GDIS

Vacuum Hot Stamping Technology with Electro-galvanizing & High-temperature Resistant Lubricating Coating

Pressler Technologies Co., Ltd.

Tony An

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Company Introduction

01

Company profile

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Pressler Technologies Co., Ltd., founded in 2014, is a professional manufacturer and supplier specializing in the R&D of critical equipment and metal-formed components in the metal forming industry. The company's high-performance vacuum hot-stamped galvanized door rings, automotive hot-pressed components, self-developed hot-stamping production lines, and innovative hot-forming mold technologies address the application needs of global customers and partners in the automotive and related industries, contributing to automotive lightweighting, energy conservation, and emission reduction.

5
Production Bases

140000㎡
Total Area

7M Strokes
Annual output

8+
Hot forming lines

Pressler is committed to delivering exceptional technical solutions for the hot stamping industry.

Main business

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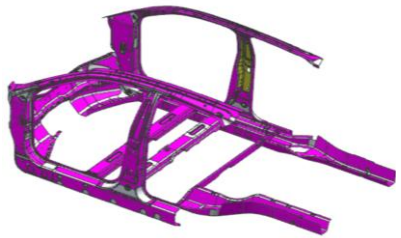
Pressler is a specialized company dedicated to R&D, manufacturing, and sales of critical equipment and metal-formed components in the metal forming industry.

Parts Production

Integrated zinc coated door ring

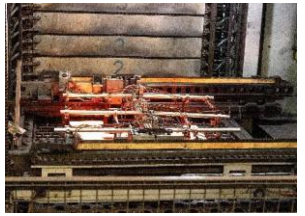


Various hot stamped BIW (Body-in-White) components

Tooling Manufacturing

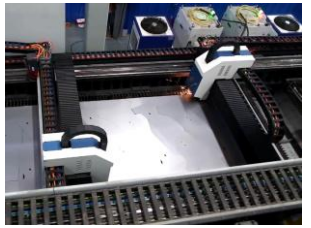
Equipment Manufacturing

3D Five-axis
Laser Cutting Machine



Multi-layer Roller
Hot Stamping Line

Vacuum Hot Stamping Line



Laser Blanking Line

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Current Pain Points in Hot Stamping

02

Current pain points

1

Corrosion Resistance

Poor corrosion resistance at weld seams and trimming edges of Al-Si material

Al-Si B-Pillar

48h Neutral Salt Spray Test

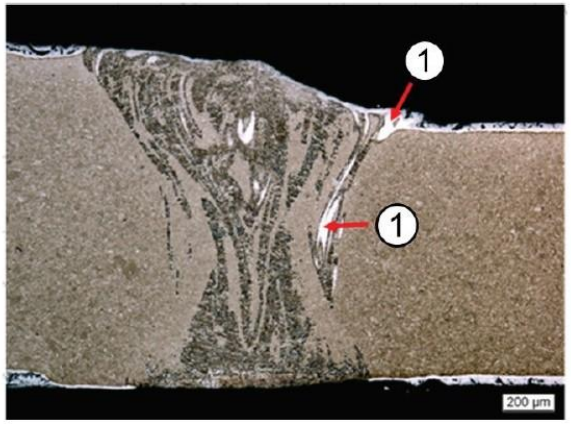
16h Neutral Salt Spray Test (Weld Seams)

Current pain points

2

Laser Welding

High difficulty in laser welding Al-Si coated blanks



Legend

1 Not OK

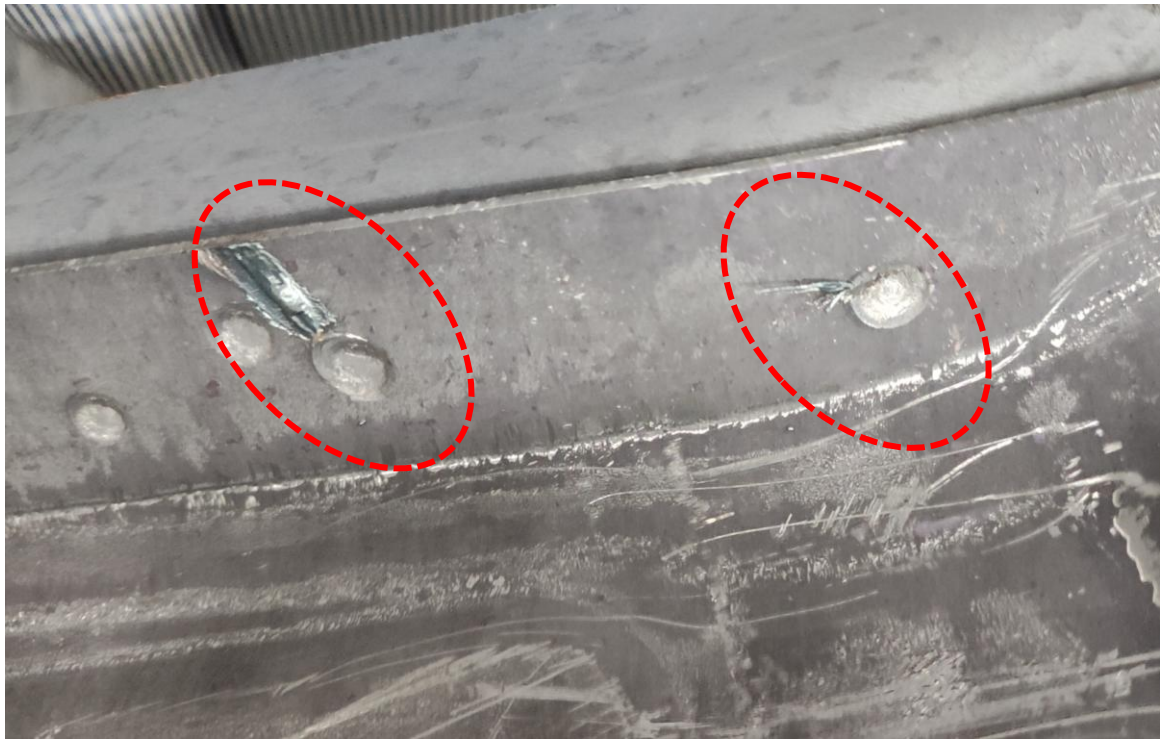
Figure B.7 – Fe-Al phases in the fusion line and in the weld material of a laser-welded blank made of AlSi-pre-coated material, which are impermissible for a joint between similar materials (hard/hard) (OM = 50:1)

Current pain points

3

Spot Welding

Significant burring and narrow welding windows



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Process

03

Manufacturing Process

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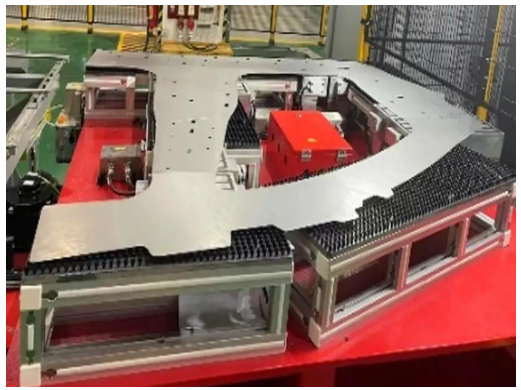
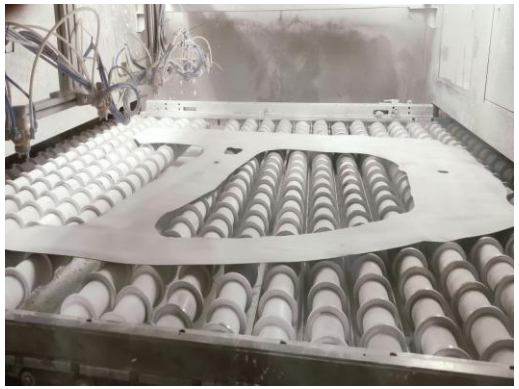
1. Blanking & TWB



2. Coating Application



3. Vacuum Heating

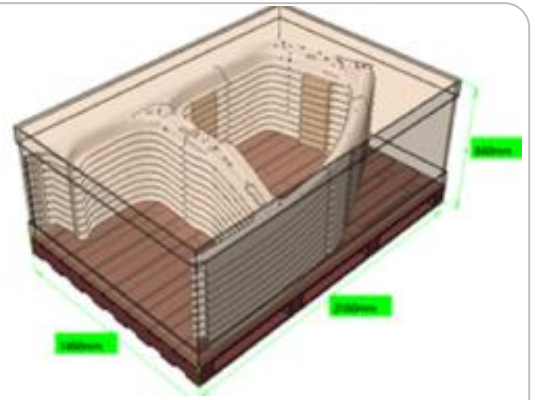
4. Hot Stamping

5. Laser Cutting

6. Zinc Coating

7. Oiling

8. Storage



Uncoated Tailor Welded Blanks

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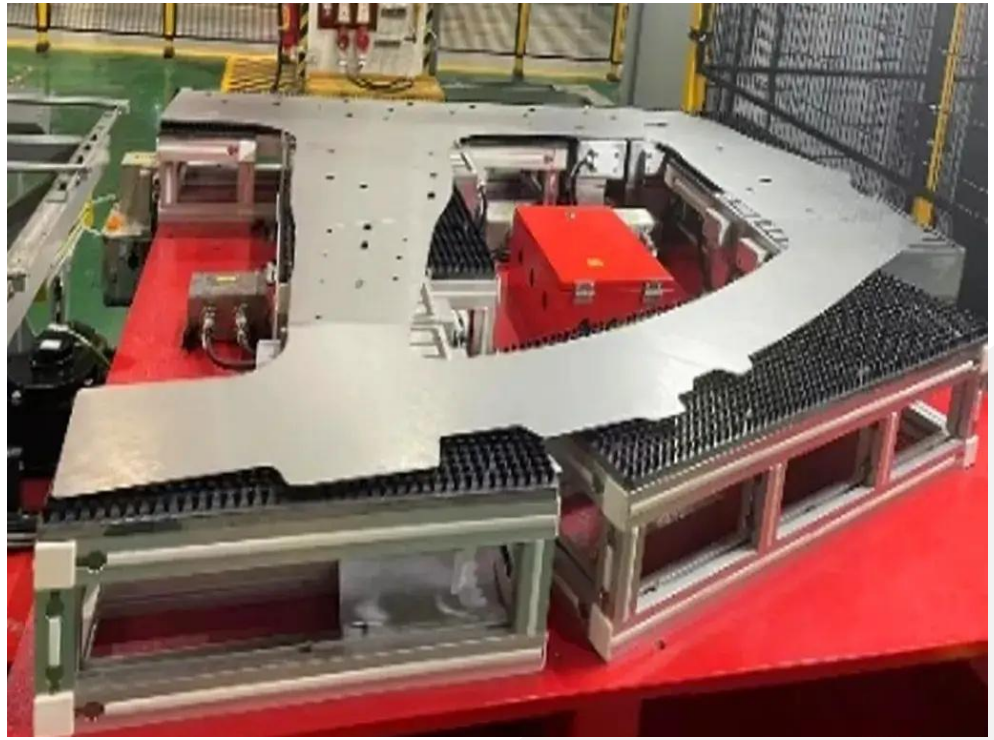
Process introduction – TWB

1. Conventional bare plate laser welding without patent restrictions
2. No need for coating ablation treatment during laser welding



Pressler Vacuum Hot Stamping Line

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KEY TECHNICAL PARAMETERS OF VACUUM HEATING FURNACE

1	Effective dimensions per zone (Length × Width)	mm	2400x2100
2	Zone	No.	4
3	Heating layers	layer	3
4	Heating temperature	℃	930~950
5	Maximum roller conveyor speed	m/s	2
6	Vacuum level	pa	1-100
7	Temperature uniformity	℃	<10

Electro-galvanized Zinc Coating

Fully Automated Galvanizing Line

Zinc plating for vacuum hot stamping components enhances surface corrosion resistance

Tempering:

Reduces hydrogen embrittlement and delayed fracture risks

Oiling:

Prevents rust formation on Zinc coating during prolonged storage

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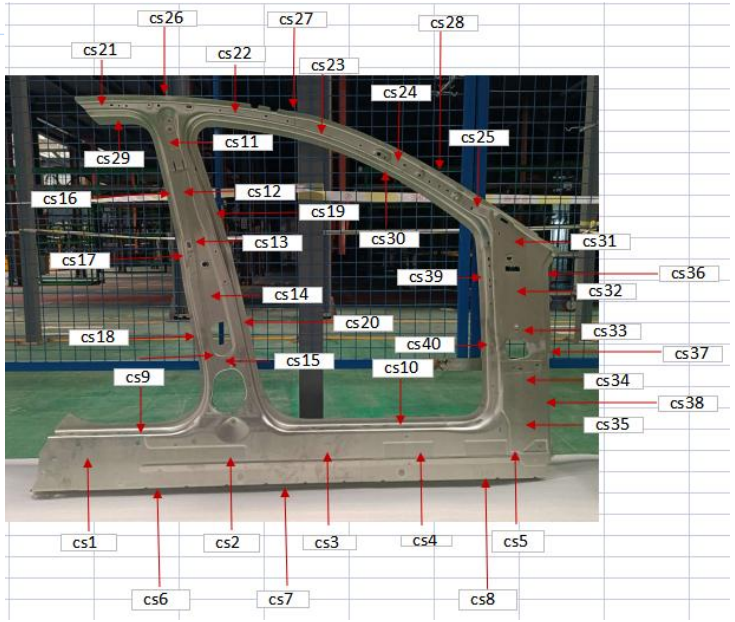
Performance

04

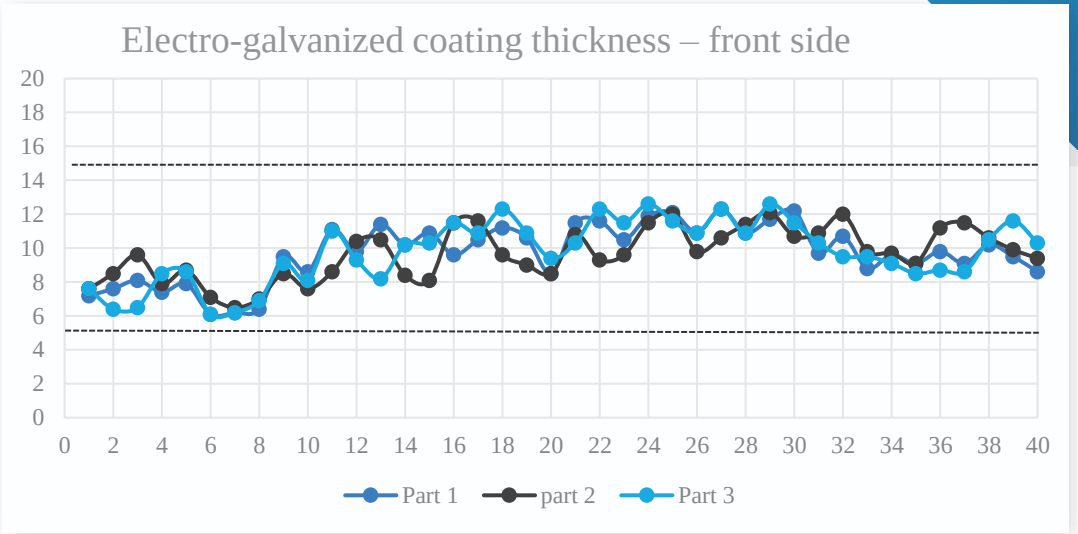
Coating Thickness

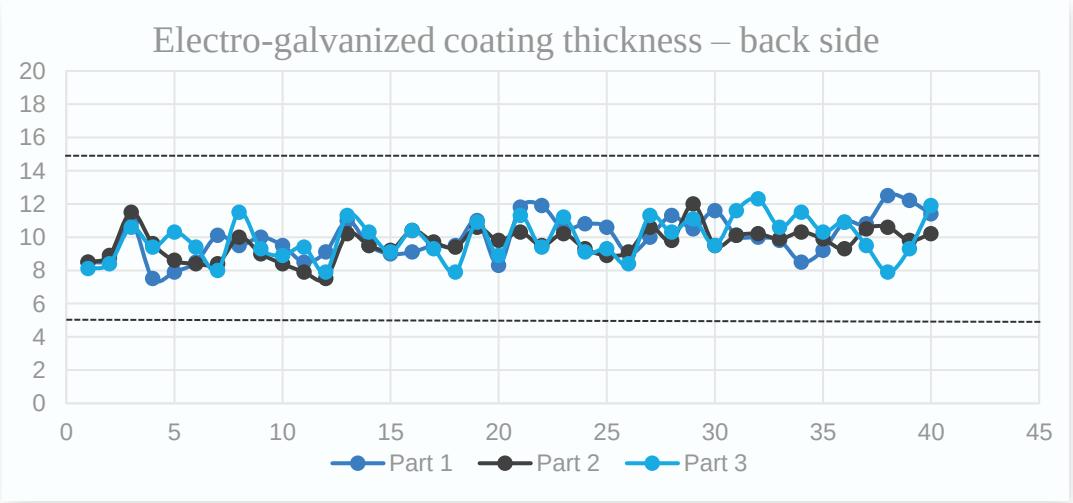
Customizable coating thickness at any location per customer requirements

Zinc coating thickness tolerance: 5-15μm

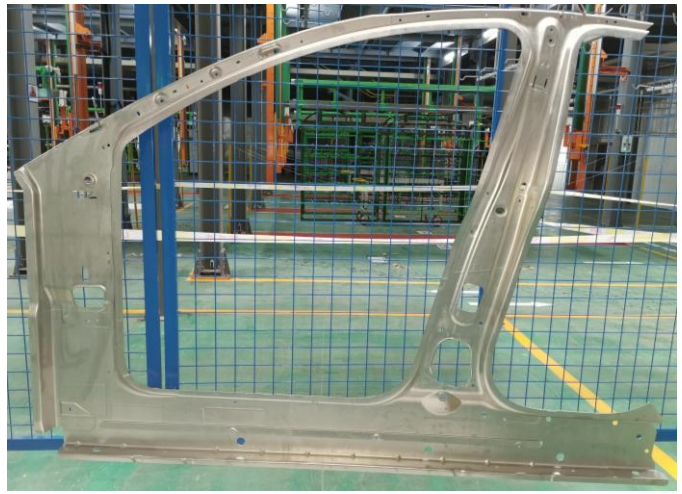


①cs1-5,cs11-15,cs21-25,cs31-35 Planar test points on all four edge positions
②cs6-10,cs16-20,cs26-30,cs36-40 Side test points on all four edge positions;
③Back side test points correspond to front side test point positions;

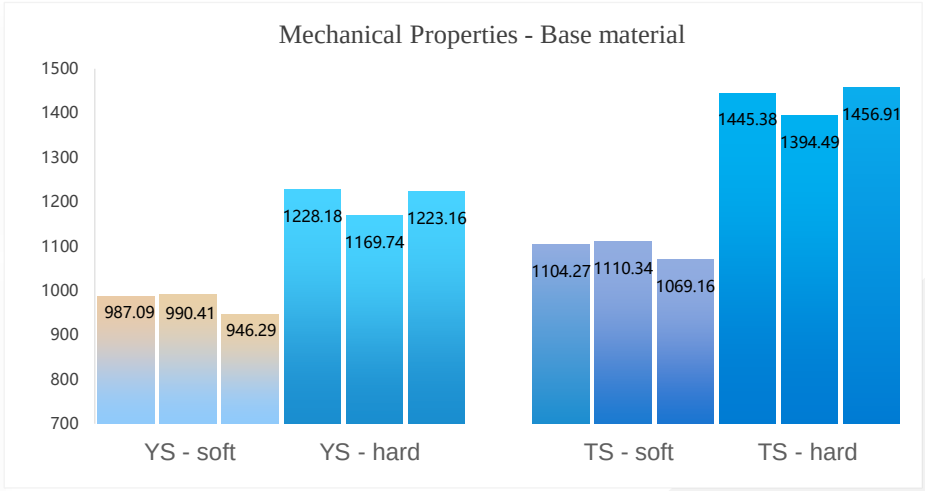


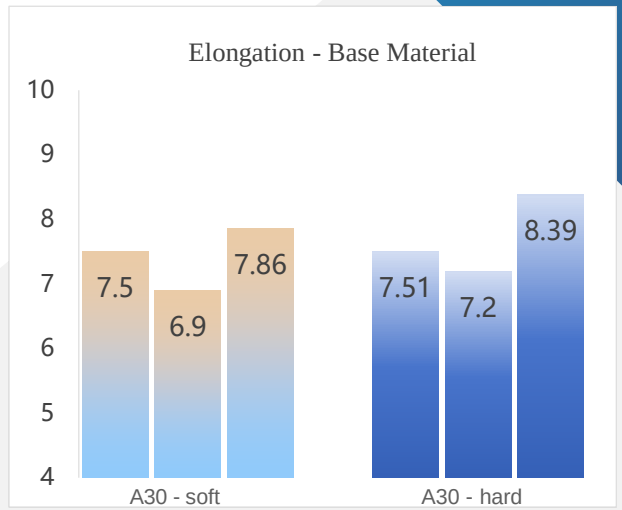


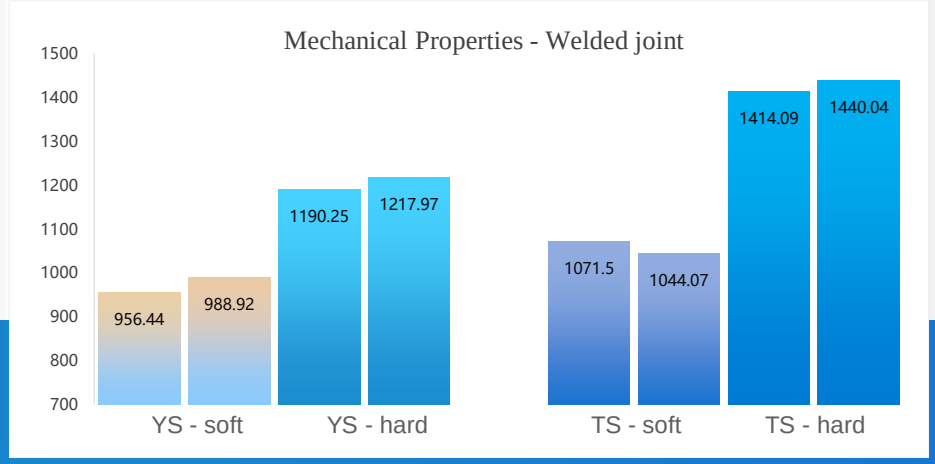
Mechanical Properties

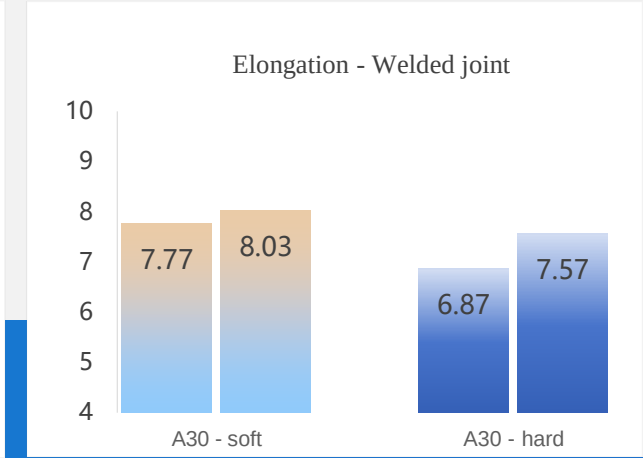


Both base material and welded areas of electro-galvanized door ring meet mechanical performance requirements;



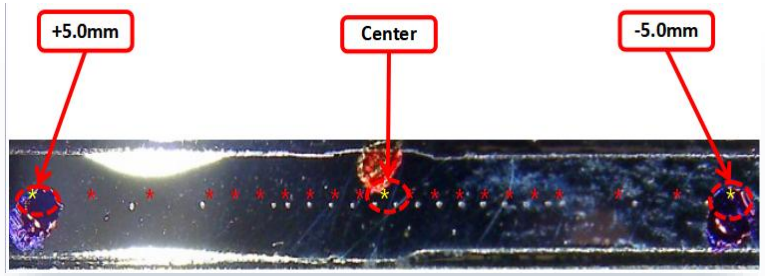


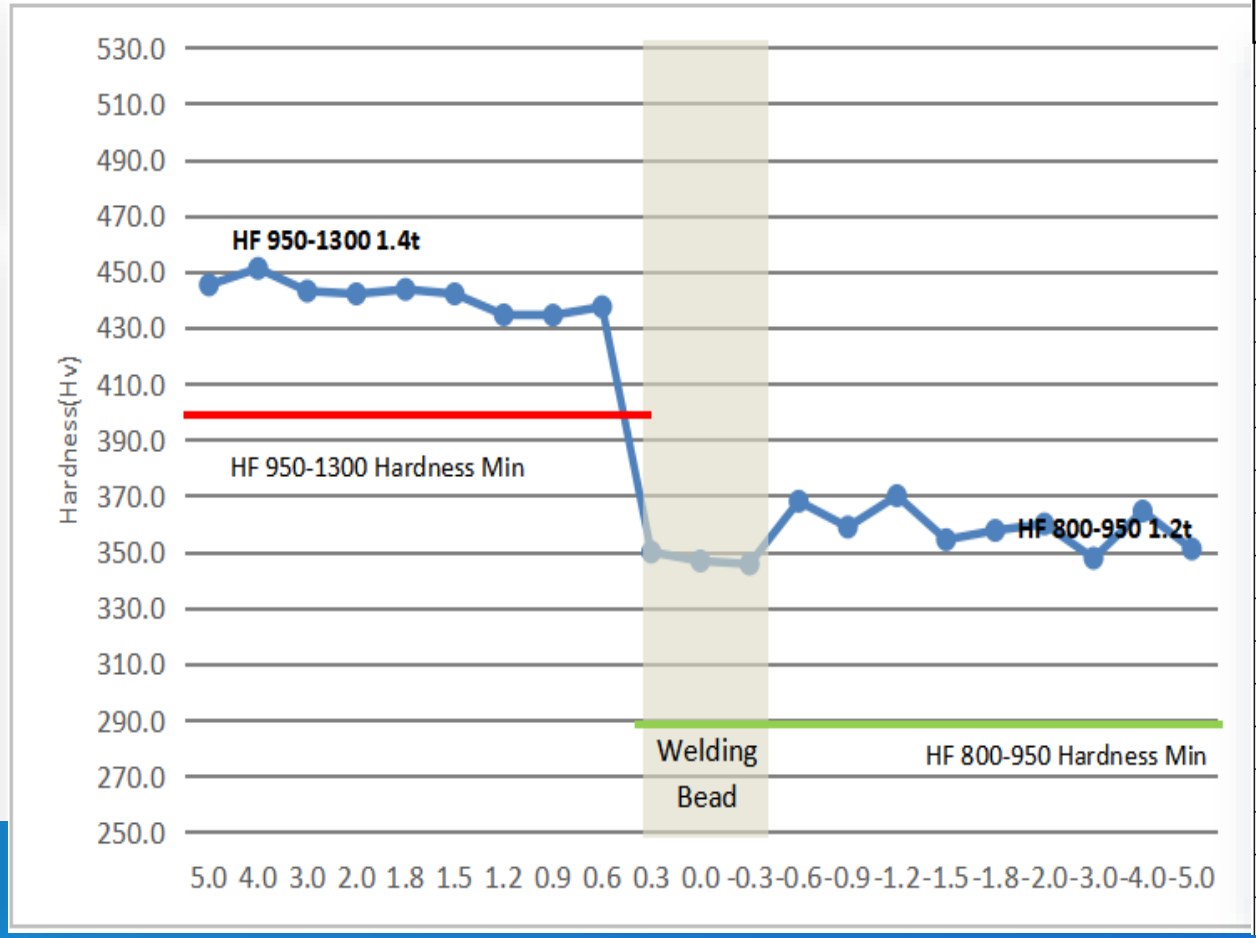




Hardness Measurement

Vickers hardness of laser welding seam per ISO 6507





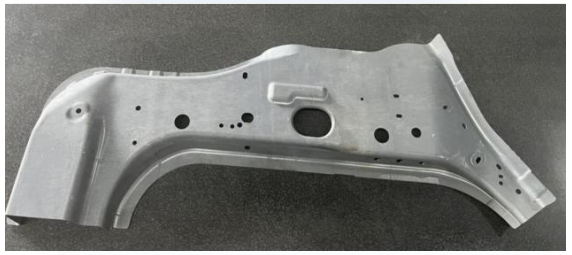
Position	SPEC(Hv) min	SPEC(Hv) max	#1 Part (Hv)
5.0	400	530	445.2
4.0	400	530	451.1
3.0	400	530	443.0
2.0	400	530	442.0
1.8	400	530	443.6
1.5	400	530	442.0
1.2	400	530	434.5
0.9	400	530	434.4
0.6	400	530	437.4
0.3	290	390	349.9
0.0	290	390	346.7
-0.3	290	390	345.6
-0.6	290	390	368.0
-0.9	290	390	358.8
-1.2	290	390	370.0
-1.5	290	390	354.3
-1.8	290	390	357.6
-2.0	290	390	359.9
-3.0	290	390	347.7
-4.0	290	390	364.5
-5.0	290	390	351.0

5% Neutral Salt Spray Test

Zn VS Al-Si components side-by-side
48H corrosion resistance test

testing equipment	salt spray testing machine		
equipment model	YHYW-90L		
testing environment	Salt spray laboratory		
testing standards	ASTM B117-2016		
salt concentration	4.9%	laboratory relative humidity	45%
salt solution pH value	7.02	laboratory temperature	35℃
air pressure	1kg/cm²	saturation pressure barrel temperature	47℃
spray volume	1ml/80cm²/H	salt spray chamber temperature	35℃

AlSi A pillar



EG B pillar

AlSi A pillar lower-24h

EG B pillar-24h

AlSi A pillar lower-48h

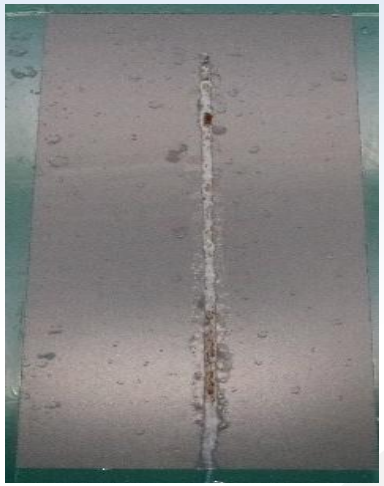
EG B pillar-48h

10 Week Cyclic Corrosion Test

22MnB5 uncoating (E-coating)

AlSi coating 22MnB5 (E-coating)

EG 22MnB5 (E-coating)



Conclusion: After 10 weeks of cyclic corrosion testing, hot stamped electro-galvanized components demonstrated superior corrosion resistance compared to Al-Si coated and bare plate counterparts.

Testing standard: AA-0224:2018 Cyclic Corrosion Test, DIN EN ISO 11997-1, Cycle B

According to the requirements of AA-0224:2018.

Table 1: set-up of one cycle

No.	Test condition	Duration
1st 24h	Salt fog (See table 2 below)	24h
2nd 24h	(40±2)°C 100%RH	8h
	(23±2)°C (50±20)%RH	16h
3rd 24h	(40±2)°C 100%RH	8h
	(23±2)°C (50±20)%RH	16h
4th 24h	(40±2)°C 100%RH	8h
	(23±2)°C (50±20)%RH	16h
5th 24h	(40±2)°C 100%RH	8h
	(23±2)°C (50±20)%RH	16h
6th 24h	(23±2)°C (50±20)%RH	24h
7th 24h	(23±2)°C (50±20)%RH	24h
Total		168h

Results (10 weeks)	EG	AlSi	Uncoated
Evaluation standard	GS 90011		
Blistering B	0	0	0
Rusting Ri	0	1	3
Rust creeps Ud (mm)	0	0.37	0.88
Cross hatch testing	0	0	0

Drop Tower Test

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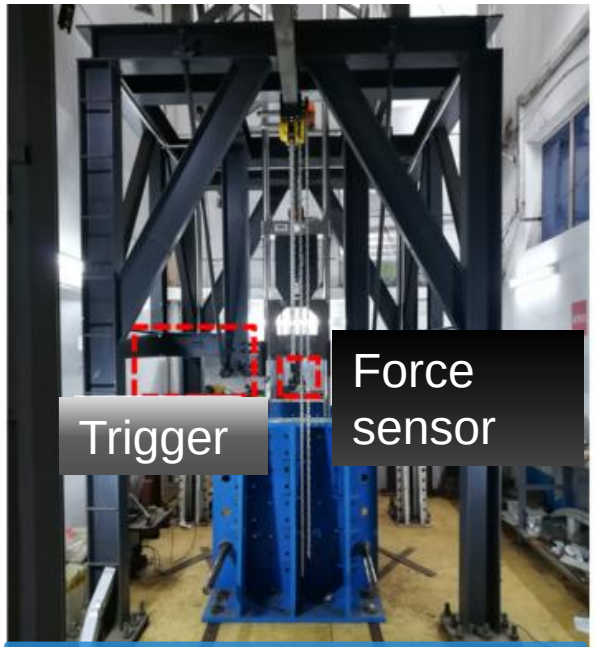
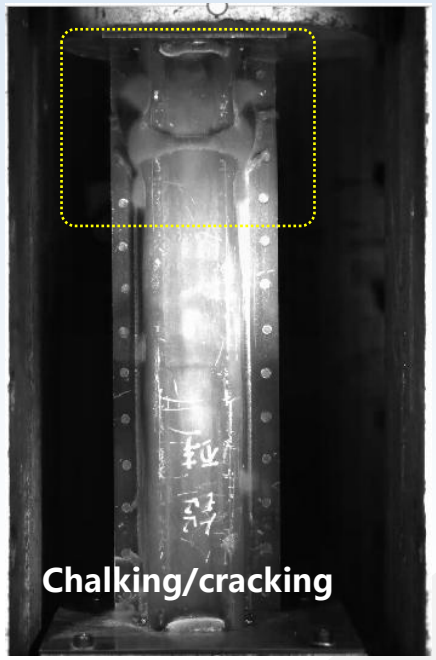


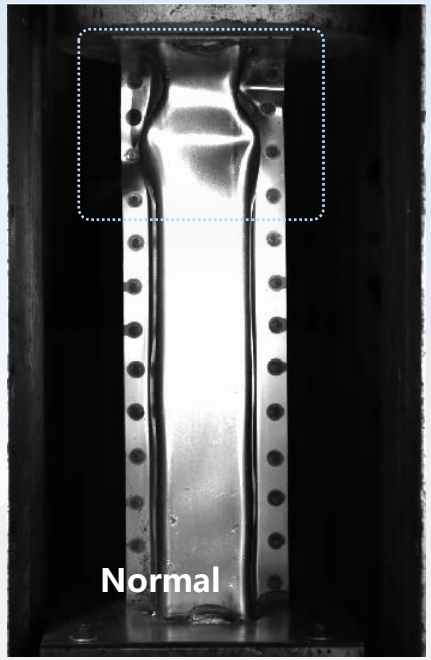
Equipment Parameters

Maximum lifting height	15M
Impact hammer mass range	220-1000KG
Maximum speed	17.3M/S
Lifting precision	1mm
Hammer head geometry	φ200Millimeter cylindrical

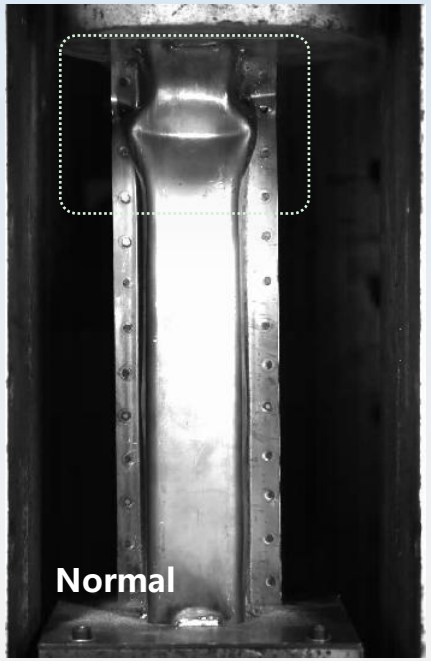
Al-Si coating



EG coating



Uncoated



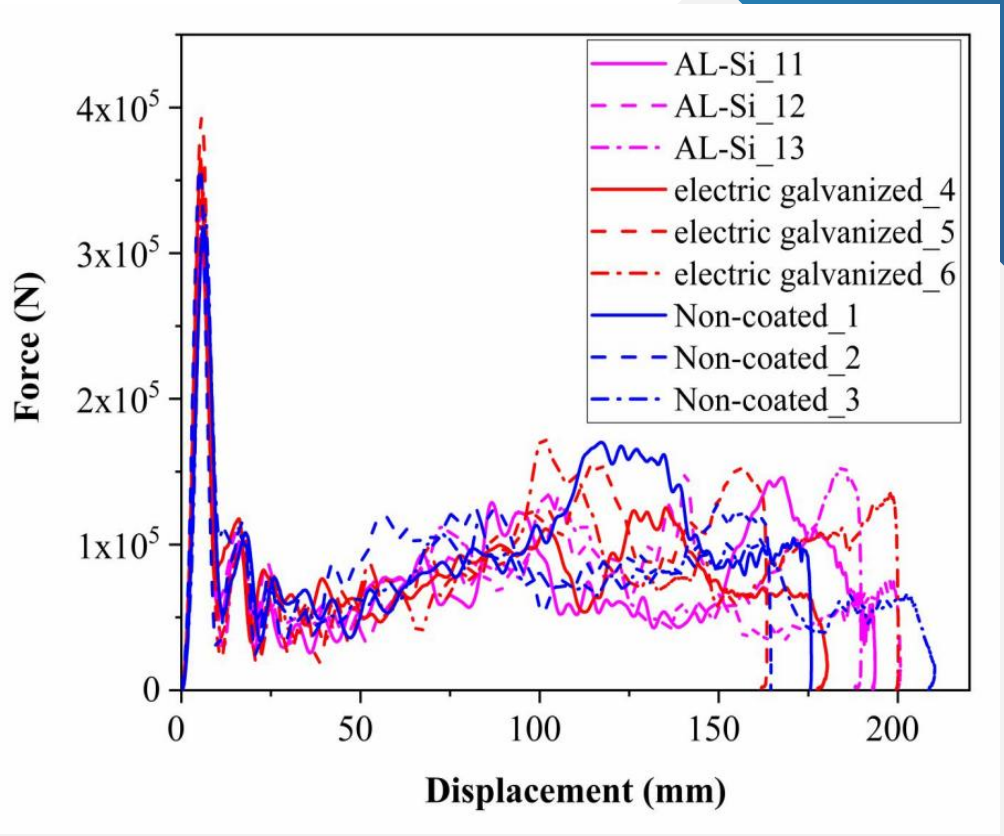
Drop tower test results:

(1) Comparison with Al-Si coated counterparts in drop tower impact tests revealed that hot stamped galvanized and uncoated components exhibit no coating cracking or powdering during collision.

(2) After collision, the aluminum silicon coating fractures at the initial deformation. Galvanized and uncoated components show higher bending angles and do not fracture during the initial deformation.

Drop Tower Test Results

Coating	Peak force (N)	Energy absorption (J)	Average energy absorption	Peak force (N)
EG-4	313014.59	15059.37	16268.05	349529.14
EG-5	393078.51	15938.62		
EG-6	342494.41	17806.16		
AlSi-11	313014.59	14969.37	15350.44	320527.32
AlSi-12	330038.27	15180.53		
AlSi-13	318529.11	15901.43		
Deviation (EG-AlSi) /AlSi			**6.0%**	**9.0%**



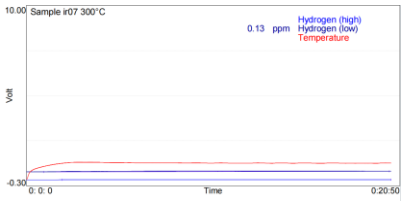
During collision, hot stamped galvanized components exhibited 6% higher energy absorption and 9% higher peak force compared to Al-Si coated components.

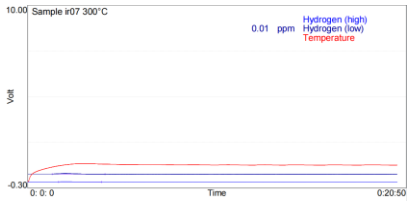
Hydrogen Embrittlement Risk Assessment

GDIS

Hydrogen content test

Test conditions：300℃，20min





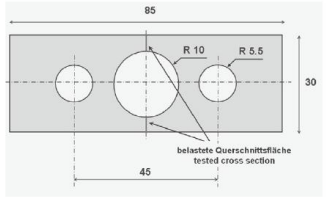
Zinc Layer- 0.13ppm　　Base Material 0.01ppm

Hydrogen embrittlement risk assessment 1——SEP1970

STAHL-EISEN-Prüfblätter (SEP) des Stahlinstituts VDEh　　September 2011

Prüfung der Beständigkeit von Advanced High Strength Steels (AHSS) für den Automobilbau gegen fertigungsbedingte wasserstoffinduzierte Sprödbrüche **Test of the resistance of Advanced High Strength Steels (AHSS) for automotive applications against production related hydrogen induced brittle fracture**	**SEP 1970** 1. Ausgabe 1st Edition

untersagt.



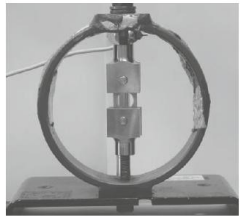


Bild 4.4: Probengeometrie
Figure 4.4: Sample geometry

Bild 4.5: Beispiel für die Prüfeinrichtung
Figure 4.5: Example for the test device

5.2 Sample with punched hole

Freedom of cracks after 96 h (= 4 days).

No cracks detected after maintaining a constant load of 96 hours at 100% yield strength (1240Mpa)

Hydrogen embrittlement risk assessment 2——GB/T 39039

INTERNATIONAL STANDARD　　**ISO 16573-1**

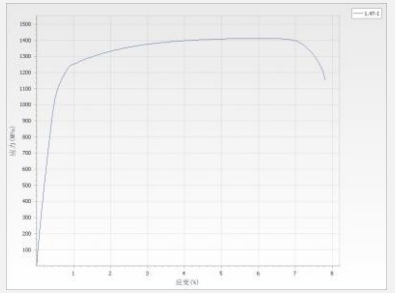
First edition
2020-08

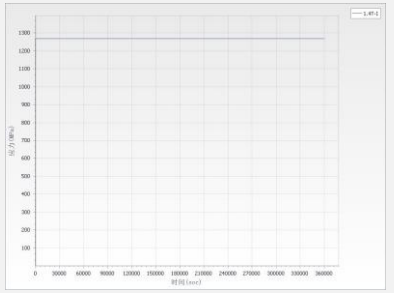
Steel — Measurement method for the evaluation of hydrogen embrittlement resistance of high strength steels —

Part 1:
Constant load test

Acier — Méthode de mesure pour l'évaluation de la résistance à la fragilisation par l'hydrogène des aciers à haute résistance —
Partie 1: Essai de charge constante

Universal Testing Machine





TS:1411.78Mpa　　Constant load:1270MpaMpa

No cracks detected after maintaining a constant load of 100 hours at 90% tensile strength (1270Mpa)

Hydrogen Embrittlement Risk Assessment

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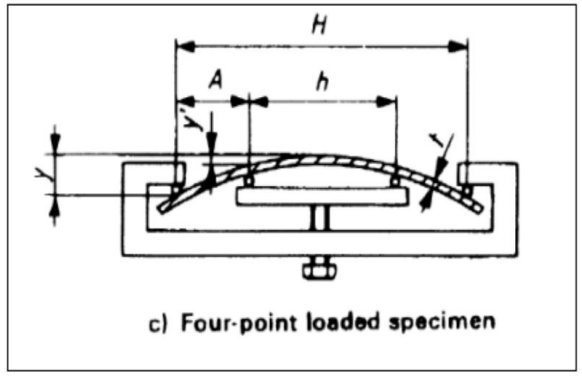
Hydrogen embrittlement risk assessment 3——ISO 16540

INTERNATIONAL STANDARD **ISO 16540**

First edition
2015-10-01

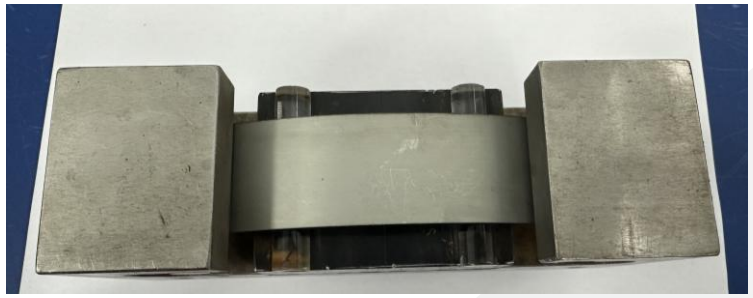
Corrosion of metals and alloys — Methodology for determining the resistance of metals to stress corrosion cracking using the four-point bend method

Corrosion des métaux et alliages — Méthodologie de détermination de la résistance des métaux à la fissuration par corrosion sous contrainte au moyen de la méthode de flexion quatre points



c) Four-point loaded specimen

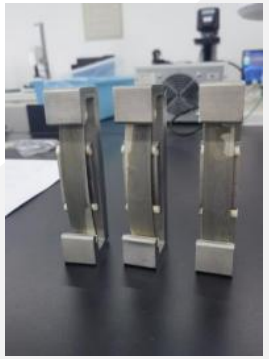
Four-point Bending Method				
T	A	H	yield strength	deflection
1.370mm	50mm	100mm	1072.474Mpa	9.419mm



No cracks detected after 30 days

Hydrogen embrittlement risk assessment 4——ISO 16540+Acid soaking

Stress Corrosion			
Yield Strength	Test conditions	Result	Judgement
1185Mpa	0.1mol/L HCl solution(PH=1)，120h	No cracking	OK



No cracks detected after soaking in 0.1mol HCl and 100% yield strength for 120 hours

Weldability

GDIS

Excellent welding performance

COMPARISION OF WELDING WITH THREE SHEETS

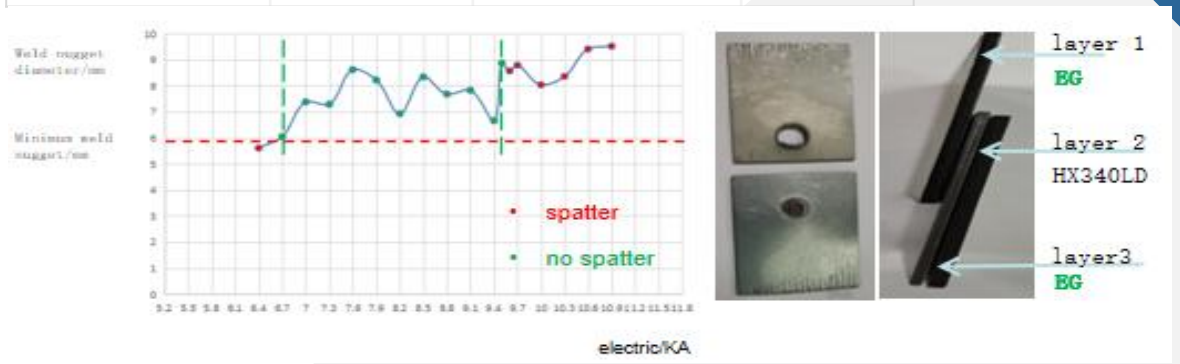
Test	Material	coating	Thickness(mm)	Note
Sheet1	HX340LAD	GI50/50	1.0	
Sheet2	HS950Y1300T-BORON	EG	1.4	Pressler
Sheet3	HS950Y1300T-BORON	EG	1.4	Pressler

Test	Material	Coating	Thickness(mm)	Note
Sheet1	HX340LAD	GI50/50	1.0	
Sheet2	HS950Y1300T-BORON	Al-Si150	1.4	Al-Si Coating
Sheet3	HS950Y1300T-BORON	Al-Si150	1.4	Al-Si Coating

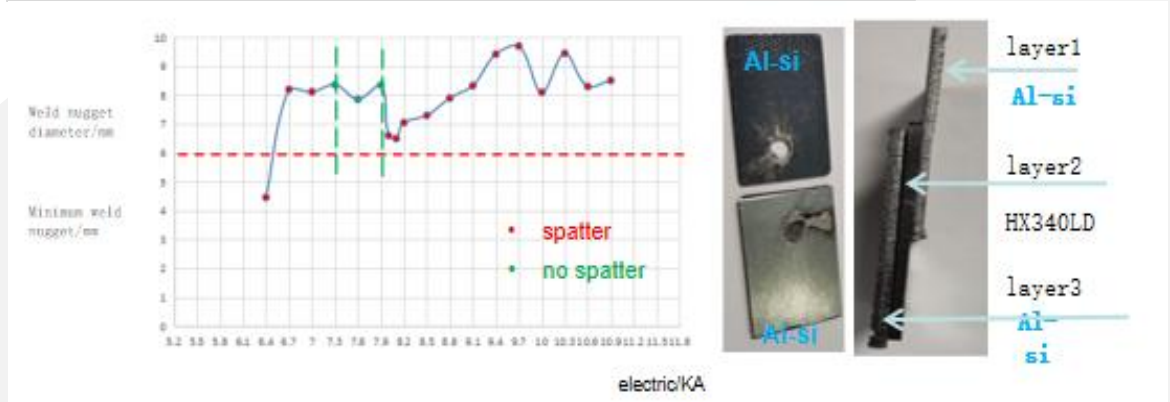
Conclusion: The welding window of galvanized sheet is 2.8KA, and the welding window of aluminum-silicon sheet is 0.6KA.

Welding window is bigger than 1000A, no splashing or burring in the spot welding process.

Result	Min(KA)	Max(KA)	Range(KA)
Welding windom	6.7	9.5	2.8KA



Result	Min(KA)	Max(KA)	Range(KA)
Welding windom	7.3	7.9	0.6KA



Weldability– Structural Adhesive

GDIS

Excellent welding performance

Structural adhesive

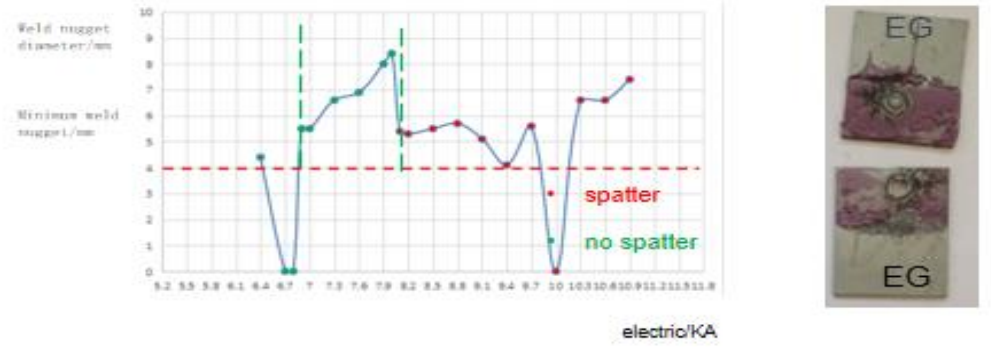
Test	Material	Coating	Thickness(mm)	Adhesive	Note
sheet 1	HS950Y1300T-BORON	EG	1.4	BM1460N	Pressler
sheet 2	HS950Y1300T-BORON	EG	1.4	BM1460N	Pressler

Test	Material	Coating	Thickness (mm)	Adhesive	Note
sheet 1	HS950Y1300T-BORON	Al-Si150	1.4	BM1460N	Al-Si coating
sheet 2	HS950Y1300T-BORON	Al-Si150	1.4	BM1460N	Al-Si coating

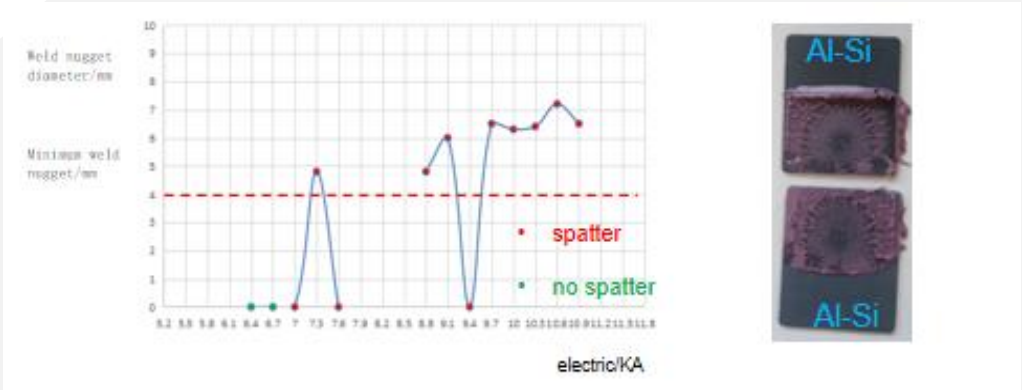
Conclusion: The welding window of galvanized sheet is 1.1KA and that of aluminum-silicon sheet is 0KA .

Welding window

Results	Min(KA)	Max(KA)	Range(KA)
Welding Windom	6.9	8.0	1.1KA



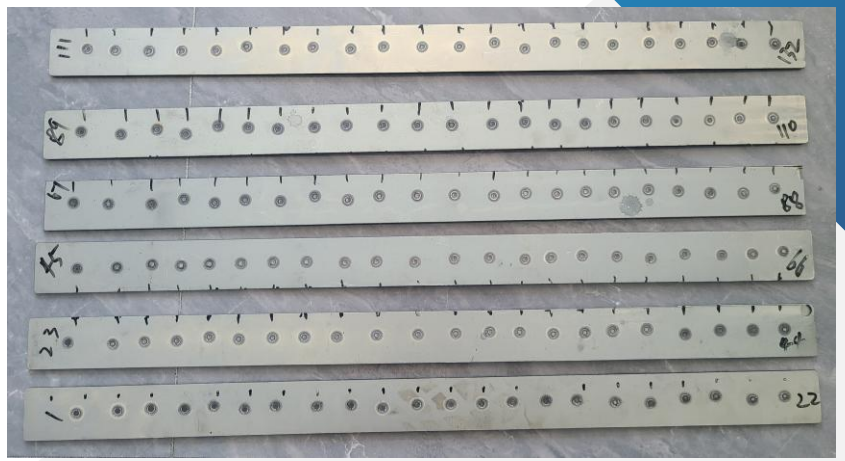
Results	Min(KA)	Max(KA)	Range(KA)
Welding Windom	/	/	0KA



Weldability – Surface Quality

No splashing or burrs during spot welding of galvanized sheets

▶ Al-Si hot-formed sheets exhibited significant splashing



▶ Electro-galvanized hot-formed sheets showed minimal splashing

Test Material	1.8mm 1500MPa Al-Si Hot Stamping Material Dimensions: 700mm x 45mm, 45mm x 56mm	1.8mm 1500MPa Zinc Coating Material Dimensions: 700mm x 45mm, 45mm x 56mm

Test Equipment

Welder model: Obara SIV32C

Electrode dimensions: Chromium-Zirconium-Copper alloy Φ8 electrode cap

Two Al-Si coated sheets (700mm x 45mm) spot-welded with 30mm spacing.

GDIS

High-temperature Resistant Lubricating Coating

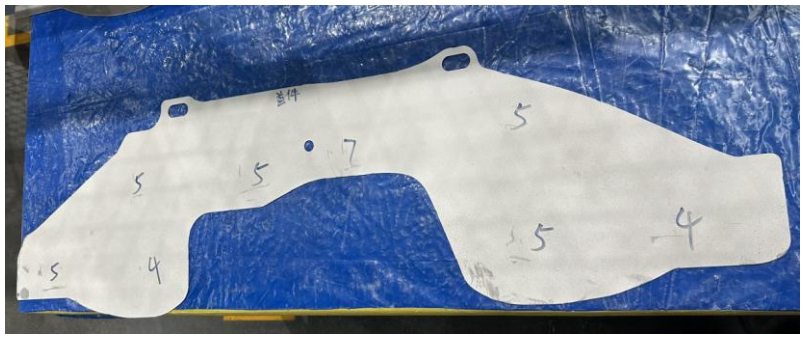
05

Hexagonal Boron Nitride Coating

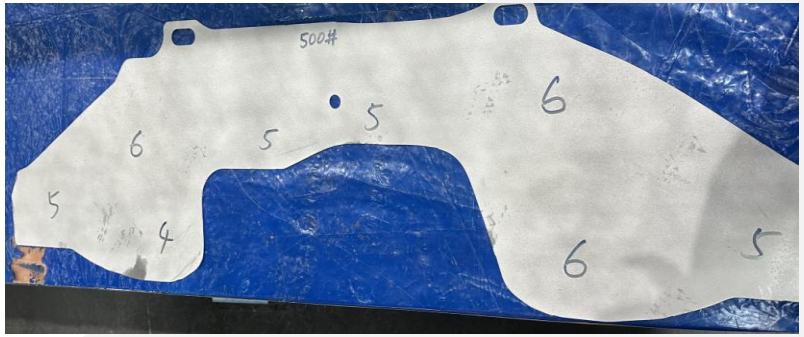
Fully automatic vacuum hot stamping production line

Fully automatic spraying station integrated into hot stamping line

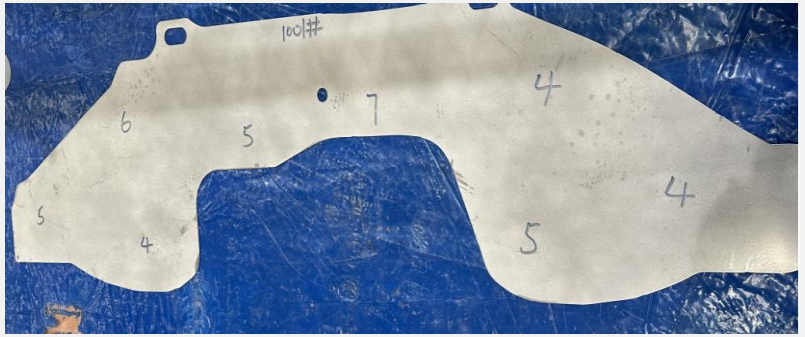
- HBN Thickness Measurement Points



Part No1#



Part No 500#



Part No 1001#

Performance of HBN Coating

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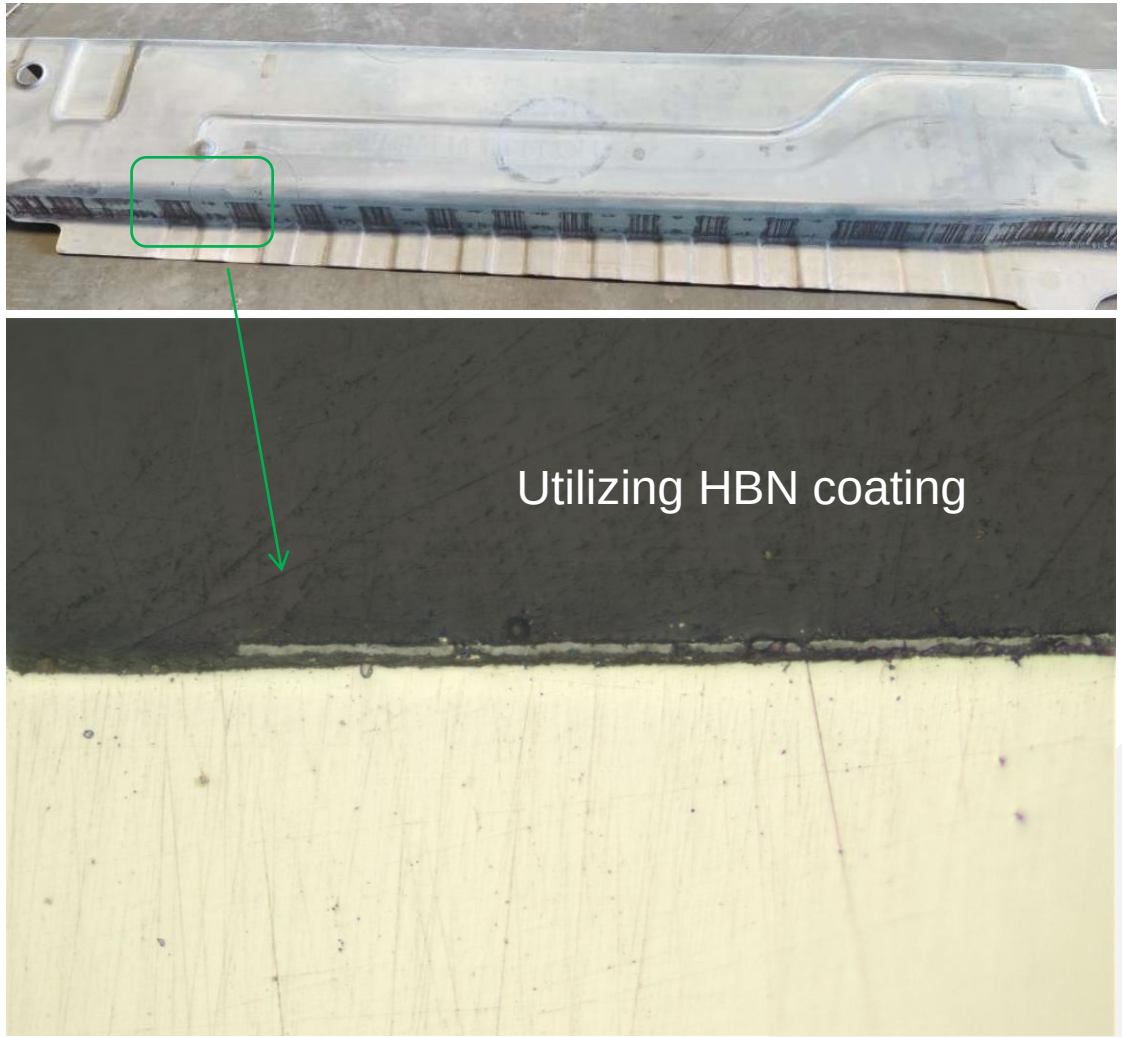
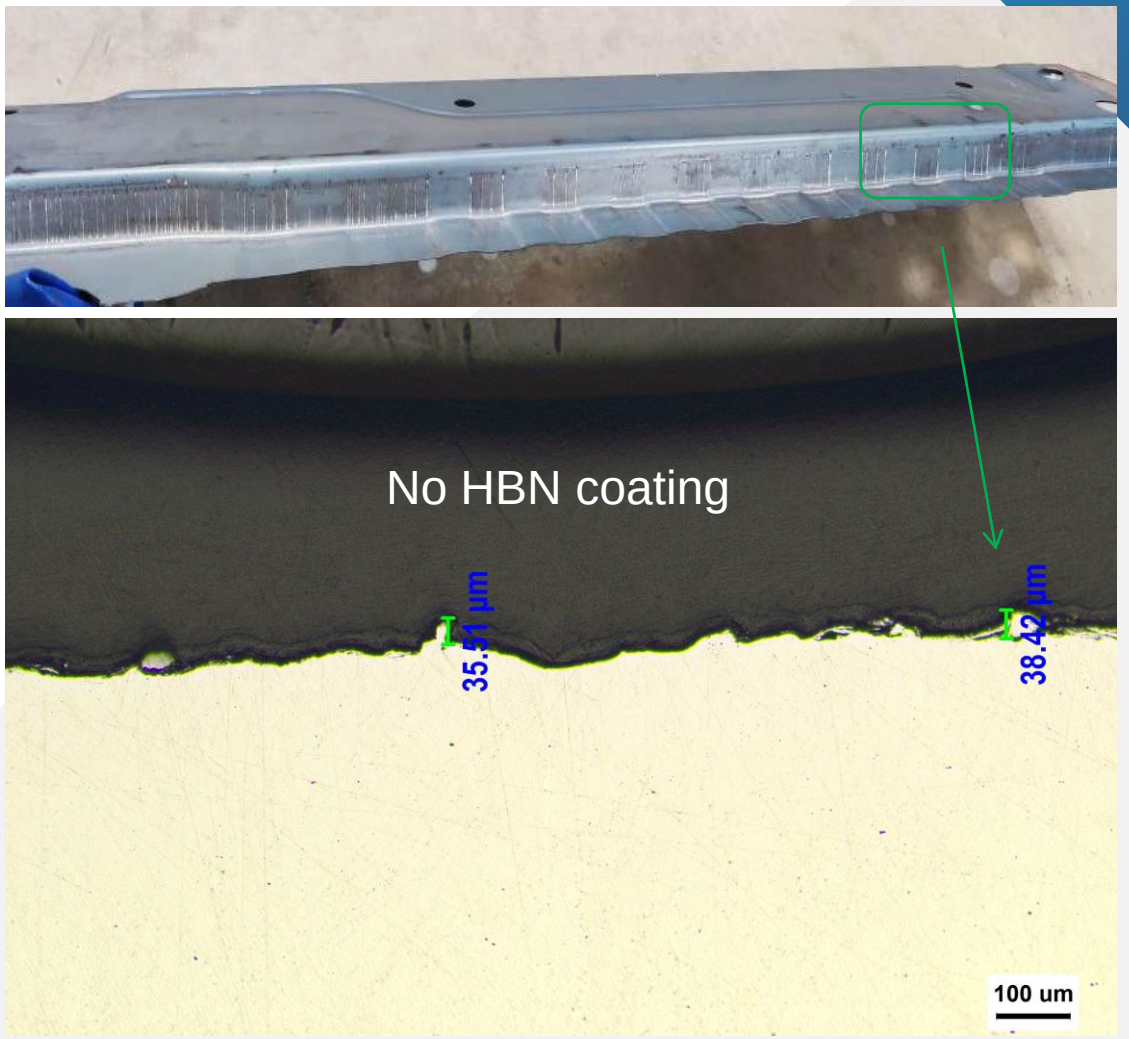
HBN coating does not affect the performance of hot forming parts.

Test item	Standard	HBN part	Without HBN Part
Hardness HRA	71-76 HRA	72.8 HRA	72.5 HRA
Core hardness HV	416-516 HV	478.5 HV	474.5 HV
Zinc coating thickness	7-13 um	9.6 um	9.3 um
Micro structure-Martensitic	≥95%	99.7%	99.62%
Micro structure-Decarburization	≤70 um	31 um	28 um
Surface roughness	/	14.09 um	54.01um

Comparison

HBN can reduce the scratch of uncoated hot stamping parts

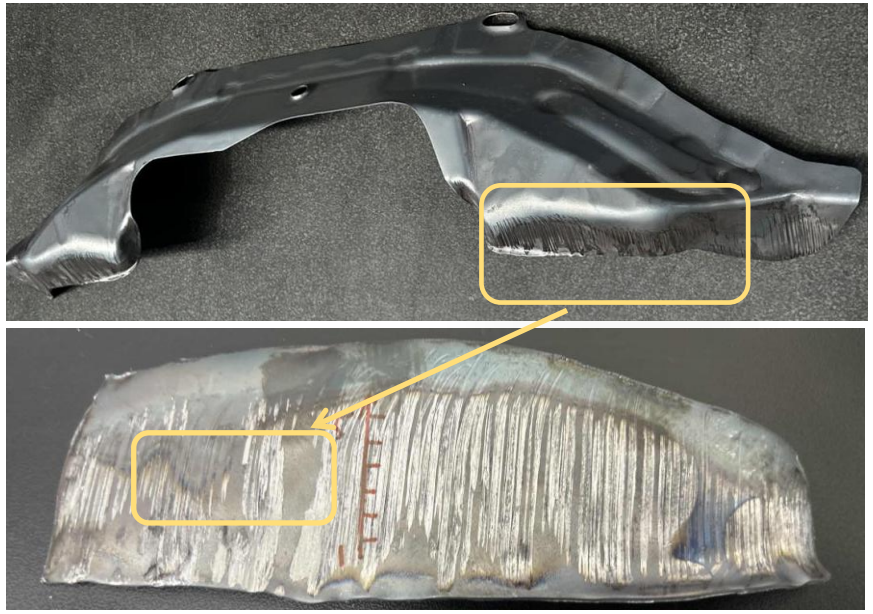


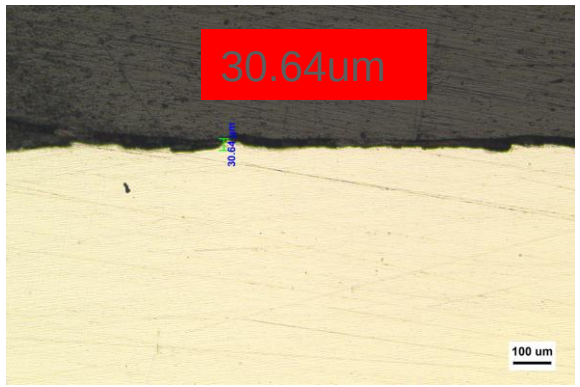


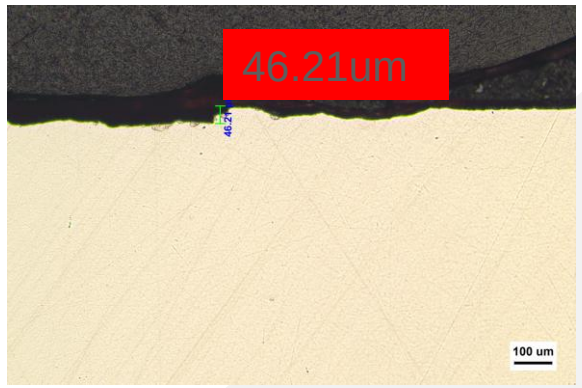
Comparison

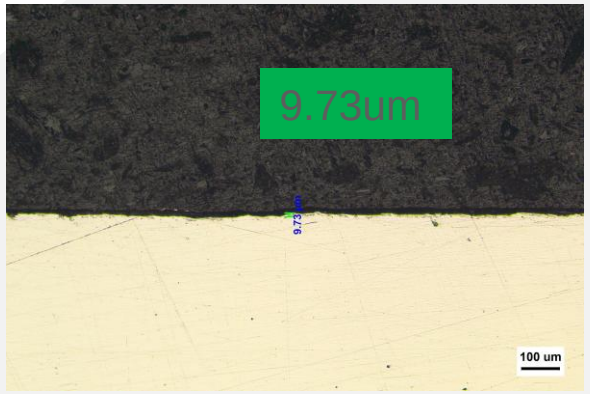
GDIS

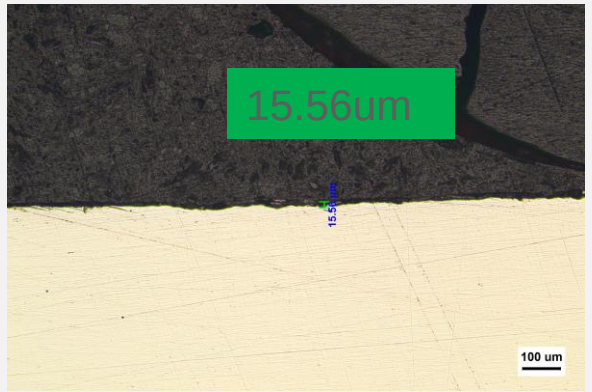
HBN can reduce the scratch of uncoated hot stamping parts











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Summary

06

Pressler© Vacuum Hot Stamping + EG + HBN

GDIS

5 ADVANTAGES

Superior mechanical properties

Excellent cold bending performance and crash energy absorption; No coating cracking or powdering;

Breakthrough in raw material limitations

No longer restricted to single steel mill sources, offering greater material flexibility.

Outstanding weldability

Wider welding window compared to AlSi hot-formed steel, achieving splash-free and burr-free spot welding.

Excellent corrosion resistance

Zinc coating applied post-hot stamping remains unaffected by heating, features dense structure and anodic protection for superior corrosion resistance.

Cost advantages

Integrated electro-galvanized door ring reduces costs by 15-20% compared to Al-Si material in certain markets.

Pressler Technologies Co., Ltd.

Thank you

Delivering outstanding technical solutions for the hot stamping industry