jetQ® – optimized AHSS material

for geometrically complex crash structures

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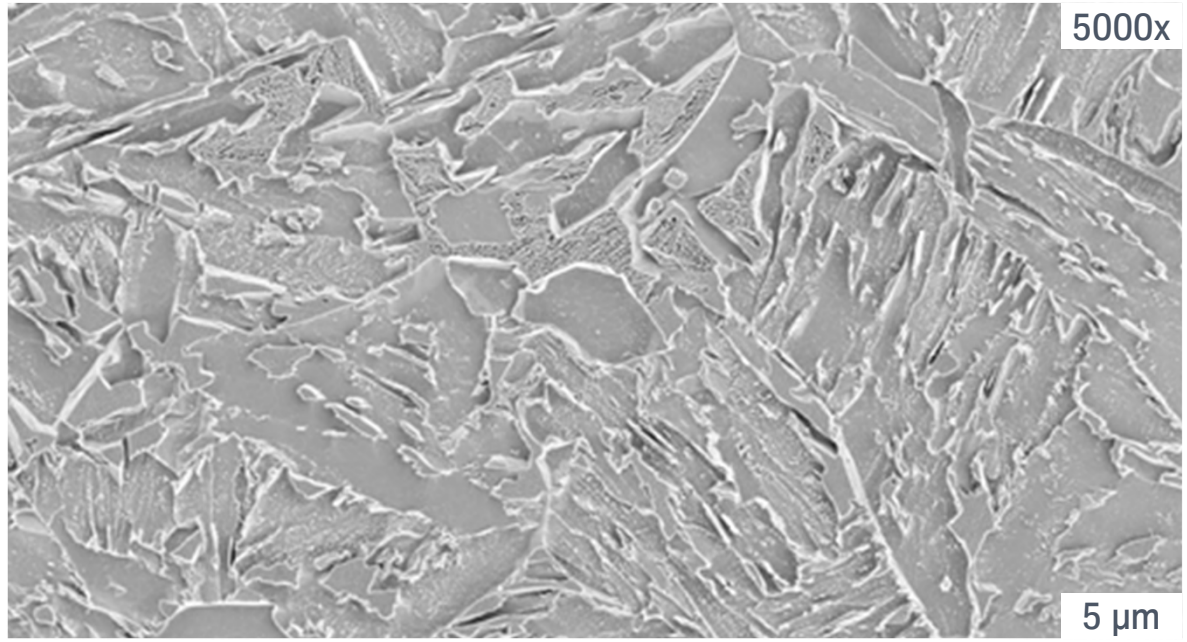
thyssenkrupp Steel Europe

jetQ®: optimized AHSS material for geometrically complex crash structures

More safety and efficiency in vehicle bodies

- Highly ductile AHSS with optimized local and global forming properties
- Robust processing in the press shop
- Optimized AHSS for new cost cutting and light-weighting potential
- Good hole expansion capability and high resistance to sheared edge failure
- Better crash performance compared with conventional DP steels thanks to increased yield strength

→ AHSS with optimized property profile for greater safety and efficiency in vehicle bodies



- Moderate alloying concepts
- Homogeneous distribution of tensile strength across the microstructural components

→ Excellent processing properties in the tensile strength class > 980 MPa

Characteristics of jetQ®

High yield strength – excellent local ductility

Mechanical properties

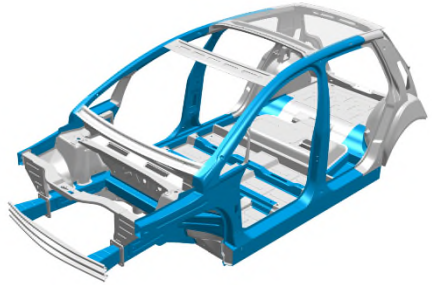
- High yield strength
- High local ductility

Parts performance

- High energy absorption
- High stretch flangeability

JFE & tkSE have collaborated in jetQ® development

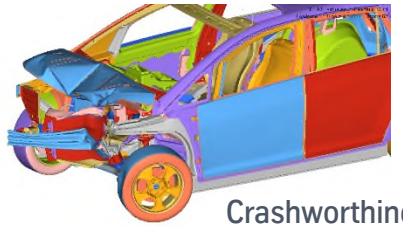
Potential applications



- Front side member
- Rear side member
- Rocker
- Seat cross member
- A pillar applications
- B pillar applications

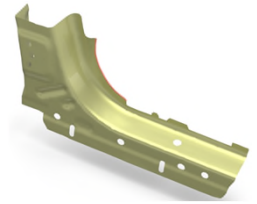
Customer Benefits

Weight & LCA saving



Crashworthiness

Production safety



Stretch flange

Global supply and availability

jetQ®: serving needs of globally acting OEM

Grade	CR[1)]	GI[2)]	GA[1)]	Reference Grade, Standard[1]
jetQ® 980	●	●	●	JSC980YH, CR700Y980T-DH
jetQ® 1180	●	●	●	JSC1180YH, CR850Y1180T-DH[2]

Availability and supply

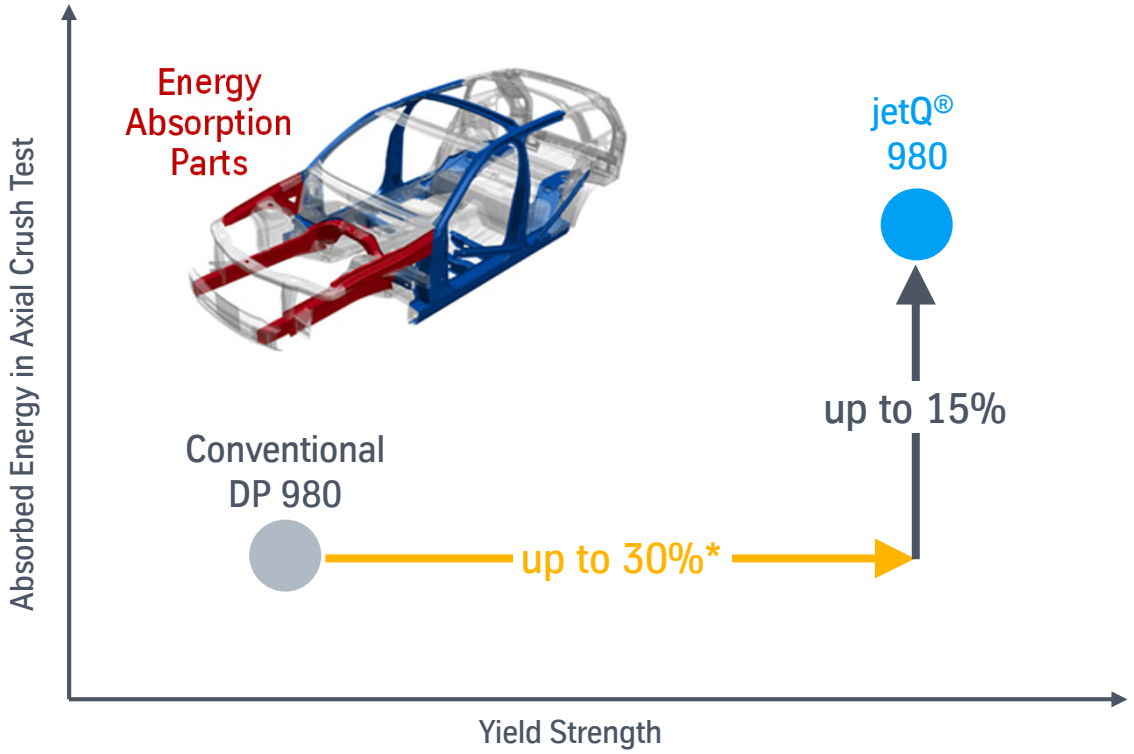
- ● Already commercially available
- ● Market launch in 2023
- ● Under development

1) CR (UC) and Galvannealed (GA) products supplied by JFE
2) GI-coated products supplied by tkSE

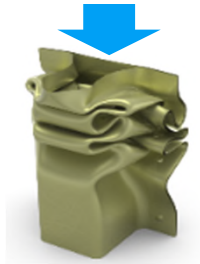
1. VDA 239-100 or JFS A 2001 and A 3011; 2. Proposal for Revision VDA 239-100

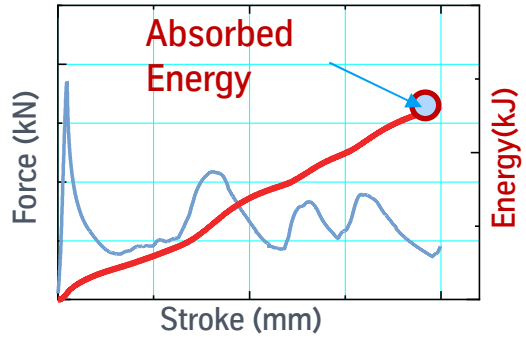
Crashworthiness – energy absorption

jetQ®: stable in axial deformation and therefore excellent for energy absorption parts



Axial crash test





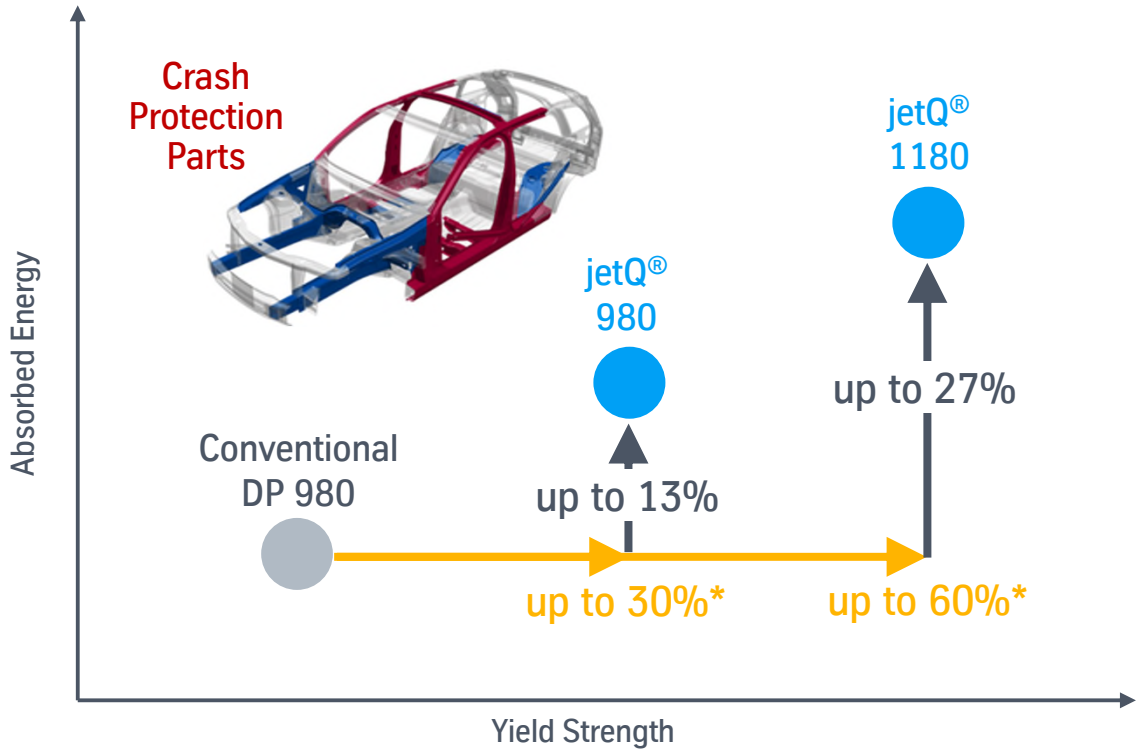
jetQ® 980

jetQ® 980 has a higher absorbed energy due to its higher yield strength than conventional DP 980

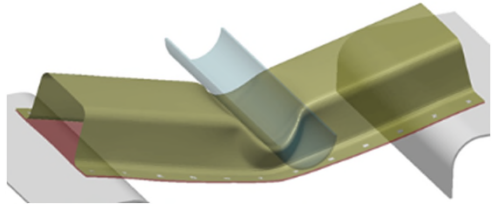
*depending on reference values

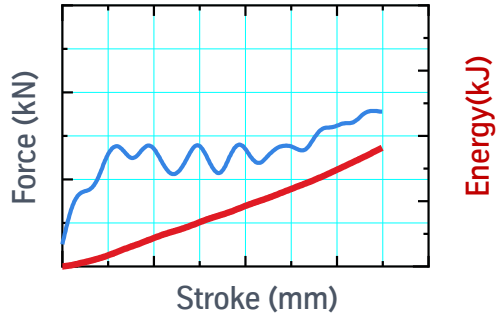
Crashworthiness – crash protection

jetQ®: stable in bending deformation and therefore excellent for crash protection



Three-point bending test





jetQ® 980

Stable deformation

jetQ® 1180

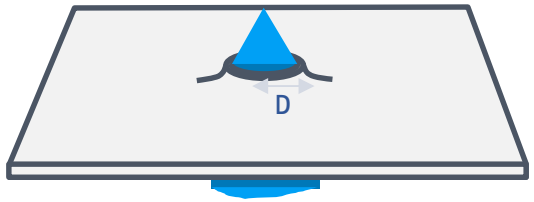
jetQ® 980/1180 has a higher absorbed energy due to its higher yield strength than conventional DP 980

*depending on reference values

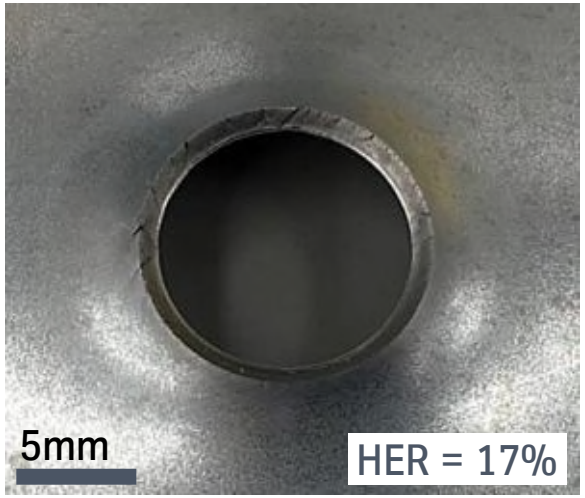
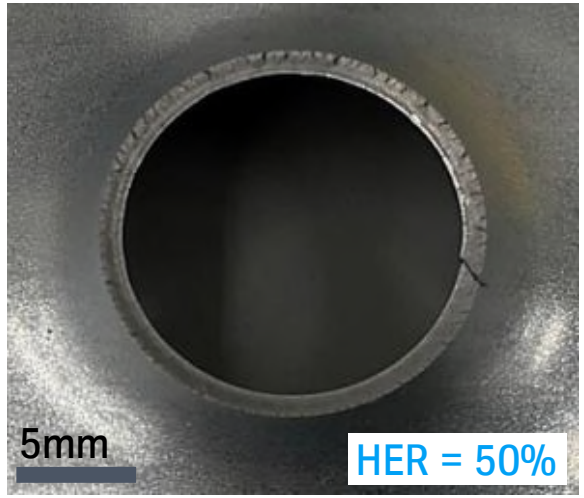
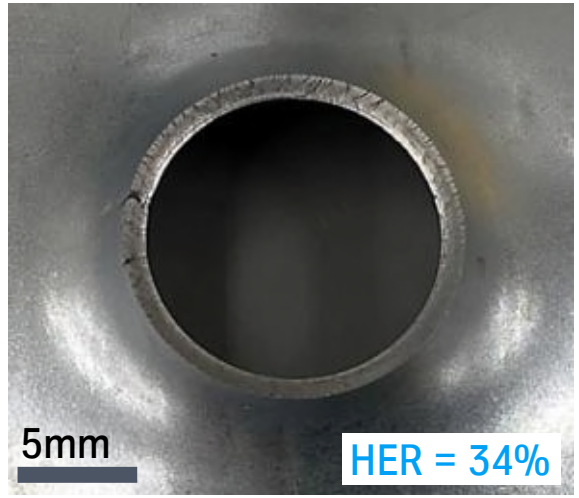
Stretch flange formability

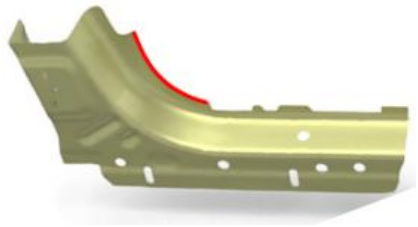
Excellent stretch flangeability of jetQ®

Example:
Hole expansion test* of GI steels



Hole Expansion Ratio (HER, %)
$= (D_{after}-D_{before}) / D_{before} \times 100$

Conventional DP 980	jetQ® 980	jetQ® 1180
		
5mm HER = 17%	5mm HER = 50%	5mm HER = 34%



Stretch flange forming in actual parts

Stretch flange

Complex shape parts can be press formed with jetQ

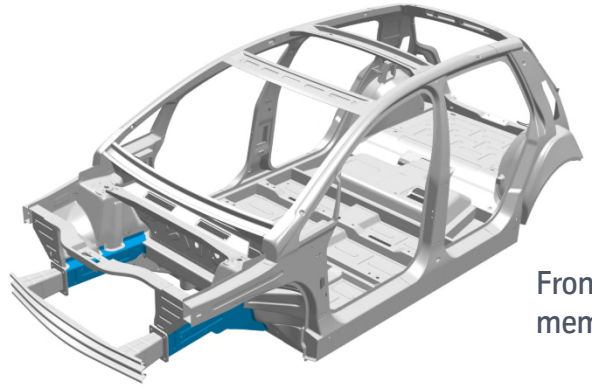
* According to ISO 16630

Potential of jetQ® 980

Application & economic efficiency – microstory: front side member

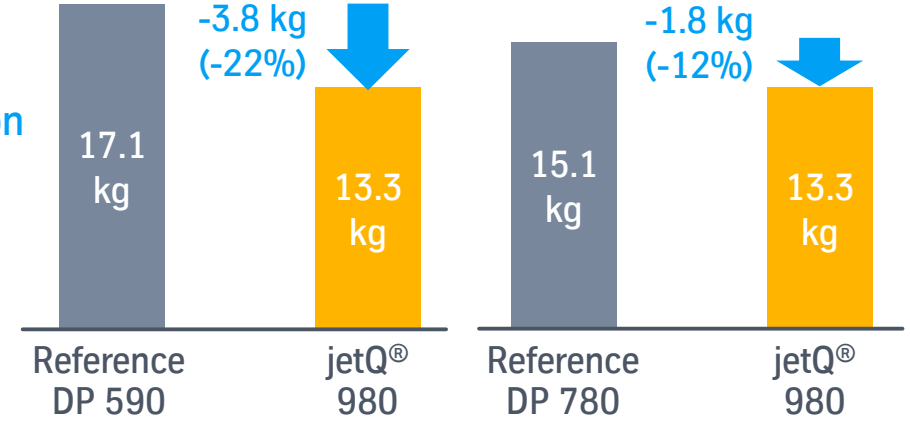
Customer Requirement	Benefit by jetQ® 980
High energy absorption in a crash situation	Higher yield strength
High ductility requirements for crash	Less sensitive to cracking
Medium to high forming complexity	Excellent local ductility

- Formability
- Crash safety
- Lightweight design



Front side member

Weight reduction
per vehicle



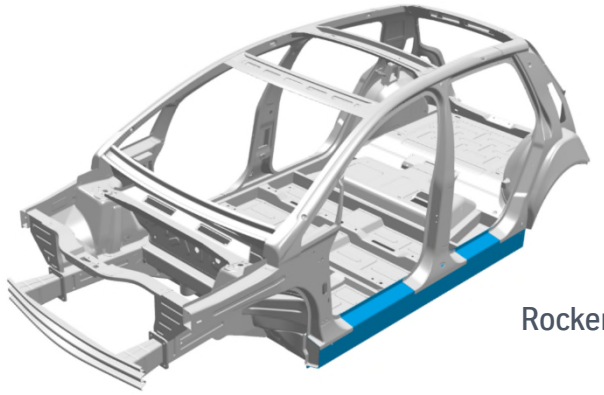
A lightweight front side member is achieved by jetQ® 980 keeping the crashworthiness of conventional DP 590/780.

Potential of jetQ® 1180

Application & economic efficiency – microstory: rocker

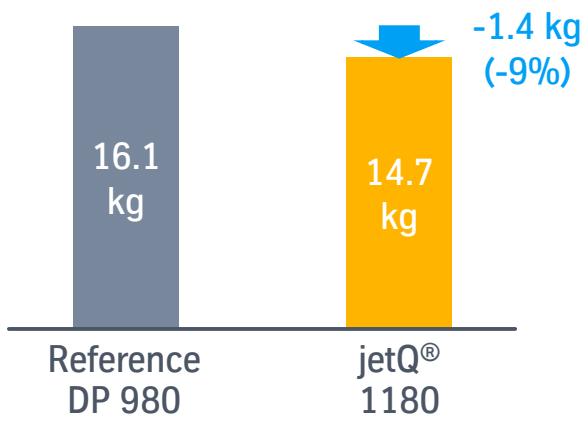
Customer Requirement	Benefit by jetQ® 1180
High crash deformation resistance	Higher yield strength
Medium ductility requirements for crash	Less sensitive to cracking
Medium to high forming complexity	Excellent local ductility

- Formability
- Crash safety
- Lightweight design



Rocker

Weight reduction
per vehicle



A weight reduction with similar crashworthiness is achieved by jetQ® 1180 due to its increased yield strength compared to conventional DP 980.

In addition, jetQ® 1180 has better formability than conventional DP 1180.

Mechanical properties – according to European standard

High yield strength & excellent hole expansion ratio

Grade	Coating	YS (MPa)	TS (MPa)	T-EL (%)	HER[1] (%)	Remarks
jetQ® 980	GI	830	1030	14	40	-
Ref. 980DP		720	1030	12-17	20	DP 700/1000 WAS[2]
jetQ® 1180	GI	1020	1200	15	25	-
Ref. 1180DP		880	1235	10-14	N/A	DP 800/1180 WAS[2]
jetQ® 980	CR (UC)	810	1040	16	60	-
Ref. 980DP		720	1030	12-17	20	DP 700/1000 WAS[2]
jetQ® 1180	CR (UC)	950	1220	13	40	-
Ref. 1180DP		880	1235	10-14	N/A	DP 800/1180 WAS[2]

1. Hole Expansion Ratio, 2. from WAS (FSV Overview Report)

Mechanical properties – according to Japanese standard

High yield strength & excellent hole expansion ratio

Grade	Coating	YS (MPa)	TS (MPa)	T-EL (%)	HER[1] (%)	Remarks
jetQ® 980	GA	850	1030	15	60	-
Ref. 980DP		720	1030	12-17	20	DP 700/1000 WAS[2]
jetQ® 1180	GA	Under development				
Ref. 1180DP		880	1235	10-14	N/A	DP 800/1180 WAS[2]
jetQ® 980	CR (UC)	810	1040	18	60	-
Ref. 980DP		720	1030	12-17	20	DP 700/1000 WAS[2]
jetQ® 1180	CR (UC)	950	1220	15	40	-
Ref. 1180DP		880	1235	10-14	N/A	DP 800/1180 WAS[2]

1. Hole Expansion Ratio, 2. from WAS (FSV Overview Report)

Mechanical properties – according to US standard

High yield strength & excellent hole expansion ratio

Grade	Coating	YS (MPa)	TS (MPa)	T-EL (%)	HER[1] (%)	Remarks
jetQ® 980	GI	830	1030	15	40	-
Ref. 980DP		720	1030	12-17	20	DP 700/1000 WAS[2]
jetQ® 1180	GI	1020	1200	16	25	-
Ref. 1180DP		880	1235	10-14	N/A	DP 800/1180 WAS[2]
jetQ® 980	CR (UC)	810	1040	17	60	-
Ref. 980DP		720	1030	12-17	20	DP 700/1000 WAS[2]
jetQ® 1180	CR (UC)	950	1220	14	40	-
Ref. 1180DP		880	1235	10-14	N/A	DP 800/1180 WAS[2]

1. Hole Expansion Ratio, 2. from WAS (FSV Overview Report)

jetQ®: optimized AHSS material for geometrically complex crash structures

More safety and efficiency in vehicle bodies

- The ideal balance between strength, formability and processing
- Increased yield strength and local ductility for improved crash behavior
- Local and global forming properties combined
- Expanding application of cold forming in lightweight body structure

The ideal balance between strength, formability and processing

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