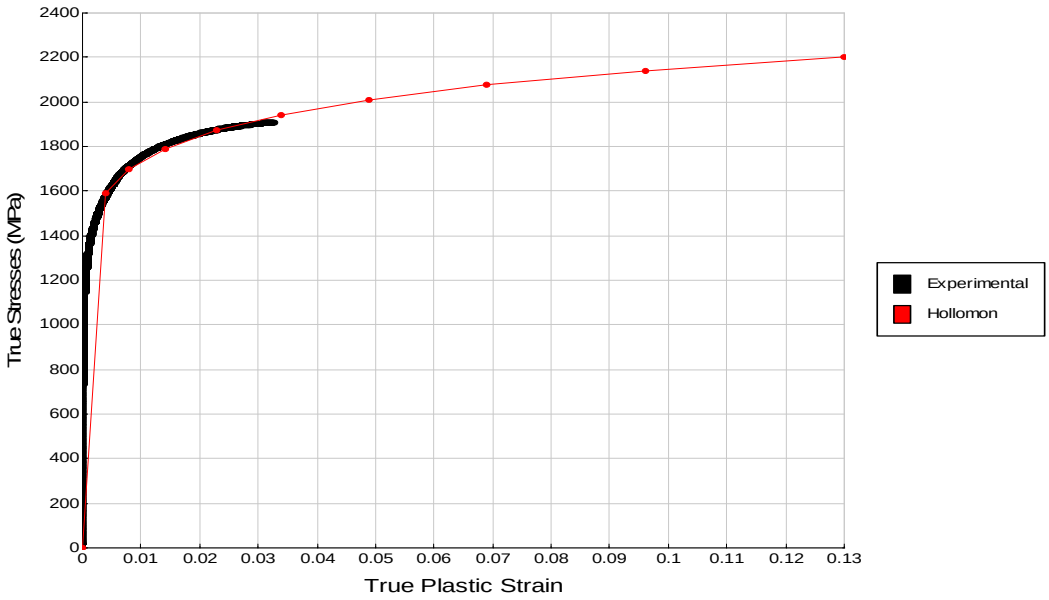
Stress-Strain curves

Hot forming Steels - Usibor® 2000 treated

Thickness (mm)	**1.7**
Coating	**AS150**

Hollomon law



Parameters identified between 0.4 and 3.3 %

K (MPa)	**2662**
n	**0.09**

$$\sigma = K\varepsilon^{n}$$

Test conditions

Test direction	**0°**
Test Type	**Uniaxial Tensile Test**
Test procedure	**NF EN ISO 6892-1**
Procedure to determine "n"	**ISO 10275**
Procedure to determine "r"	**ISO 10113**
Sample geometry (b0xL0)	**20*80**
Gauge length (mm)	**80**

Test temperature	**Room Temperature**
Initial width of the calibrated zone (mm)	**12.6**
Initial thickness (mm)	**1.65**
Loading rate (MPa/s)	**23**
Strain rate before yielding (/s)	**0.0025**
Strain rate after yielding (/s)	**0.008**

Engineering properties

Ultimate Tensile Strength (MPa)	**1848**
Upper Yield Stress (MPa)	**-**
Lower Yield Stress (MPa)	**-**
Proof stress (MPa)	**1462**

Ae (%)	**-**
Ag (%)	**3.3**
A (%)	**5.4**
n (3% - 20%/Ag%)	**0.03**
r (3% - 20%/Ag%)	**0.67**

AZ0321/Rheo-TU-3104

Last updated: 30/06/2009

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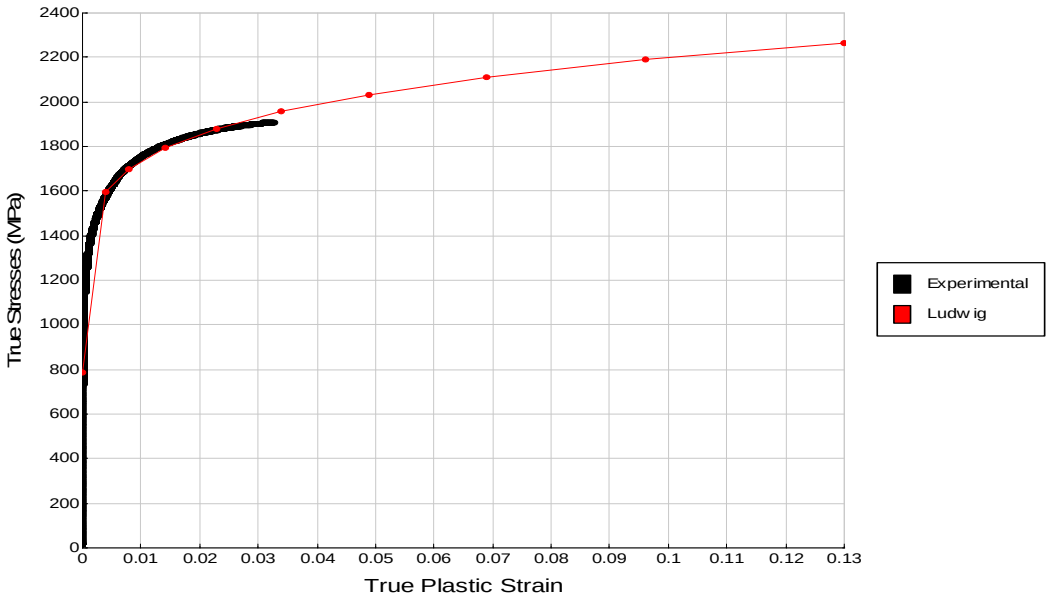
Stress-Strain curves

Hot forming Steels - Usibor® 2000 treated

Thickness (mm)	**1.7**
Coating	**AS150**

Ludwig law



Parameters identified between 0.4 and 3.3 %

σ_0 (MPa)	**788**
K (MPa)	**2098**
n	**0.17**

$$\sigma = \sigma_0 + K\varepsilon^n$$

Test conditions

Test direction	**0°**
Test Type	**Uniaxial Tensile Test**
Test procedure	**NF EN ISO 6892-1**
Procedure to determine "n"	**ISO 10275**
Procedure to determine "r"	**ISO 10113**
Sample geometry (b0xL0)	**20*80**
Gauge length (mm)	**80**

Test temperature	**Room Temperature**
Initial width of the calibrated zone (mm)	**12.6**
Initial thickness (mm)	**1.65**
Loading rate (MPa/s)	**23**
Strain rate before yielding (/s)	**0.0025**
Strain rate after yielding (/s)	**0.008**

Engineering properties

Ultimate Tensile Strength (MPa)	**1848**
Upper Yield Stress (MPa)	**-**
Lower Yield Stress (MPa)	**-**
Proof stress (MPa)	**1462**

Ae (%)	**-**
Ag (%)	**3.3**
A (%)	**5.4**
n (3% - 20%/Ag%)	**0.03**
r (3% - 20%/Ag%)	**0.67**

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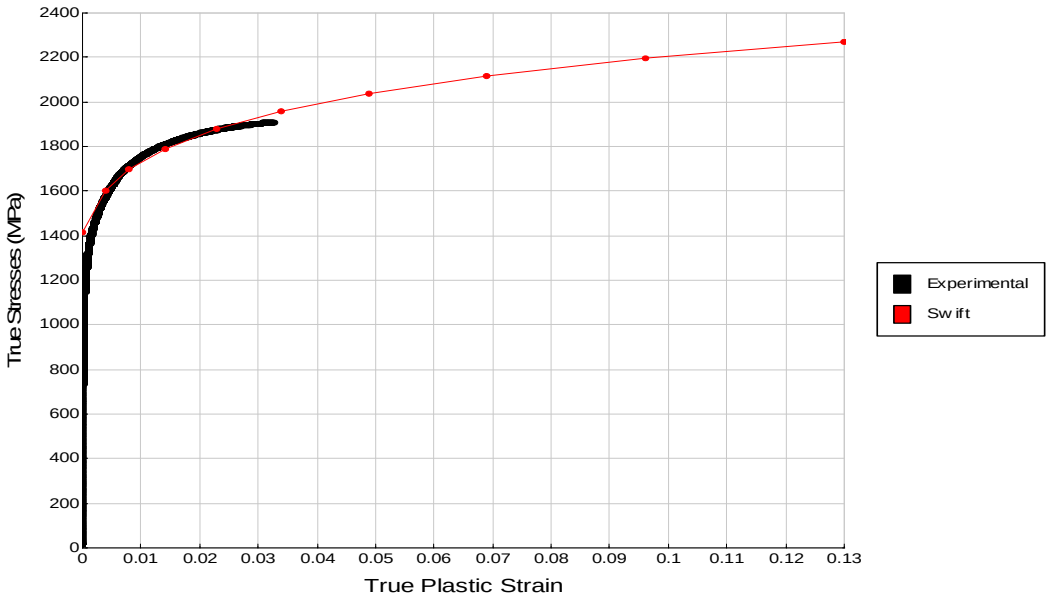
Stress-Strain curves

Hot forming Steels - Usibor® 2000 treated

Thickness (mm)	**1.7**
Coating	**AS150**

Swift law



Parameters identified between 0.4 and 3.3 %

ε_0	0.0020
K (MPa)	2847
n	0.11

$$\sigma = K(\varepsilon_0 + \varepsilon)^n$$

Test conditions

Test direction	**0°**
Test Type	**Uniaxial Tensile Test**
Test procedure	**NF EN ISO 6892-1**
Procedure to determine "n"	**ISO 10275**
Procedure to determine "r"	**ISO 10113**
Sample geometry (b0xL0)	**20*80**
Gauge length (mm)	**80**

Test temperature	**Room Temperature**
Initial width of the calibrated zone (mm)	**12.6**
Initial thickness (mm)	**1.65**
Loading rate (MPa/s)	**23**
Strain rate before yielding (/s)	**0.0025**
Strain rate after yielding (/s)	**0.008**

Engineering properties

Ultimate Tensile Strength (MPa)	**1848**
Upper Yield Stress (MPa)	**-**
Lower Yield Stress (MPa)	**-**
Proof stress (MPa)	**1462**

Ae (%)	**-**
Ag (%)	**3.3**
A (%)	**5.4**
n (3% - 20%/Ag%)	**0.03**
r (3% - 20%/Ag%)	**0.67**

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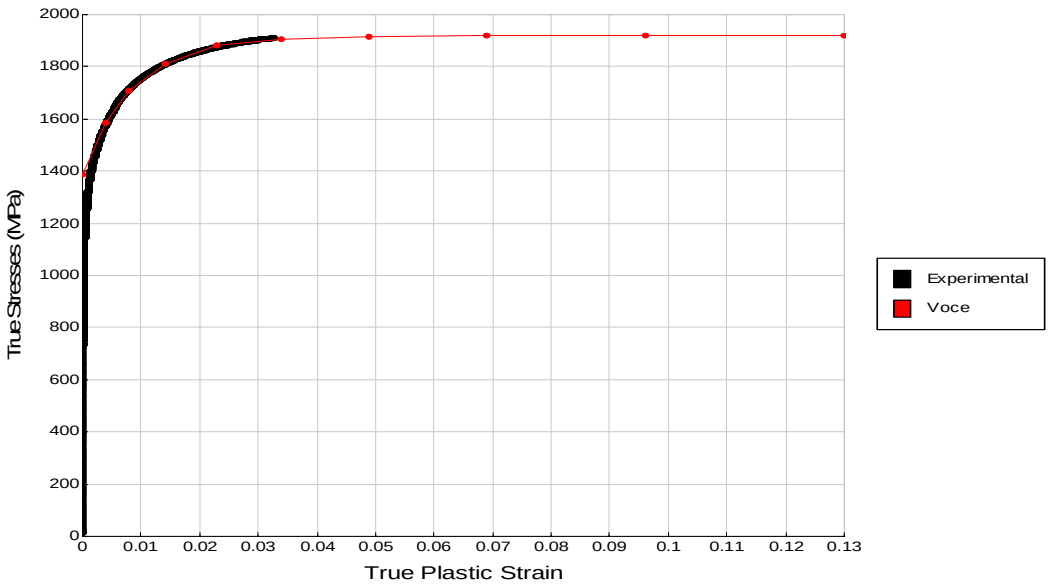
Stress-Strain curves

Hot forming Steels - Usibor® 2000 treated

Thickness (mm)	**1.7**
Coating	**AS150**

Voce law



Parameters identified between 0.4 and 3.3 %

σ_0 (MPa)	**1388**	**m**	**114.98**
Rsat (MPa)	**530**		

$$\sigma = \sigma_0 + R_{sat}\left(1 - \exp\left(-m\varepsilon\right)\right)$$

Test conditions

Test direction	**0°**
Test Type	**Uniaxial Tensile Test**
Test procedure	**NF EN ISO 6892-1**
Procedure to determine "n"	**ISO 10275**
Procedure to determine "r"	**ISO 10113**
Sample geometry (b0xL0)	**20*80**
Gauge length (mm)	**80**

Test temperature	**Room Temperature**
Initial width of the calibrated zone (mm)	**12.6**
Initial thickness (mm)	**1.65**
Loading rate (MPa/s)	**23**
Strain rate before yielding (/s)	**0.0025**
Strain rate after yielding (/s)	**0.008**

Engineering properties

Ultimate Tensile Strength (MPa)	**1848**
Upper Yield Stress (MPa)	**-**
Lower Yield Stress (MPa)	**-**
Proof stress (MPa)	**1462**

Ae (%)	**-**
Ag (%)	**3.3**
A (%)	**5.4**
n (3% - 20%/Ag%)	**0.03**
r (3% - 20%/Ag%)	**0.67**

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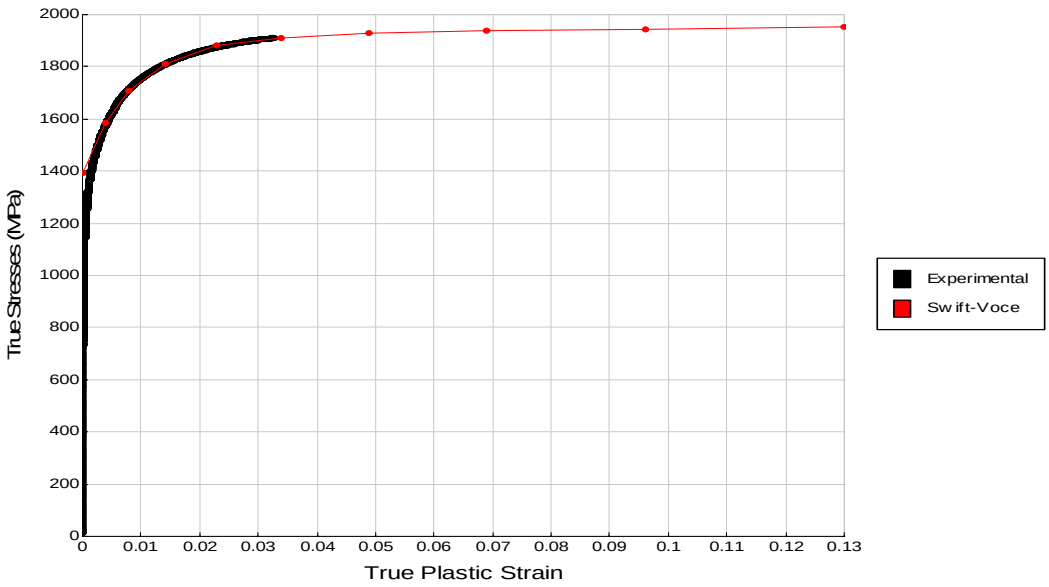
Stress-Strain curves

Hot forming Steels - Usibor® 2000 treated

Thickness (mm)	1.7
Coating	AS150

Swift-Voce law (Recommended model)



Parameters identified between 0.4 and 3.3 %

ε_0	0.0020	Rsat (MPa)	530
K (MPa)	2847	m	114.98
n	0.11	α	0.90
σ_0 (MPa)	1388		

$$\sigma = (1-\alpha)K(\varepsilon+\varepsilon_0)^n + \alpha\cdot(\sigma_0 + R_{sat}(1-\exp(-m\varepsilon)))$$

Test conditions

Test direction	0°	Test temperature	Room Temperature
Test Type	Uniaxial Tensile Test	Initial width of the calibrated zone (mm)	12.6
Test procedure	NF EN ISO 6892-1	Initial thickness (mm)	1.65
Procedure to determine "n"	ISO 10275	Loading rate (MPa/s)	23
Procedure to determine "r"	ISO 10113	Strain rate before yielding (/s)	0.0025
Sample geometry (b0xL0)	20*80	Strain rate after yielding (/s)	0.008
Gauge length (mm)	80		

Engineering properties

Ultimate Tensile Strength (MPa)	1848	Ae (%)	-
Upper Yield Stress (MPa)	-	Ag (%)	3.3
Lower Yield Stress (MPa)	-	A (%)	5.4
Proof stress (MPa)	1462	n (3% - 20%/Ag%)	0.03
		r (3% - 20%/Ag%)	0.67

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