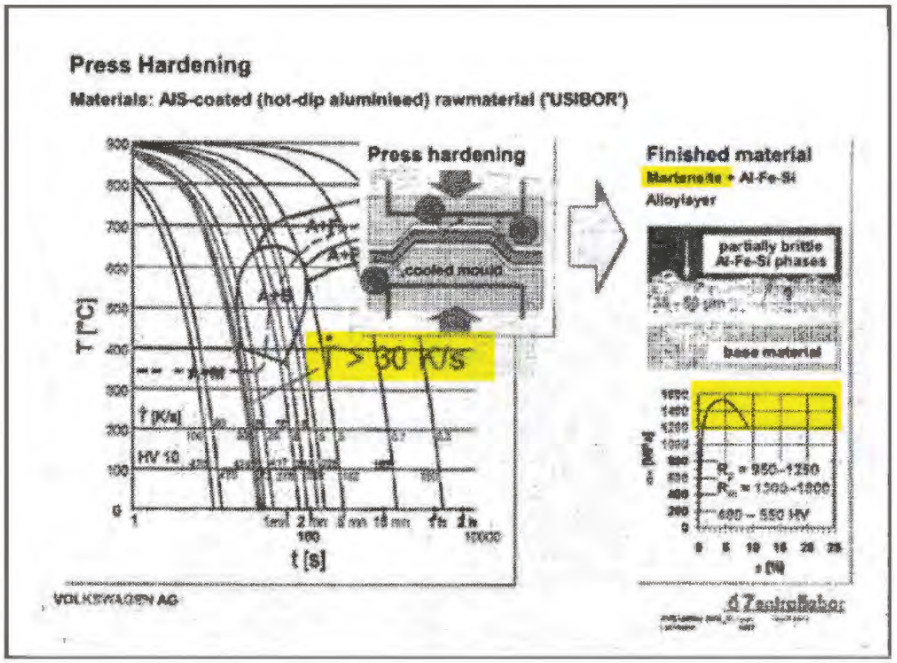


RX-0062.0007 (English)

Invalidity – Lachmann

'227 Patent, Claim 15

The hot stamped coated steel product according to claim 1, wherein the hot stamped coated steel product is fully martensitic.



RX-0062.0006 (English)

Invalidity – Lachmann in view of Laurent

'227 Patent, Claim 16

The hot stamped coated steel product according to claim 1, wherein the base steel consists of 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%;

a remainder being iron and impurities inherent in processing.

'602 Patent, Claim 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.

Invalidity – Lachmann in view of Laurent

'227 Patent, Claim 17

The hot stamped coated steel product according to claim 1, wherein the base steel consists of the following components by weight based on total weight:

- 0.15%<carbon<0.25%,
- 0.8%<manganese<1.8%,
- 0.10%<silicon<0.35%,
- 0.01%<chromium<0.5%,
- titanium<0.1%,
- aluminum<0.1%,
- phosphorus<0.1%,
- sulfur<0.05%,
- 0.002%<boron<0.005%,

a remainder being iron and impurities inherent in processing.

Usibor®1500 Alusi
Global product file
As coated specification
Update January 2021

1) Chemical Composition (wgt %)

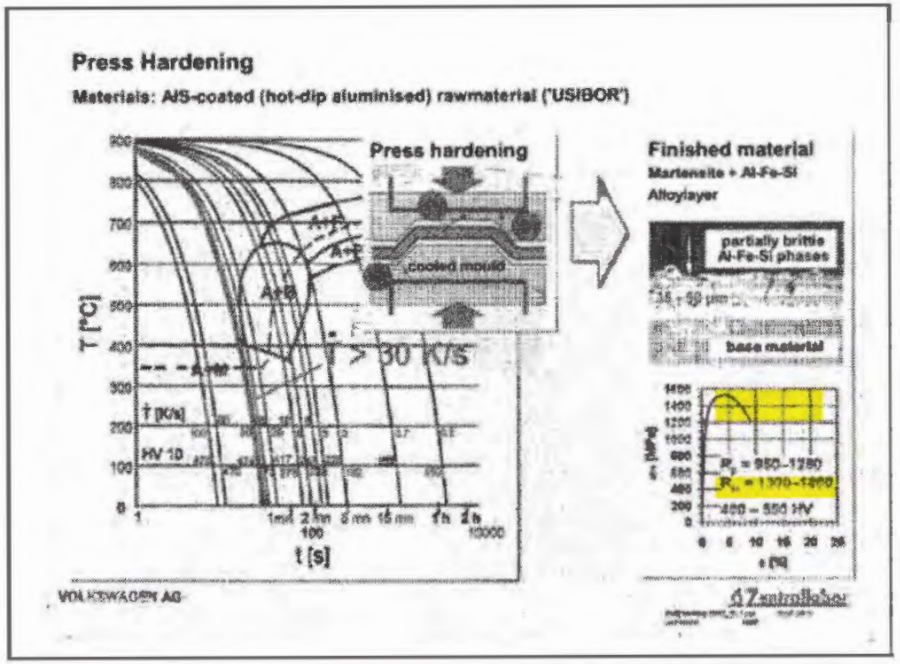
C	Si	Mn	Cr	P	S	Ti	Al	B	N
0,20 - 0,25	0,15 - 0,40	1,10 - 1,40	≤ 0,5	≤ 0,03	≤ 0,01	0,02 - 0,05	0,01 - 0,06	0,001 – 0,005	≤ 0,01

CX-0669C.0002 ("Usibor® 1500 AluSi Global product file"))

Invalidity – Lachmann

'227 Patent, Claim 24

The hot stamped coated steel product according to claim 1, wherein the hot stamped coated steel product has a mechanical strength in excess of 1000 MPa.



RX-0062.0006 (English)

Summary

'227 Patent Claim 1

[1pre]	A hot stamped coated steel product, which comprises:	✓
[1a]	(a) a strip of base steel having a first side and a second side; and	✓
[1b]	(b) a coating on at least one of said first side of said strip of base steel and said second side of said strip of base steel, wherein:	✓
[1c]	(i) said coating results from interdiffusion between said base steel and an aluminum or aluminum alloy pre-coating, and	✓
[1d]	(ii) wherein said coating comprises, proceeding from the base steel outwards:	✓
[1e]	(a) an Interdiffusion layer,	✓
[1f]	(b) an Intermediate layer,	✓
[1g]	(c) an Intermetallic layer, and	✓
[1h]	(d) a Superficial layer,	✓
[1i]	wherein layers (a), (b), (c), and (d) each have a different mean composition from one another,	✓
[1j]	wherein said coating of the hot stamped coated steel product has a thickness greater than 30 micrometers.	✓

Summary

Claim 2	The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness that is less than half of said thickness of the coating.	✓
Claim 4	The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness of 17 micrometers or less.	✓
Claim 5	The hot stamped coated steel product according to claim 1, wherein said layer (a) has a thickness of 15 micrometers or less.	✓
Claim 7	The hot stamped coated steel product according to claim 1, wherein the interdiffusion layer has a first mean iron composition, the intermediate layer has a second mean iron composition less than the first mean iron composition; wherein the intermetallic layer has a third mean iron composition, the third mean iron composition less than the first mean iron composition and greater than the second mean iron composition, and the superficial layer has a fourth mean iron composition, the fourth mean iron composition being less than the third mean iron composition.	✓
Claim 8	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (b).	✓
Claim 9	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (c).	✓
Claim 10	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than a thickness of layer (d).	✓

Summary

Claim 11	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness: that is greater than a thickness of layer (b); that is greater than a thickness of layer (c); and that is greater than a thickness of layer (d).	✓
Claim 13	The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is more than twice a thickness of layer (c).	✓
Claim 15	The hot stamped coated steel product according to claim 1, wherein the hot stamped coated steel product is fully martensitic.	✓
Claim 16	The hot stamped coated steel product according to claim 1, wherein the base steel consists of 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%; a remainder being iron and impurities inherent in processing.	✓
Claim 17	The hot stamped coated steel product according to claim 1, wherein the base steel consists of the following components by weight based on total weight: 0.15%<carbon<0.25%, 0.8%<manganese<1.8%, 0.10%<silicon<0.35%, 0.01%<chromium<0.5%, titanium<0.1%, aluminum<0.1%, phosphorus<0.1%, sulfur<0.05%, 0.002%<boron<0.005%, a remainder being iron and impurities inherent in processing.	✓
Claim 24	The hot stamped coated steel product according to claim 1, wherein the hot stamped coated steel product has a mechanical strength in excess of 1000 MPa.	✓

Secondary Considerations Do Not Support Non-obviousness

Commercial Success Factor: No Nexus to the Alleged Novelty	Hot Stamping of USIBOR and DUCTIBOR existed before the Asserted Patents
No Long Felt Need: Disclosed in the Prior Art	The claim elements are all disclosed in the prior art
No Unexpected Results: Results are Predictable	The alleged novel parameters are already found in the prior art hot stamping processes

No Commercial Success



Dr. James Fekete
ArcelorMittal Expert

Q. In the middle of paragraph 112, do you see the sentence: "Based on my knowledge and experience in the industry, **Usibor 1500P has not been a substantial commercial success** over other hot stamped boron products"? Do you see that?
A. Um-hum.

Q. Do you stand by that -- that opinion?
A. **Yes.**

RX-1287C (Fekete Tr. at 32:.18-33:3)

No Technical Domestic Industry

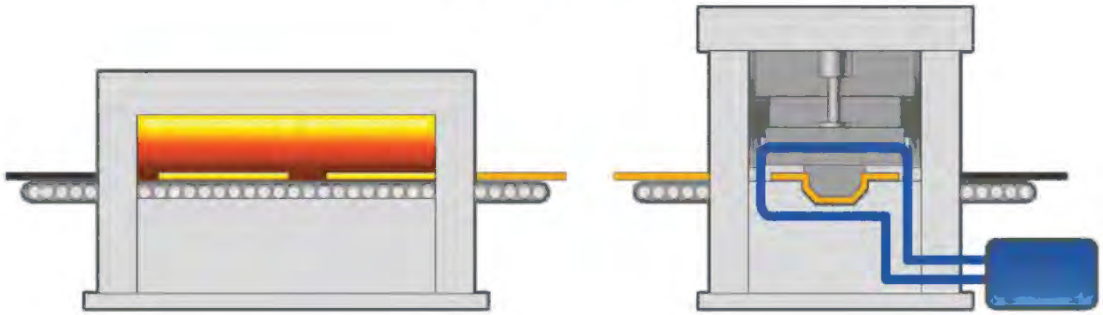


Alleged Domestic Industry Products

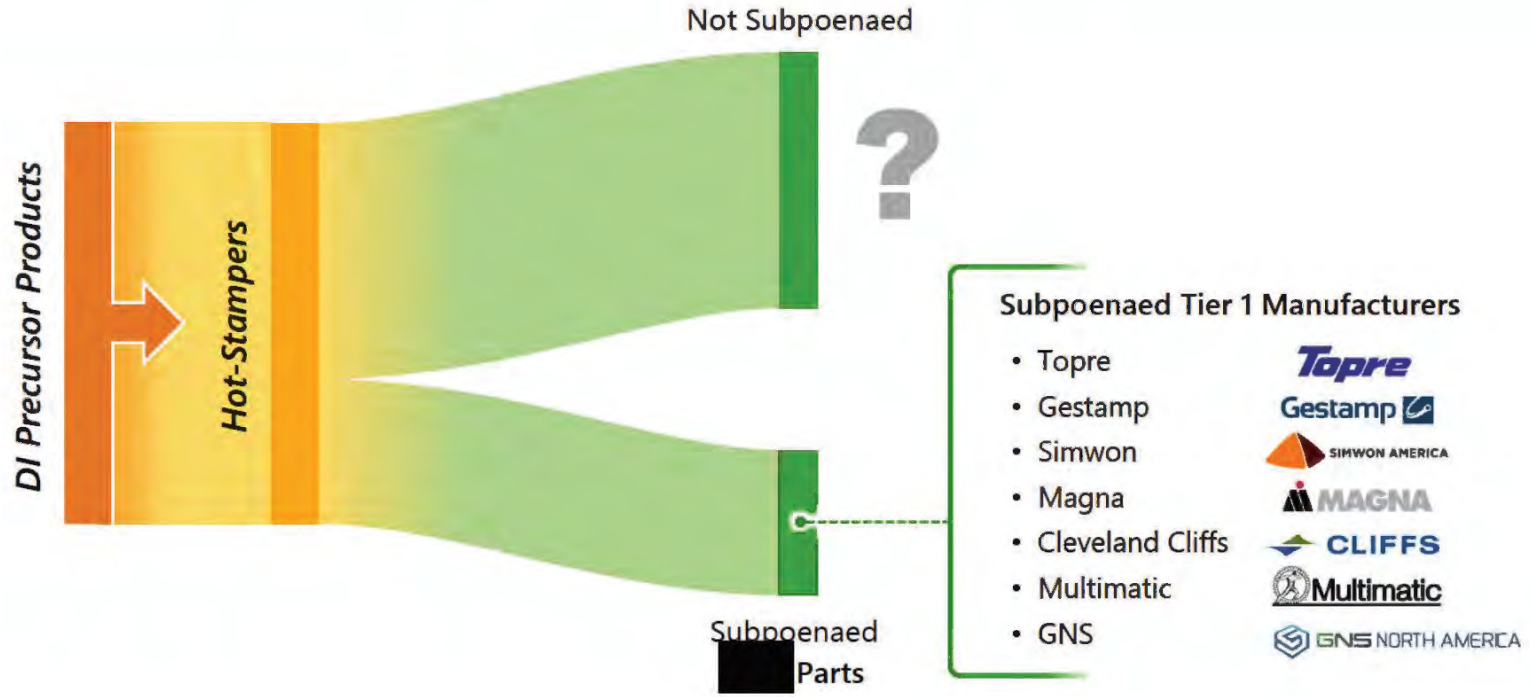
DI Precursor Products

- USIBOR 1500
- USIBOR 2000
- DUCTIBOR 450
- DUCTIBOR 500
- DUCTIBOR 1000
- ULTRALUME 1500
- ULTRALUME 2000

DI Direct Products



Alleged Domestic Industry Products



Flawed Alleged Representativeness



Dr. James Fekete
ArcelorMittal Expert

193. Indeed, DI Direct Products hot stamped by Tier 1 manufacturers who were not subpoenaed as part of this Investigation would also practice at least one of the claims of the Asserted Patents. OEMs generally have a single specification for hot stamping that they use to

* * *

as discussed above. Tier 1 hot stampers generally manufacture parts consistent with OEM specifications, it is my opinion that DI Direct Products manufactured by hot stampers not subpoenaed in this Investigation would also practice at least one claim of the Asserted Patents.

RX-1146C.0137 (Fekete Op. Rpt.) ¶ 193

Flawed Alleged Representativeness



Dr. James Fekete
ArcelorMittal Expert

Q. Do you know how many unsubpoenaed tier 1 hot stampers there are that make use of Usibor 1500 ALSI150?

A. I do not.

Q. Do you know how many hot stamped parts the unsubpoenaed tier 1 hot stampers make from Usibor 1500 ALSI150?

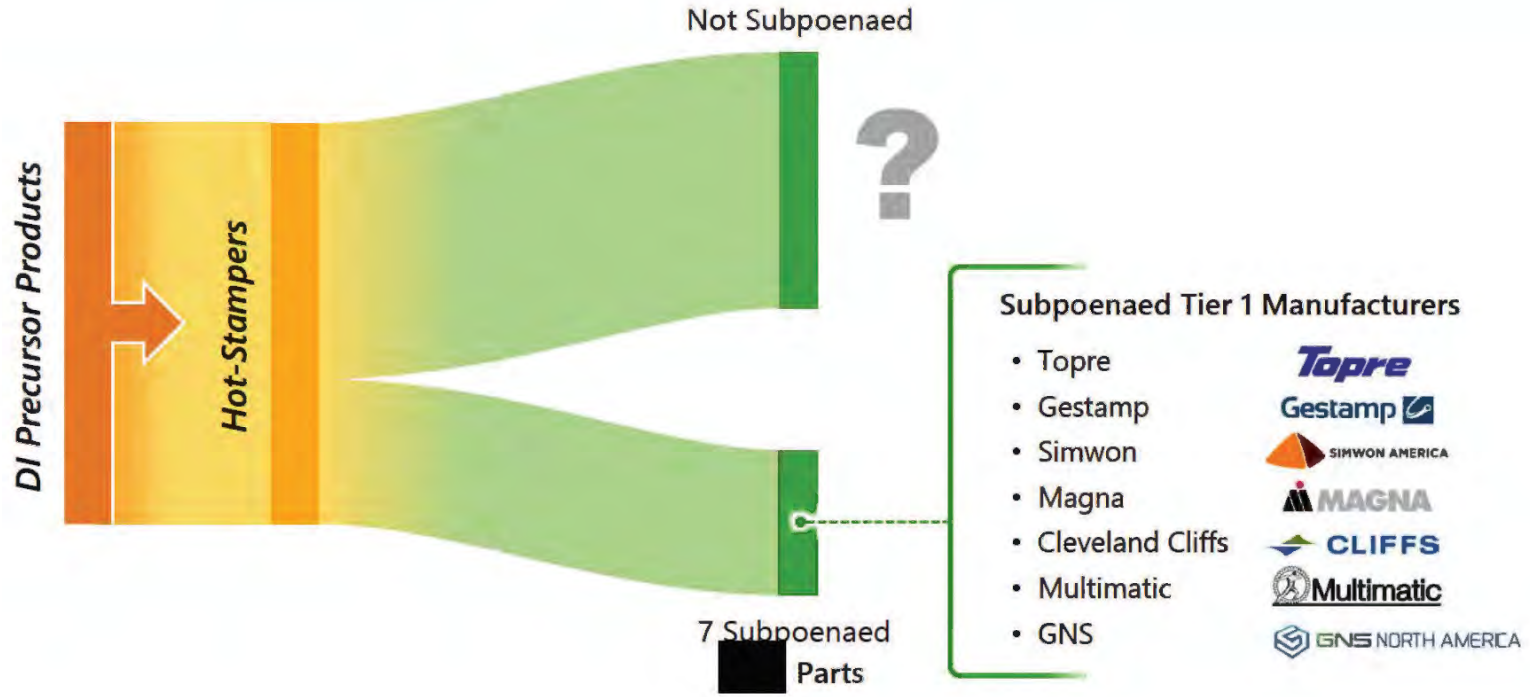
A. I do not.

Q. Do you know how many unsubpoenaed tier 1 hot stampers that there are?

A. I do not. That -- Those last three questions were not something I was asked to provide an opinion on, so I do not know.

RX-1287C (Fekete Tr. at 119:14-120:1)

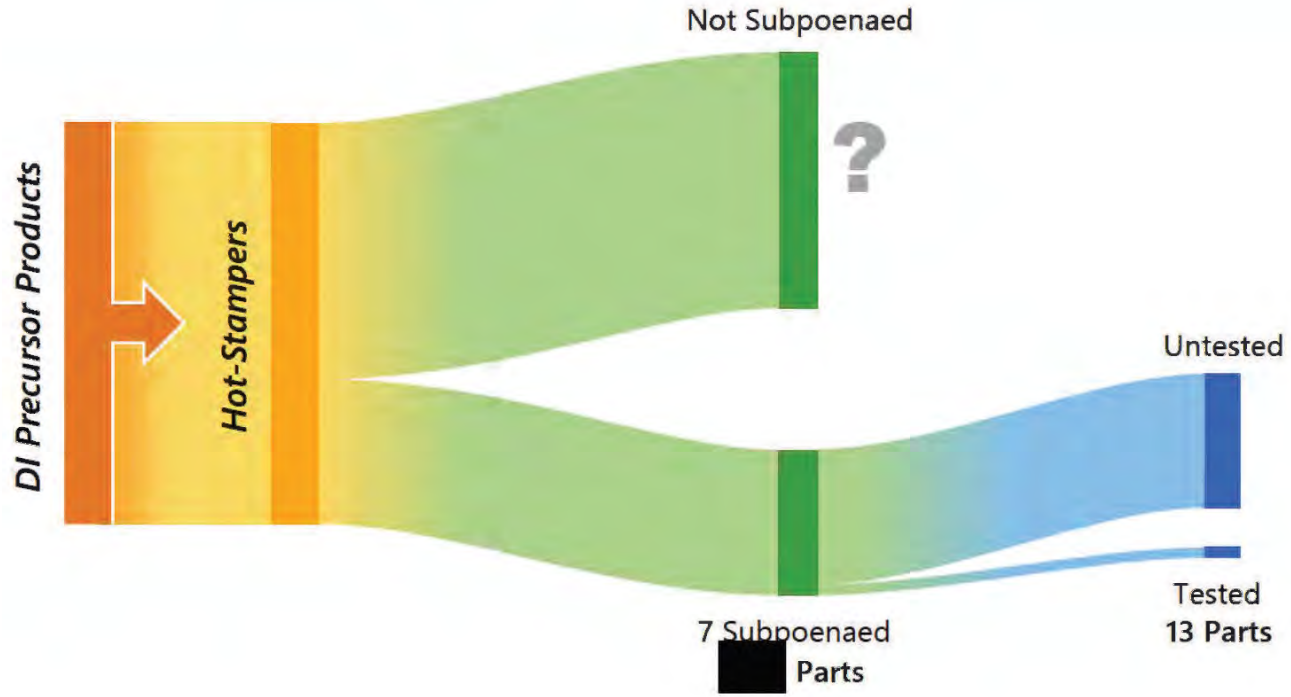
Alleged Domestic Industry Products



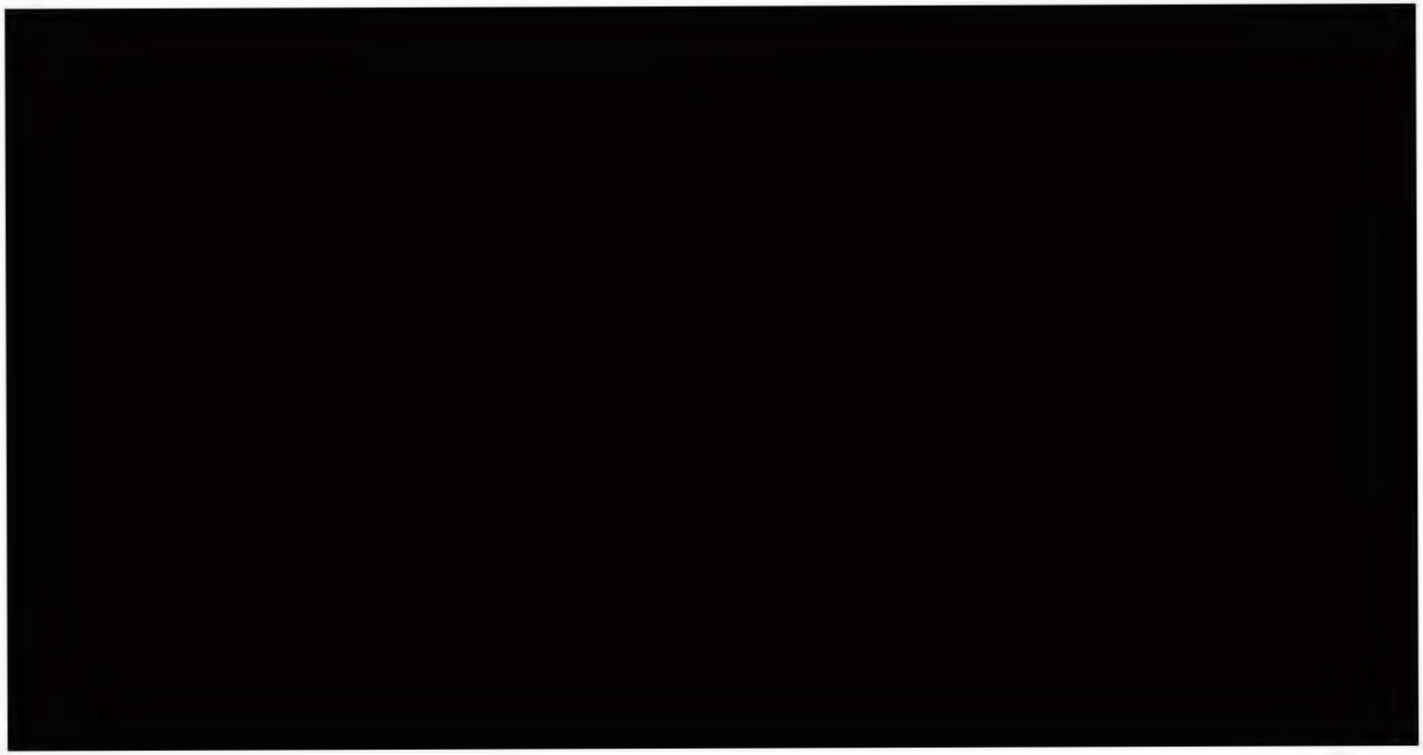
Flawed Alleged Representativeness

[redacted]

Alleged Domestic Industry Products



Tested Products

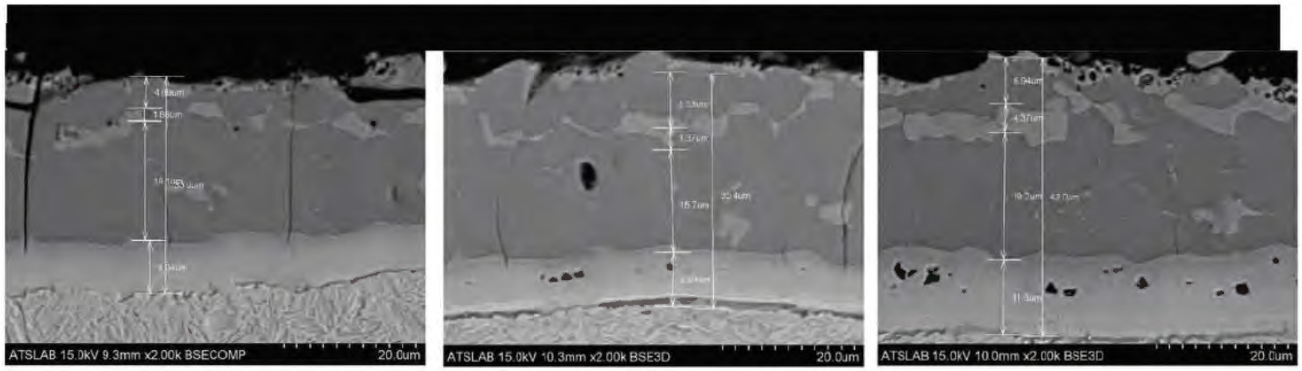


Flawed Alleged Representativeness



Dr. James Fekete
ArcelorMittal Expert

[redacted] "Anomalies"



CX-0111C (Fekete Op. Rpt.) Ex. W

Flawed Alleged Representativeness



Dr. James Fekete
ArcelorMittal Expert

Ford "Anomalies"

196. Second, the test results for the three [redacted] parts manufactured by Magna suggest that the parts were each left to dwell in the furnace for too short a time. Tests of the [redacted]

* * *

Accordingly, it is likely that the [redacted] parts were not left to dwell in the furnace for a sufficiently long time, resulting in insufficient time to build the intermetallic layer. In my opinion, a slightly longer dwell time would have allowed the formation of the intermetallic layer and thus result in the expected four-layer structure demanded by [redacted]

RX-1146C.0139-.0140 (Fekete Op. Rpt.) ¶ 196

Process Parameters Affect Coating Layers



Dr. James Fekete
ArcelorMittal Expert

Q. You haven't looked at any process parameters for the technical domestic industry products; correct?

A. Correct.

Q. Have you reviewed the heating rate of any of the DI products?

A. I have not. Again, not part of what I was asked to render an opinion on.

RX-1287C (Fekete Tr. at 124:5-8; 131:2-5)

Process Parameters Affect Coating Layers



Dr. Pascal Drillet
Named Inventor

Q. Is the heating rate an important parameter in developing the four-layer coating?

A. Yes. It's key in this case, yes.

Trial Tr. 125:25-126:3

Process Parameters Affect Coating Layers



Dr. Pascal Drillet
Named Inventor

Q. So other than the thickness of the blank, the temperature of the furnace, and the heating rate, are there other factors that impact the growth of the interdiffusion layers we see in Exhibit 1?

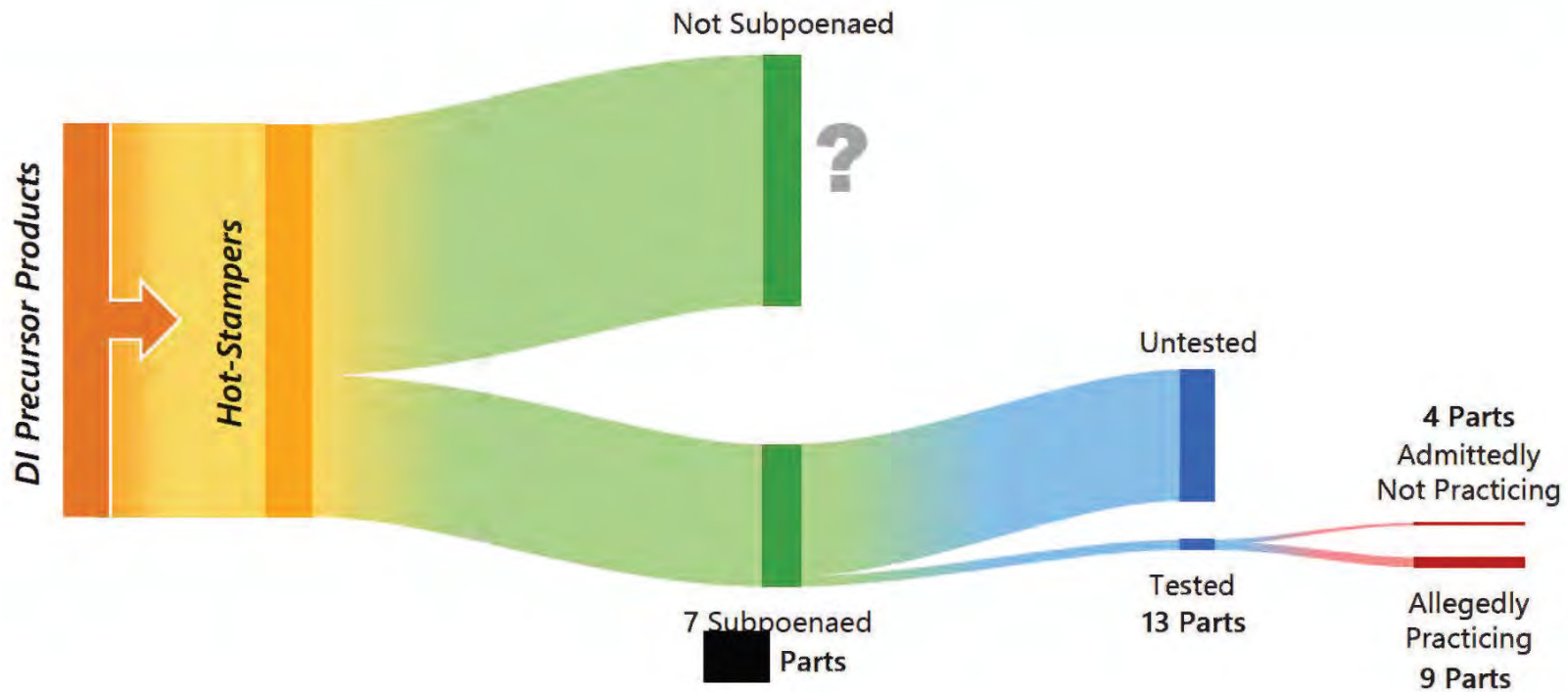
A. The thickness of the coatings also.

RX-1282C (Drillet Tr.) at 24:14 – 25:1

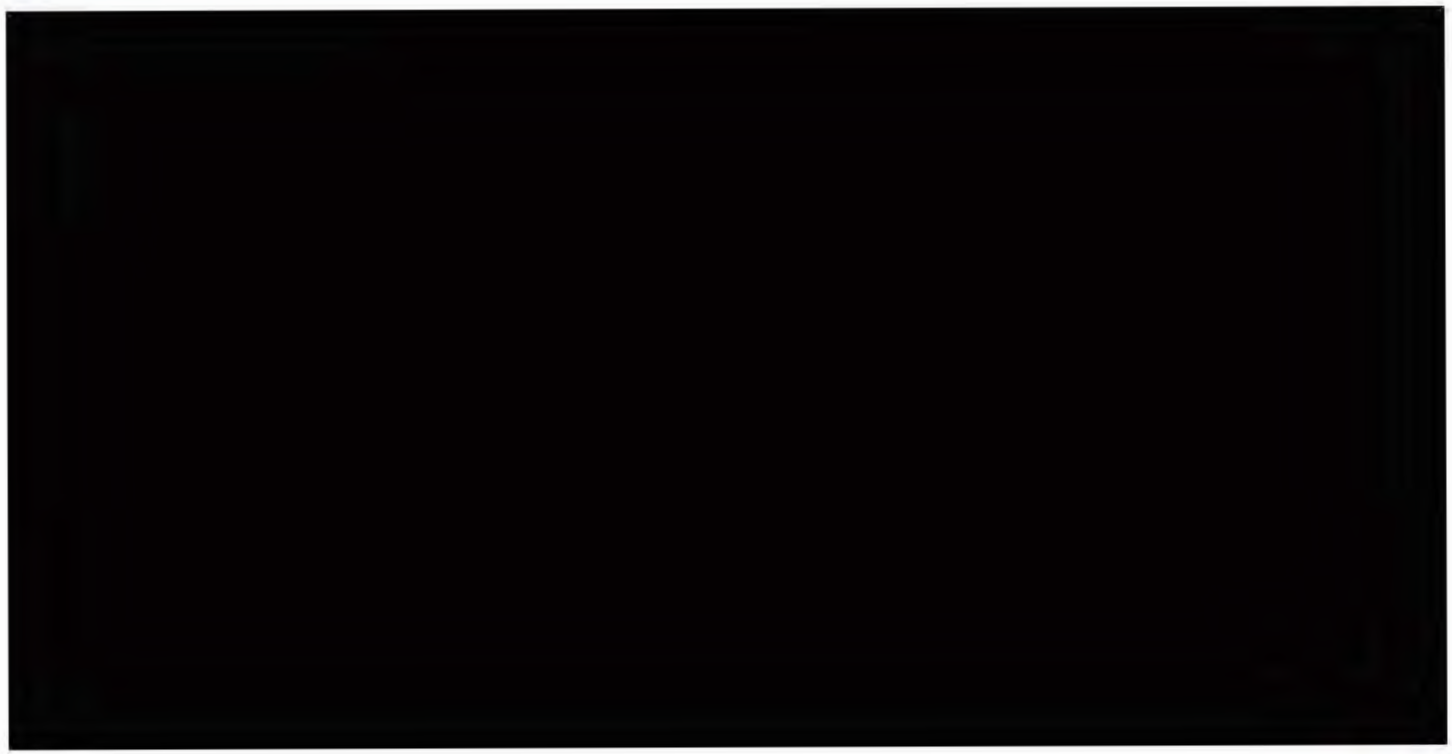
Process Parameters Are Different For Each Part



No Representativeness



Tested Products

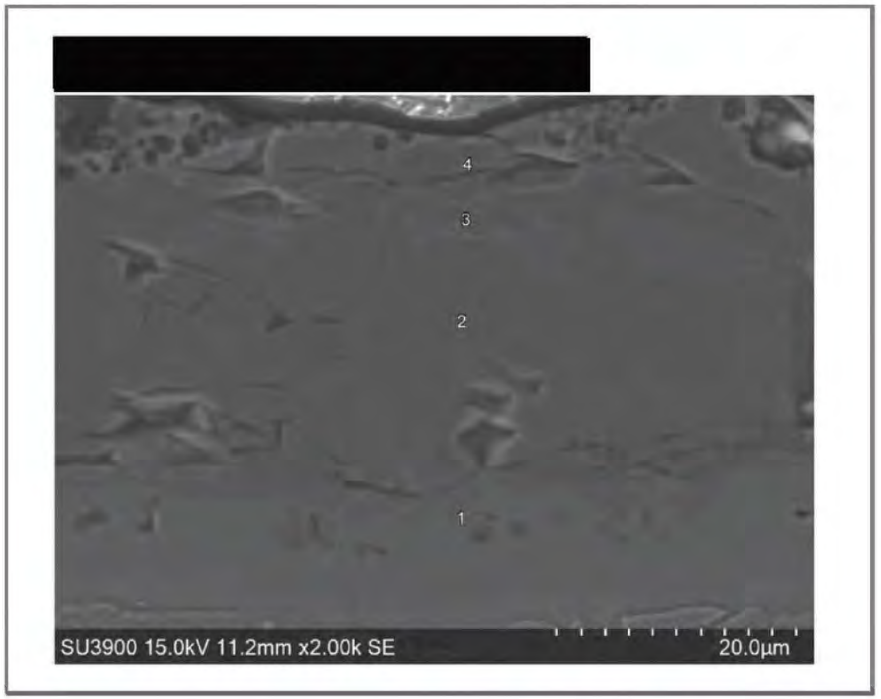


No Technical Domestic Industry Claim by Claim Analysis



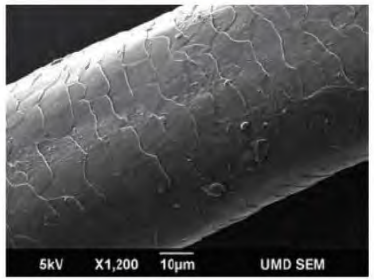
RDX-002.188

No Tech DI– 602 and 227 Patents



CX-0109C.0002 (Fekete Op. Rpt.) Ex. U

30 microns is half the width of a human hair





No Claimed Layer



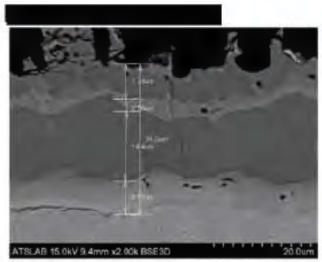
Dr. Pascal Drillet
Named Inventor

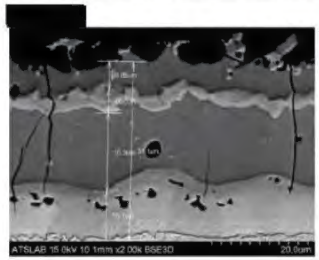
Q. How do I know whether a band of intermetallic compound is a layer or a phase?

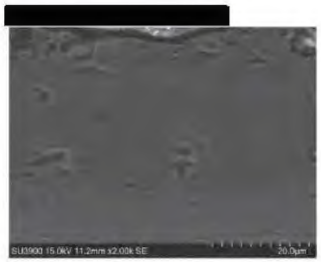
A. I can't say based on an image,.... A multilayer structure of coating has to be the same across the entire part.... It's not enough, one picture.

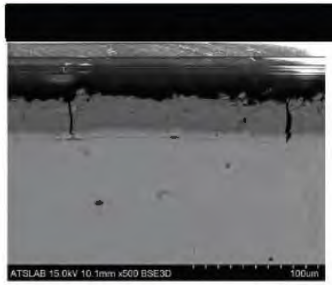
RX-1282C.0099 (Drillet Tr.) at 99:5 – 100:24

One SEM Per Physical Part



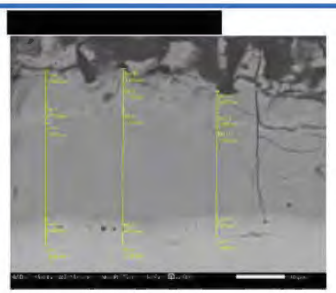


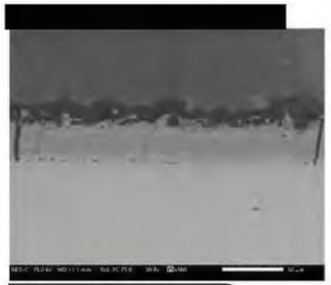


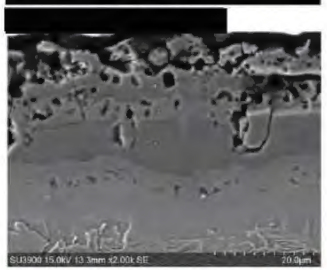










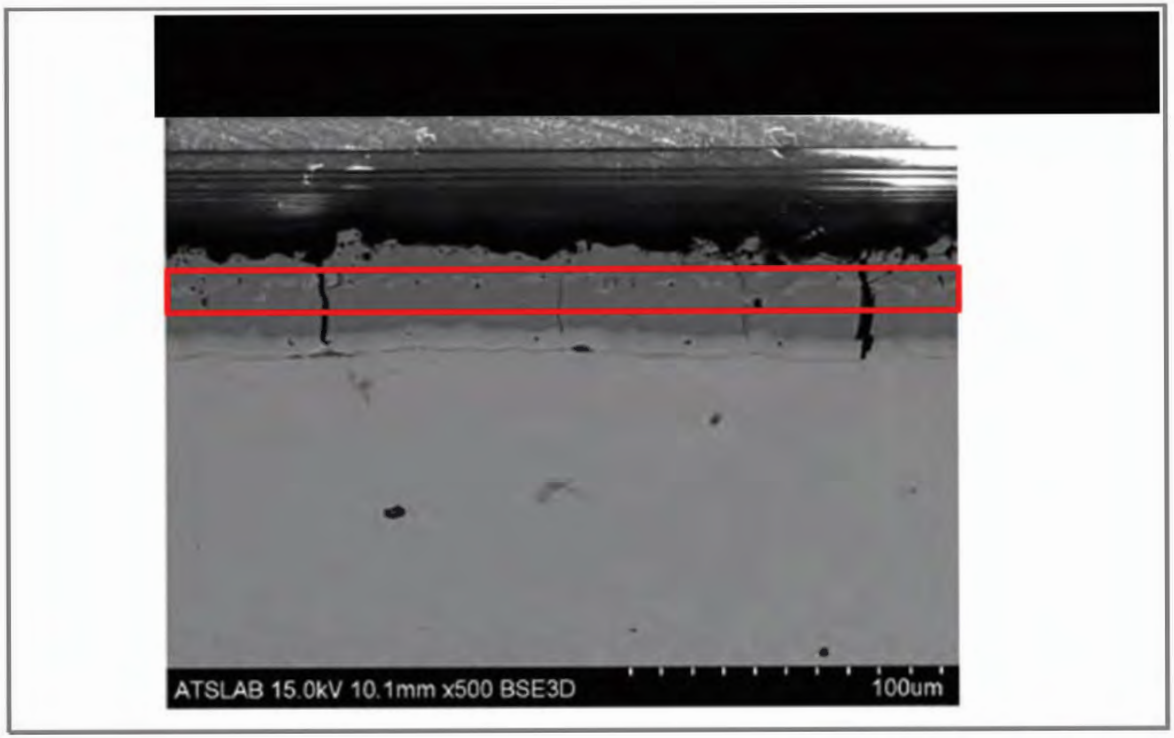


No Tech DI

'602 Patent, 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, 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:	
[1c]	(a) an interdiffusion layer having a first mean iron composition,	
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✗
[1e]	(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	✗
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,	✗
[1g]	wherein the coating has a thickness greater than 30 micrometers.	

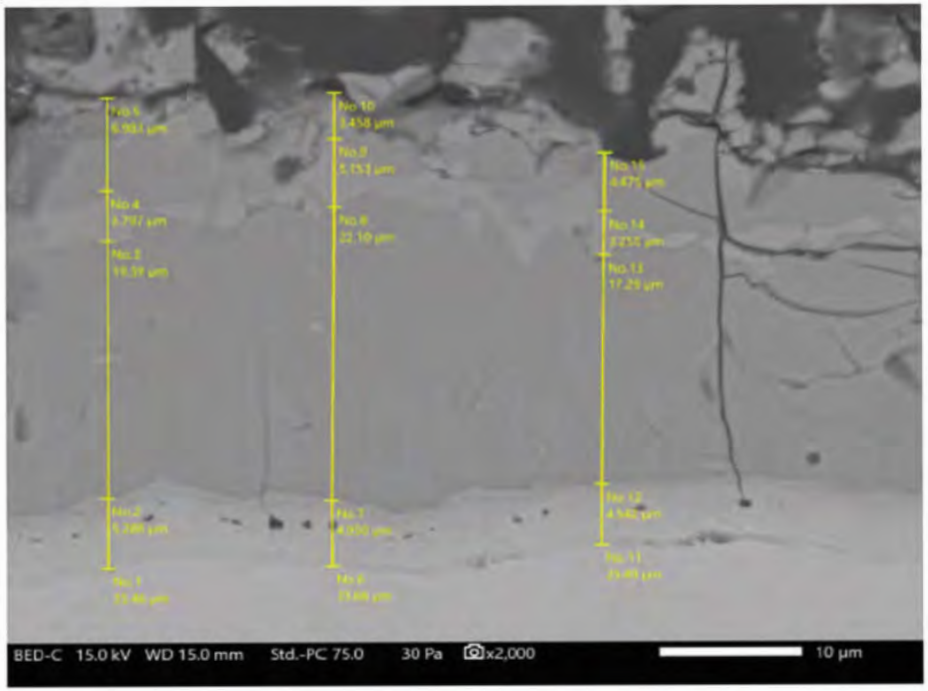
No Claimed Layers



CX-0109C.0002 (Fekete Op. Rpt.) Ex. U

No Claimed Layers

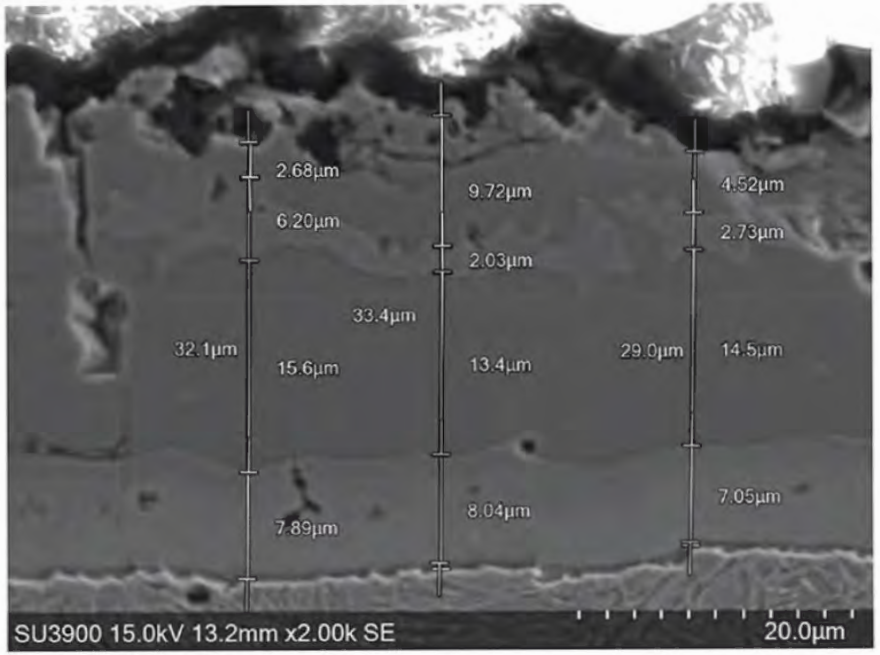
[redacted]



CX-0109C.0003 – .0005 (Fekete Op. Rpt.) Ex. U; CX-0114C.0013 – .0015 (Fekete Op. Rpt.) Ex. Z

No Claimed Layers

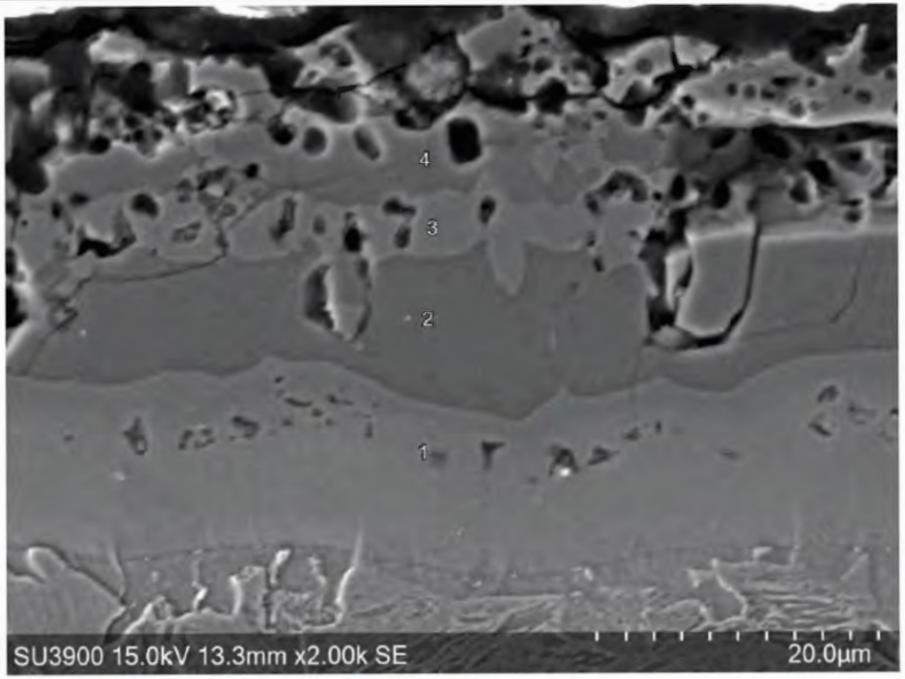
[redacted]



CX-0109C.0003 – .0005 (Fekete Op. Rpt.) Ex. U; CX-0114C.0013 – .0015 (Fekete Op. Rpt.) Ex. Z

No Claimed Layers

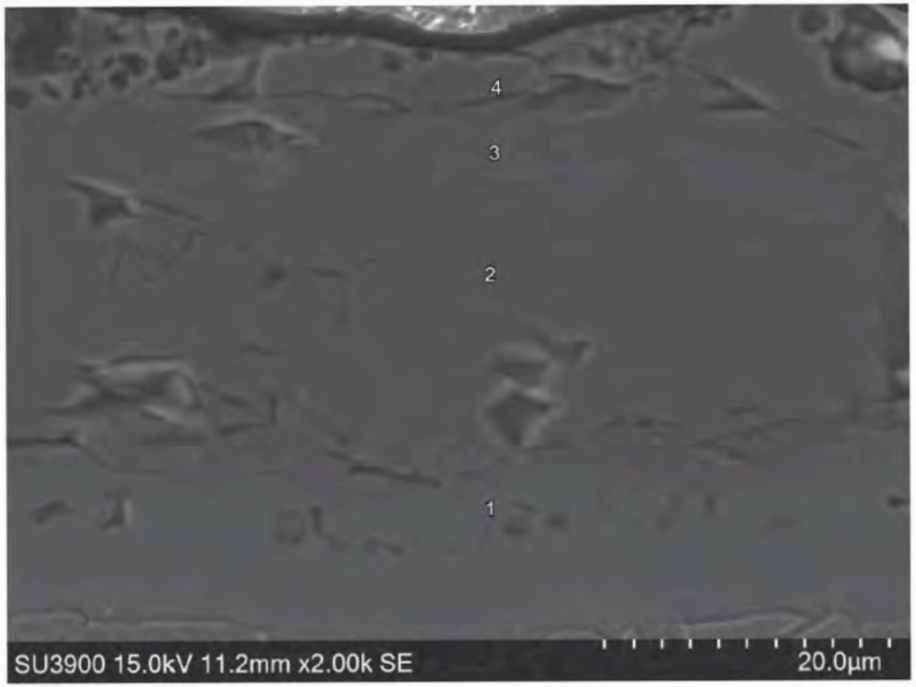
[redacted]



CX-0109C.0003 – .0005 (Fekete Op. Rpt.) Ex. U; CX-0114C.0013 – .0015 (Fekete Op. Rpt.) Ex. Z

No Claimed Layers

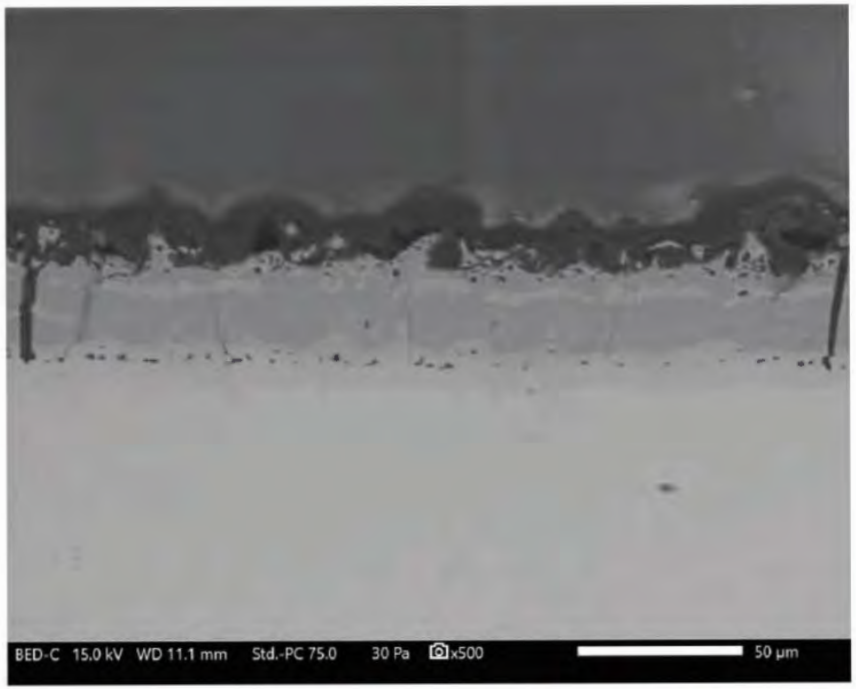
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CX-0109C.0003 – .0005 (Fekete Op. Rpt.) Ex. U; CX-0114C.0013 – .0015 (Fekete Op. Rpt.) Ex. Z

No Claimed Layers

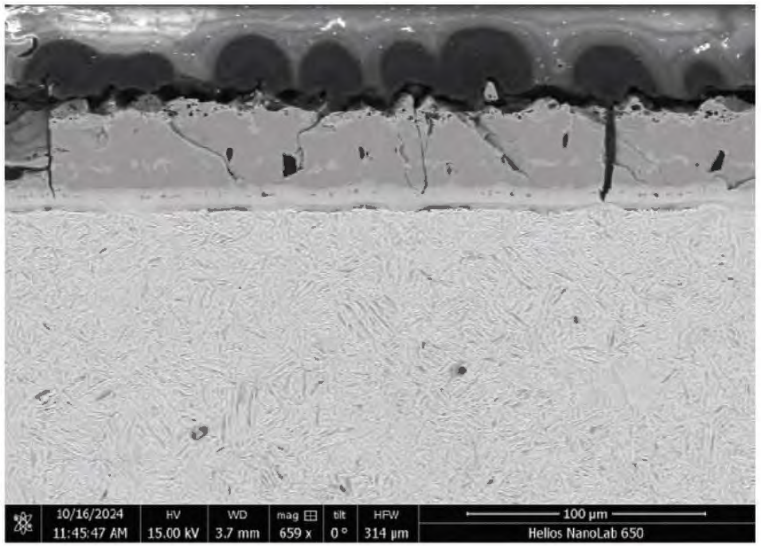
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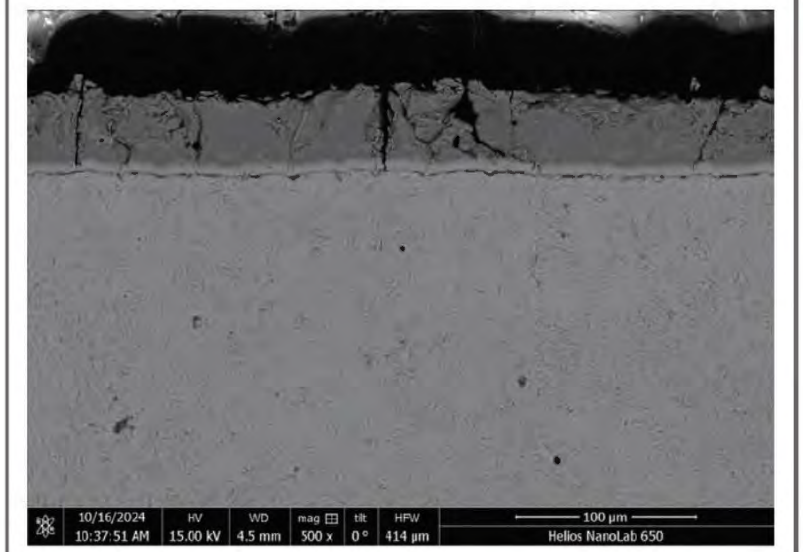
CX-0109C.0003 – .0005 (Fekete Op. Rpt.) Ex. U; CX-0114C.0013 – .0015 (Fekete Op. Rpt.) Ex. Z

No Claimed Layers – Dr. Bradley's Test Results

[redacted]



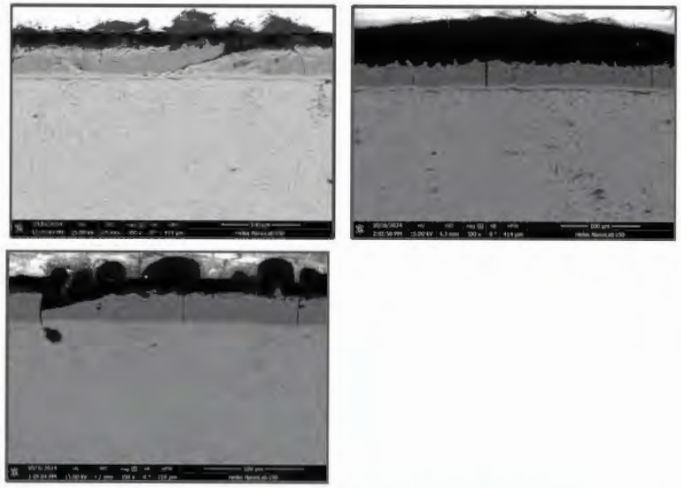
CX-0086C.0036 Bradley Testing Rpt. ¶ 59; RX-0153C



CX-0086C.0036 Bradley Testing Rpt. ¶ 59; RX-0152C

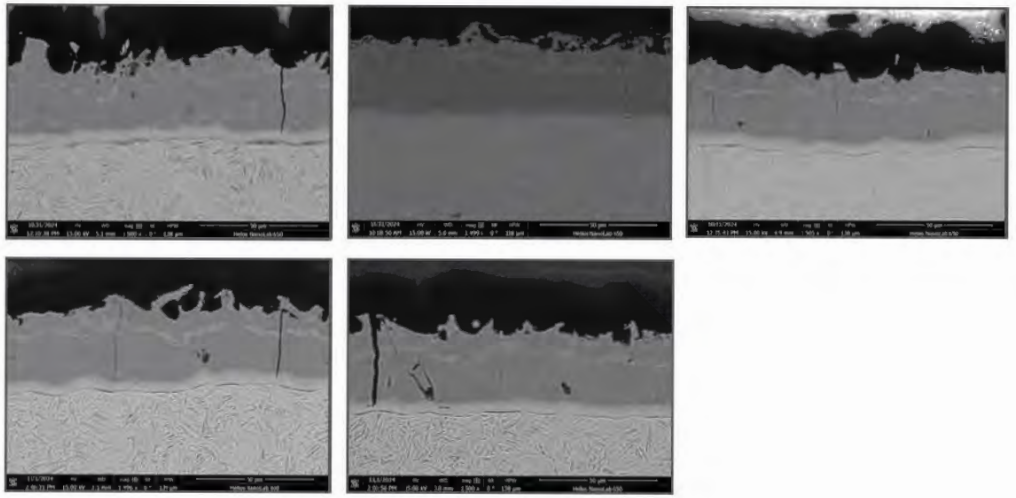
No Claimed Layers – Dr. Bradley's Test Results

[redacted]



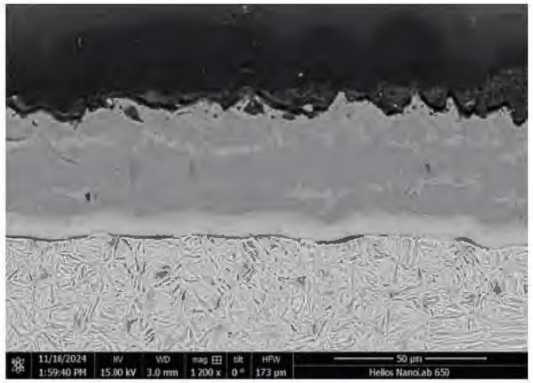
CX-0086C.0037 – .0038 Bradley Testing Rpt. ¶ 59;
RX-0154C ; RX-0155C ; RX-0156C

[redacted]

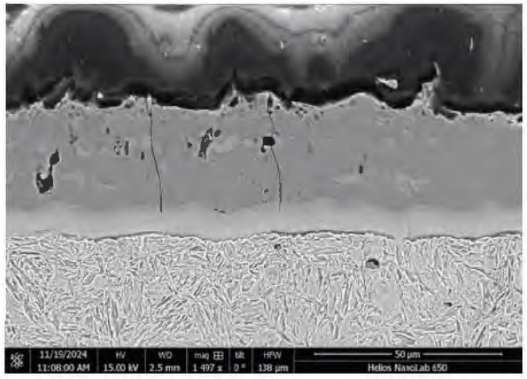


CX-0086C.0039 – .0041 Bradley Testing Rpt. ¶ 61;
RX-0169C, RX-0165C, RX-0166C ; RX-0167C ; RX-0168C

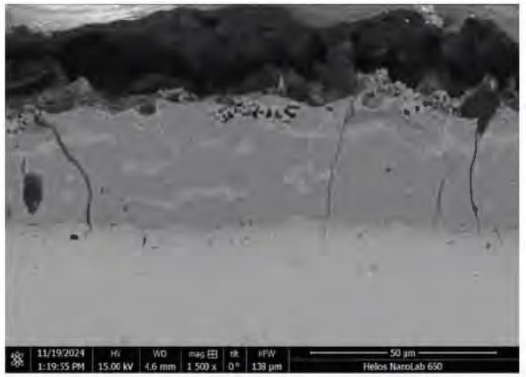
No Claimed Layers



CX-0086C.0043 Bradley Testing
Rpt. ¶ 63; RX-0158C



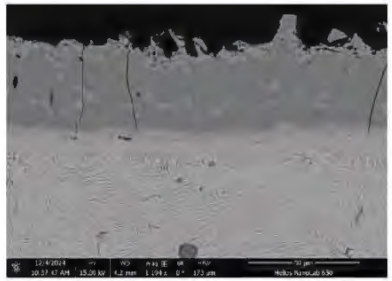
CX-0086C.0044 Bradley Testing
Rpt. ¶ 63; RX-0162C

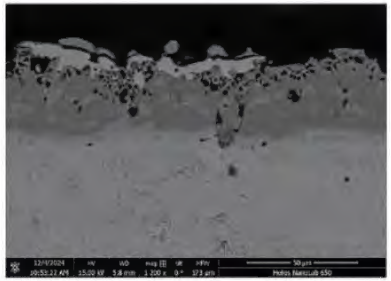


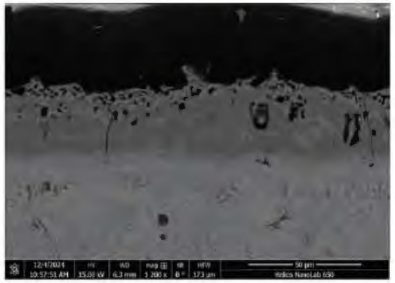
CX-0086C.0050 Bradley Testing
Rpt. ¶ 69; RX-0164C

No Claimed Layers

[redacted]

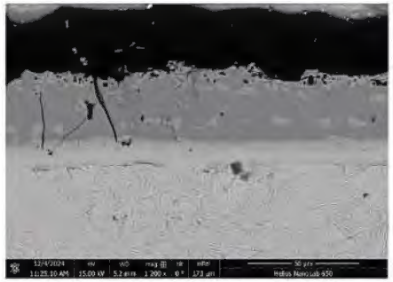


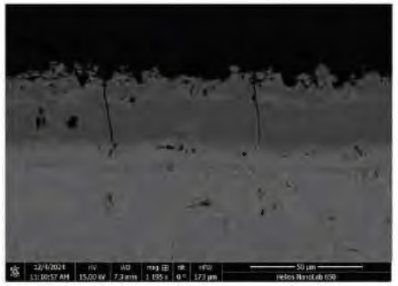




CX-0086C.0054 – .0055 Bradley Testing Rpt. ¶ 72; RX-0635C ; RX-0655C ; RX-0665C

[redacted]





CX-0086C.0056 – .0057 Bradley Testing Rpt. ¶ 73; RX-0694C ; RX-0679C ; RX-0702C

No Tech DI

'602 Patent, 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, 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:	
[1c]	(a) an interdiffusion layer having a first mean iron composition,	
[1d]	(b) an intermediate layer having a second mean iron composition different from the first mean iron composition,	✗
[1e]	(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	✗
[1f]	(d) a superficial layer having a fourth mean iron composition different from the third mean iron composition,	✗
[1g]	wherein the coating has a thickness greater than 30 micrometers.	

'602 Patent Claim 2

'602 Patent, Claim 2

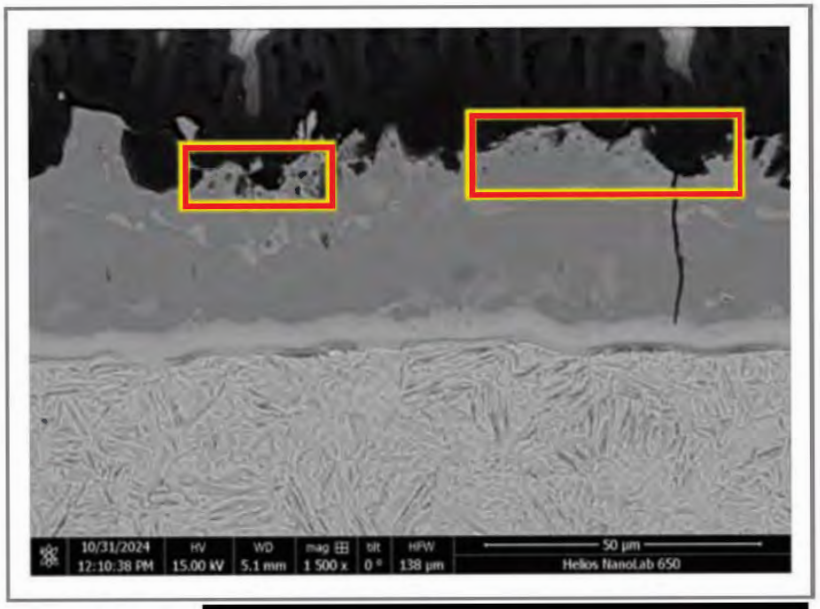
The precoated steel product as recited in claim 1 wherein the layers (c) and (d) are quasi continuous by occupying at least 90% of a level corresponding to each of the layers (c) and (d) and wherein less than 10% of layer (c) is present at an extreme surface of the product.



RX-0163C [redacted]

CX-0086C.0048 Bradley Testing Rpt. ¶ 68

’602 Patent Claim 2



RX-0169C [redacted];
CX-0086C.0039 Bradley Testing Rpt. ¶ 61

'602 Patent Claims 7 & 8

'602 Patent, Claim 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."

'602 Patent, Claim 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.

Exhibit N: Domestic Industry Direct Product Steel Substrate Elemental Composition

A	B	C	D	E	F	G	H	I	J	K	L	M
Part	Carbon Composition (% weight)	Manganese Composition (% weight)	Silicon Composition (% weight)	Chromium Composition (% weight)	Titanium Composition (% weight)	Aluminum Composition (% weight)	Phosphorus Composition (% weight)	Sulfur Composition (% weight)	Boron Composition (% weight)	Iron Composition (% weight)	Nitrogen Composition (% weight)	Ti:N
[redacted]	0.20	1.15	0.23	0.19	0.02	0.04	0.016	0.015	0.002	98.1	0.003	6.67
	0.22	1.23	0.28	0.19	0.04	0.04	0.012	0.013	0.003	98.0	0.004	10.00
	0.21	1.274	0.234	0.174	-	0.047	0.008	0.003	-	-	-	-

CX-0102C.0002 (Fekete Op. Rpt.) Ex. NC

'602 Patent Claim 10

'602 Patent, Claim 10

The precoated steel product as recited in claim 1 wherein the layer (a) has a thickness less than 10 micrometers.

Exhibit O: Domestic Industry Direct Product Coating and Layer Thicknesses

A	B	C	D	E	F
Part	Coating Thickness	Layer (a) Thickness	Layer (b) Thickness	Layer (c) Thickness	Layer (d) Thickness
[redacted]	39.6	10.7	14.4	5.1	9.4

CX-0103C.0002 (Fekete Op. Rpt.) Ex. O

'227 Patent Claim 10

'227 Patent, Claim 10

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is greater than the thickness of layer (d).

Exhibit O: Domestic Industry Direct Product Coating and Layer Thicknesses

A	B	C	D	E	F
Part	Coating Thickness	Layer (a) Thickness	Layer (b) Thickness	Layer (c) Thickness	Layer (d) Thickness
[redacted]	31.2	6.6	15.0	2.7	7.1
	32.98	5.04	17.93	3.30	6.71

CX-0103C.0002 (Fekete Op. Rpt.) Ex. O

'227 Patent Claim 13

'227 Patent, Claim 13

The hot stamped coated steel product according to claim 1, wherein layer (a) has a thickness that is more than twice a thickness of layer (c).

Exhibit O: Domestic Industry Direct Product Coating and Layer Thicknesses

A	B	C	D	E	F
Part	Coating Thickness	Layer (a) Thickness	Layer (b) Thickness	Layer (c) Thickness	Layer (d) Thickness
[redacted]	32.98	5.04	17.93	3.30	6.71

CX-0103C.0002 (Fekete Op. Rpt.) Ex. O

'227 Patent Claims 16 & 17

'227 Patent, Claim 16

The hot stamped coated steel product according to claim 1, wherein the base steel consists of 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%; a remainder being iron and impurities inherent in processing.

'227 Patent, Claim 17

The hot stamped coated steel product according to claim 1, wherein the base steel consists of the following components by weight based on total weight:0.15%<carbon<0.25%, 0.8%<manganese<1.8%, 0.10%<silicon<0.35%, 0.01%<chromium<0.5%, titanium<0.1%, aluminum<0.1%, phosphorus<0.1%, sulfur<0.05%, 0.002%<boron<0.005%, a remainder being iron and impurities inherent in processing.

Exhibit N: Domestic Industry Direct Product Steel Substrate Elemental Composition

A	B	C	D	E	F	G	H	I	J	K	L	M
Part	Carbon Composition (% weight)	Manganese Composition (% weight)	Silicon Composition (% weight)	Chromium Composition (% weight)	Titanium Composition (% weight)	Aluminum Composition (% weight)	Phosphorus Composition (% weight)	Sulfur Composition (% weight)	Boron Composition (% weight)	Iron Composition (% weight)	Nitrogen Composition (% weight)	Ti:N
[redacted]	0.21	1.274	0.234	0.174	-	0.047	0.008	0.003	-	-	-	-
	0.22	1.19	0.24	0.19	0.036	0.047	0.014	< 0.005	0.0018	97.9	0.006	6

CX-0102C.0002 (Fekete Op. Rpt.) Ex. N

Summary Slide

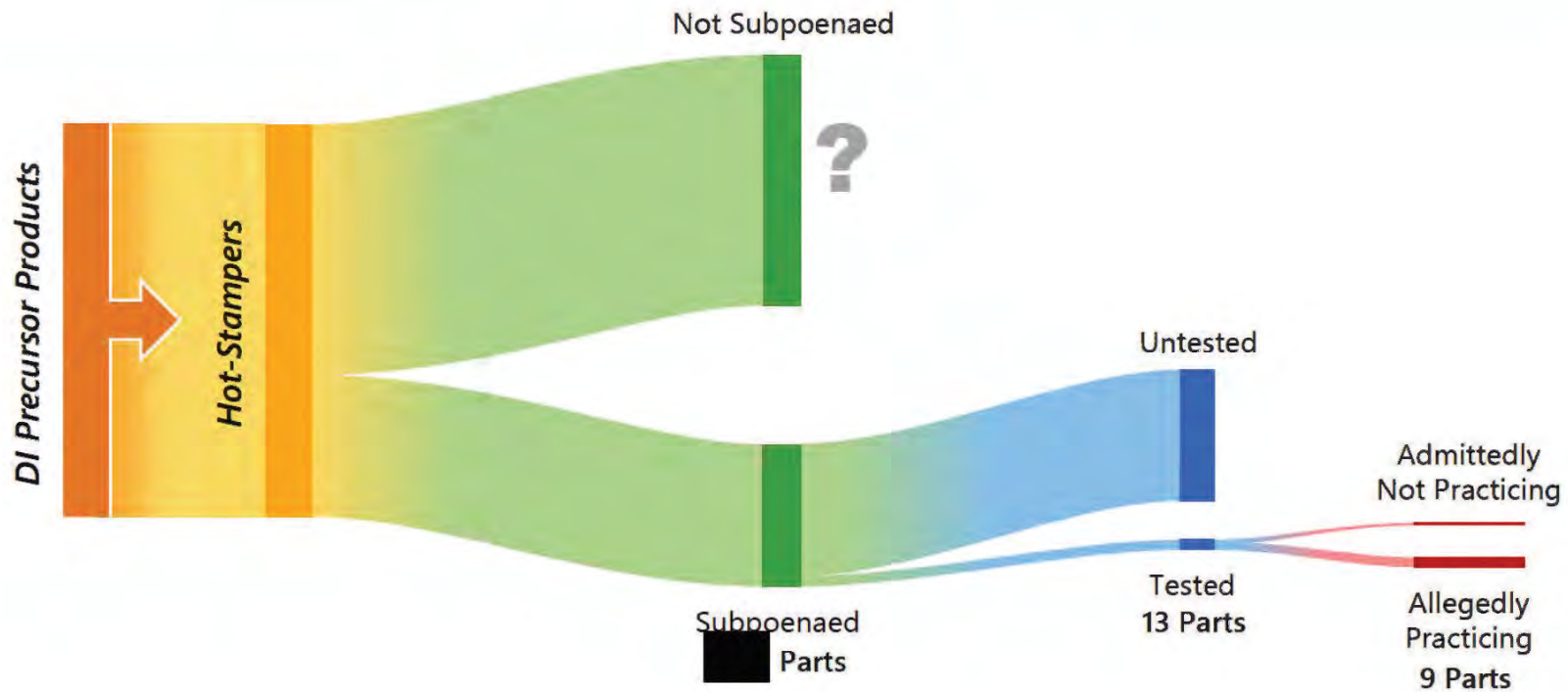
Tested Part	Claims Not Met
[redacted]	All independent claims; 227 Cl 10
[redacted]	All independent claims
[redacted]	All independent claims; 602 Cl 2, Cl 7; Cl 8, 227 Cl 10, Cl 13, Cl 16, Cl 17
[redacted]	All independent claims; 227 Cl 17
[redacted]	All independent claims; 602 Cl 2, Cl 10,
[redacted]	All independent claims
[redacted]	All independent claims
[redacted]	All independent claims
[redacted]	All independent claims

Invalidity Based on Complainants' Domestic Industry Analysis



RDX-002.212

Alleged Domestic Industry Products



RDX-002.213

Patent's Discussion of Preferred Process Conditions

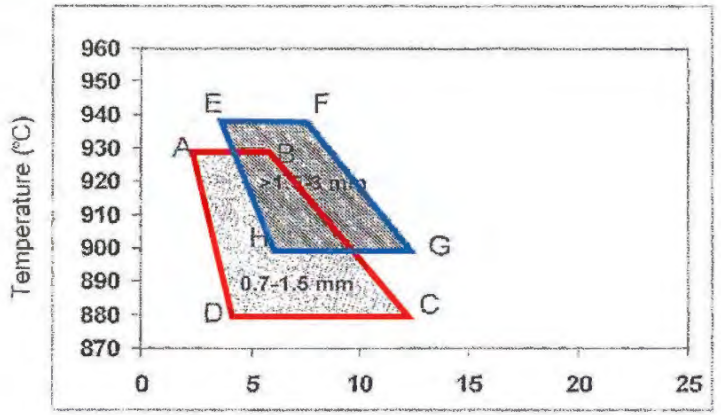


Fig. 7

JX-0002.0009 ('602 Patent) at Fig. 7

in its entirety 7.7° C./s). In this regard, all of the conditions specified within FIG. **7** are incorporated herein by reference thereto. Particularly preferred conditions are:

(for thicknesses of 0.7-1.5 mm)

930° C., from 3 minutes up to 6 minutes;

880° C., from 4 minutes 30 seconds up to 13 minutes (for thicknesses of 1.5 to 3 mm)

940° C., from 4 minutes up to 8 minutes;

900° C., from 6 minutes 30 seconds up to 13 minutes.

JX-0002.0013 ('602 Patent) at 7:29-35

USIBOR 1500P

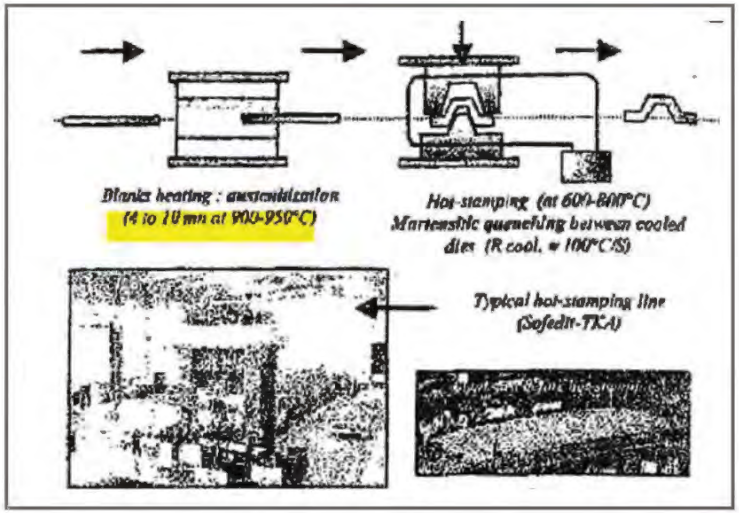
Development of safety and structural automotive parts by hot-stamping : the "USIBOR 1500P" solution

R.KEFFERSTEIN (Arcelor-Auto / ARCELOR)

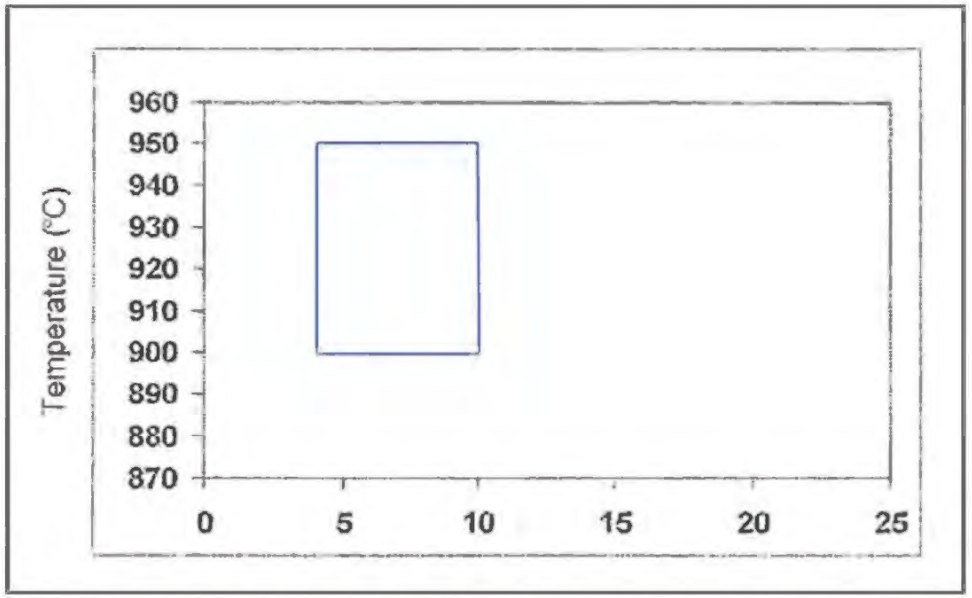
La Revue de Métallurgie - ATS - JSI 2004

RX-0049.0001

The graph below presents the ultimate bending load, before structural collapse, for a 3 points bending test and for various metallurgical solutions (impact speed = 29 km/h - Energy = 10 kJ - Thickness = 1,5 mm)



USIBOR 1500P



CX-0085C.0074 Brown Reb. Rpt. ¶ 85 (JX-0002 ('602 Patent) at Fig. 7 (annotated)

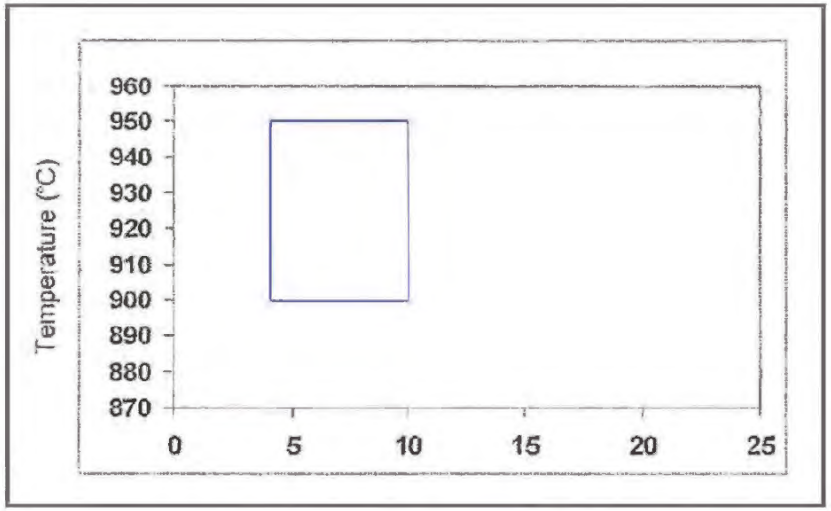
HOT-STAMPING WITH DIE-QUENCHING

The metallurgy of hot-stamping is linked to the chemistry of quenchable boron steels (0,002 to 0,005% of Boron).
Hot-stamping consists in heating blanks, until the complete austenitization (900°C to 950°C, during 4 to 10 minutes). The blanks are then transferred very quickly on a press for the stamping. At high temperature (600 to 850°C), the material has an excellent formability, which makes it possible to obtain complex parts.
The martensitic quenching is carried out just after the forming, thanks to the contact with the cooled tools (cooling speed of about 100°C/s).
The total cycle time (transfer + stamping + cooling between the dies) is, today, between 15 and 25 seconds.
At the exit of the stamping line, the parts leave at approximately 50-80°C, with their final, repeatable and homogeneous mechanical properties: T_s of 1400-1600 MPa and Y_s of 900-1100 MPa.
Finally, hot-stamping eliminates the issue of springback, as well as offering increased formability and accuracy.

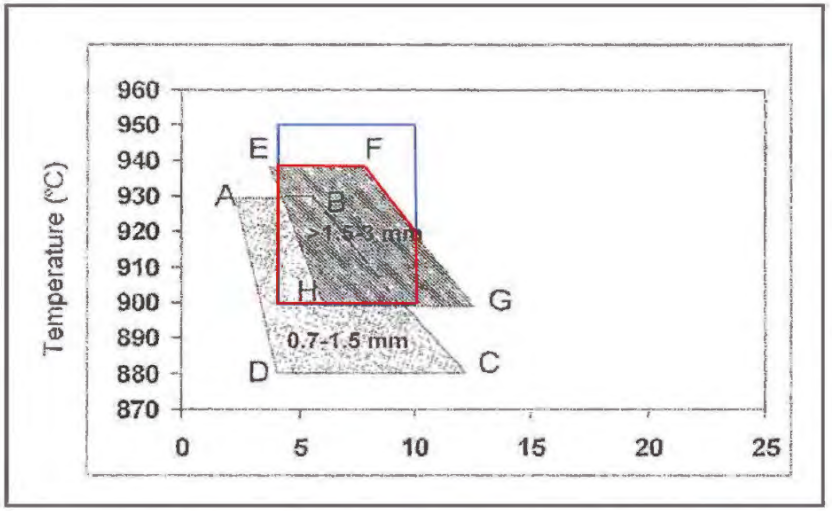
The graph below presents the ultimate bending load, before structural collapse, for a 3 points bending test and for various metallurgical solutions (impact speed = 29 km/h - Energy = 10 kJ - Thickness = 1.5 mm)

RX-0049.0001

USIBOR 1500P



CX-0085C.0074 Brown Reb. Rpt. ¶ 85 (JX-0002 ('602 Patent) at Fig. 7 (annotated)

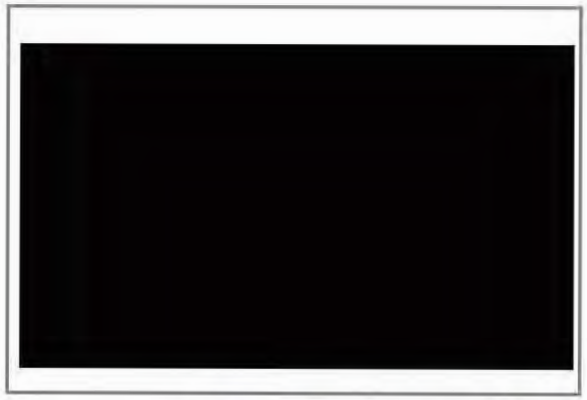


CX-0085C.0075 Brown Reb. Rpt. ¶ 86 (JX-0002 ('602 Patent) at Fig. 7 (annotated)

CX-0458C
RDX-002C-218

[redacted]

[redacted]


[redacted]

CX-0085C.0084 Brown Reb. Rpt. ¶ 92
(JX-0002 ('602 Patent) at Fig. 7

[redacted]

[redacted]

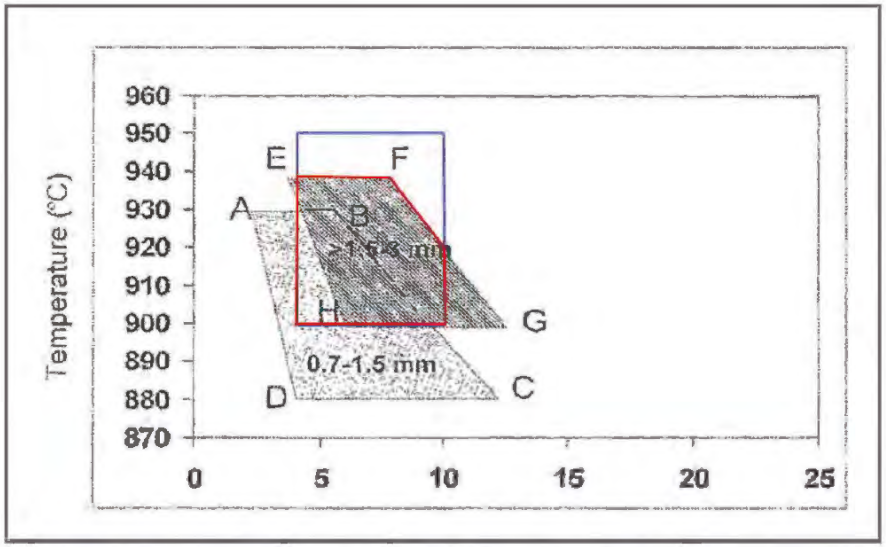
[redacted]



CX-0085C.0087 Brown Reb. Rpt. ¶ 94
(JX-0002 ('602 Patent) at Fig. 7 (annotated)

[redacted]

Overlapping Conditions



CX-0085C.0075 Brown Reb. Rpt. ¶ 86 (JX-0002 ('602 Patent) at Fig. 7 (annotated)

[redacted]

Overlapping Conditions



tives)

RDX-002.222

Invalidity



Invalidity



Tested [redacted] Parts





[redacted]

Summary of Opinions

