



Unique material properties of toughcore[®] plates and pipes

Rupert Egger and Thilo Reichel

4th InnoTech Partner Event, 9 June 2016, Linz

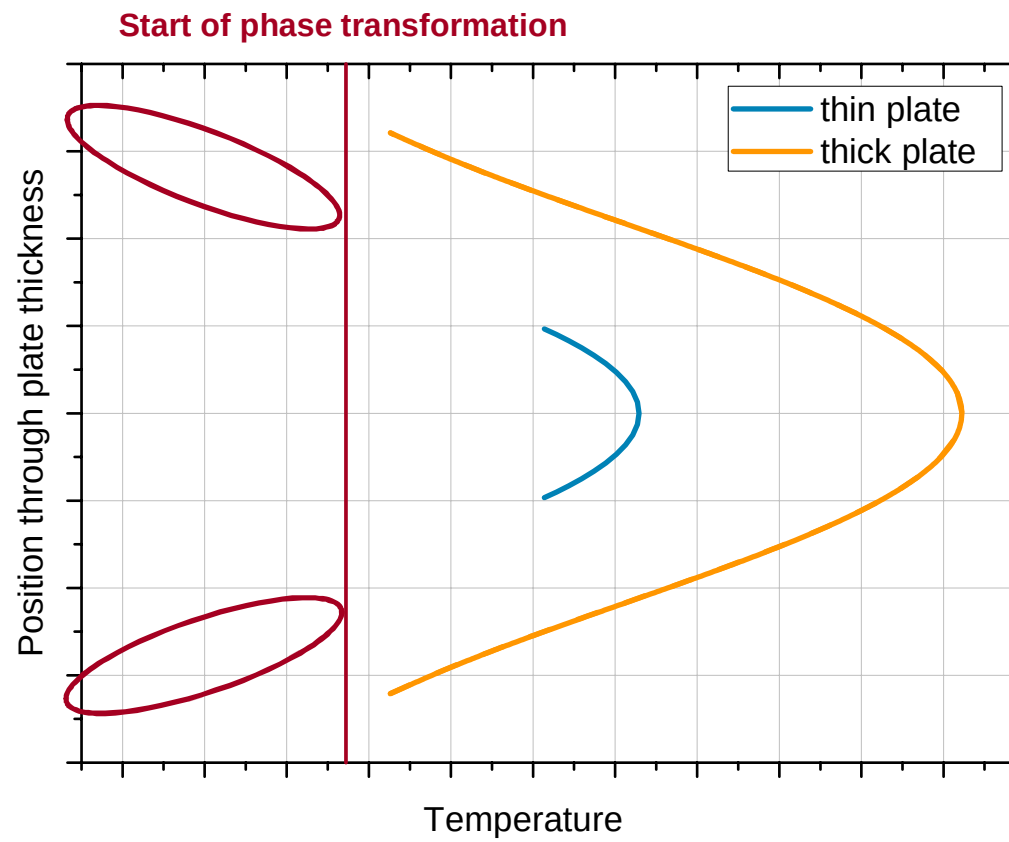
voestalpine Grobblech GmbH
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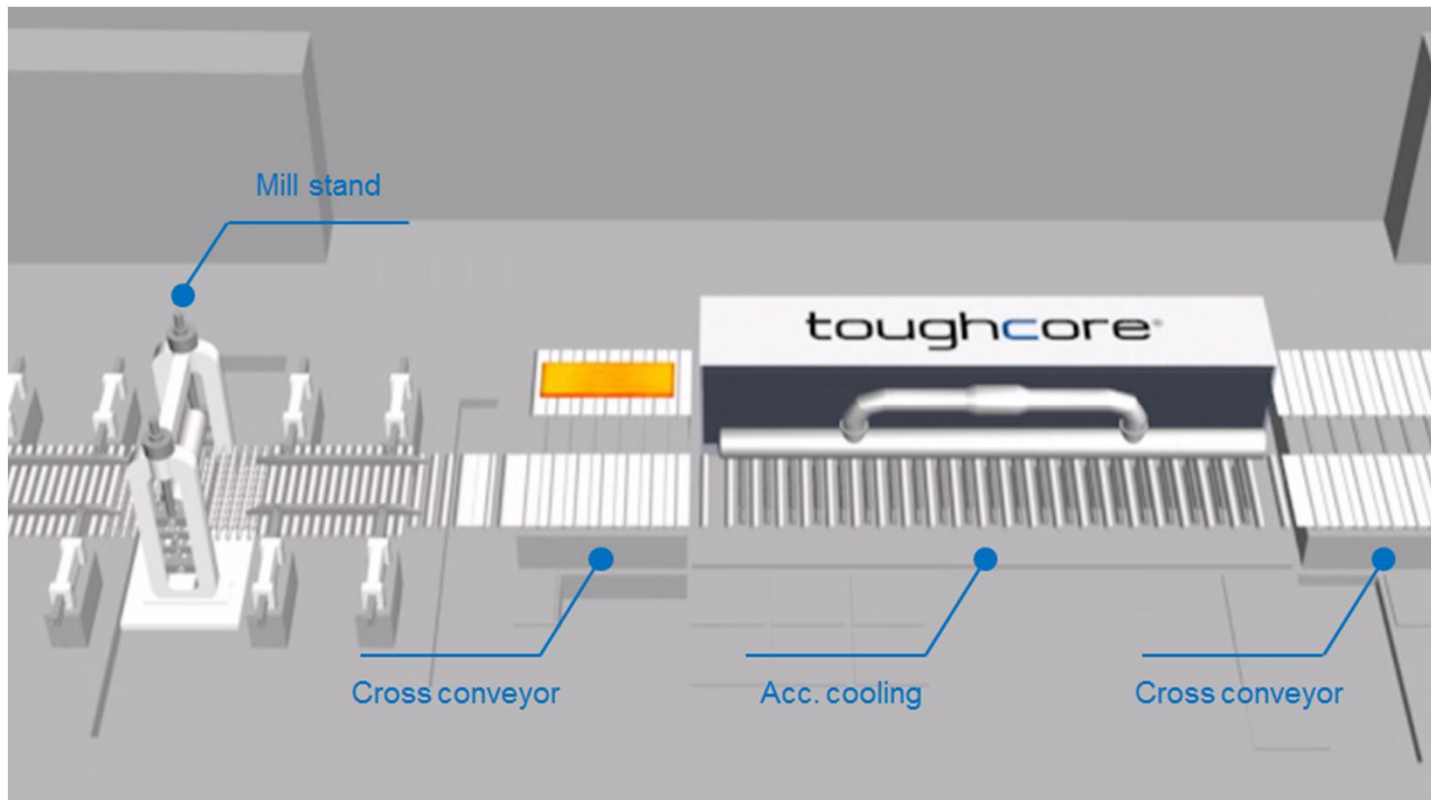
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ONE STEP AHEAD.

Limit of TMCP



Production Process



Trials

Grade	WT	C	Si	Mn	Cr+Cu+Ni+Mo	Nb+V+Ti	Pcm
X65MS PSL2	35mm	0.03	0.30	1.55	≤0.4	≤0.08	≈0.13
X70M PSL2	25mm	0.04	0.30	1.70	≤0.4	≤0.08	≈0.15
X80M PSL2	50mm	0.05	0.30	1.85	≤0.6	≤0.08	≈0.17

$$P_{cm} = C + \frac{Si}{30} + \frac{Mn + Cu + Cr}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5 \times B$$

Results

- n Plate
- n Pipe Body
- n Welded Pipe

X80 – 50mm

Plate – Microstructure

Mid-thickness

running production

toughcore®



Plate – Charpy Impact Test

Mid-thickness

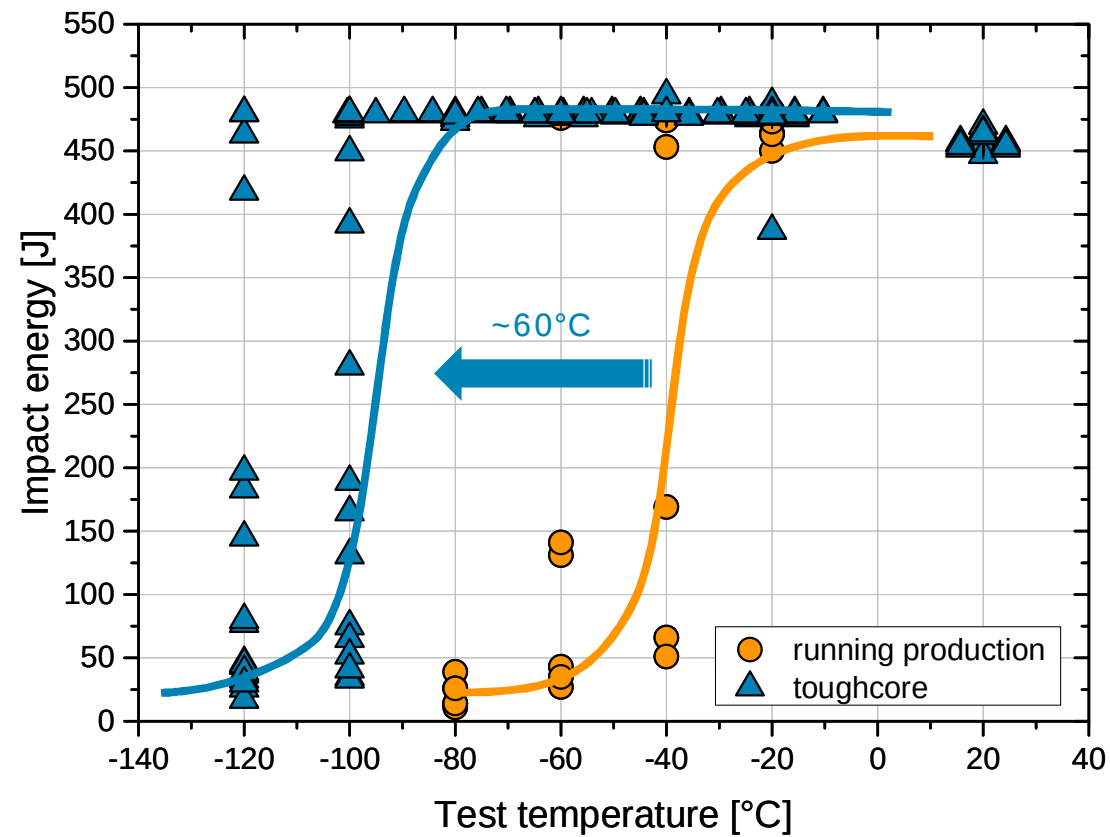


Plate – Battelle Drop Weight Tear Test

Mid-thickness

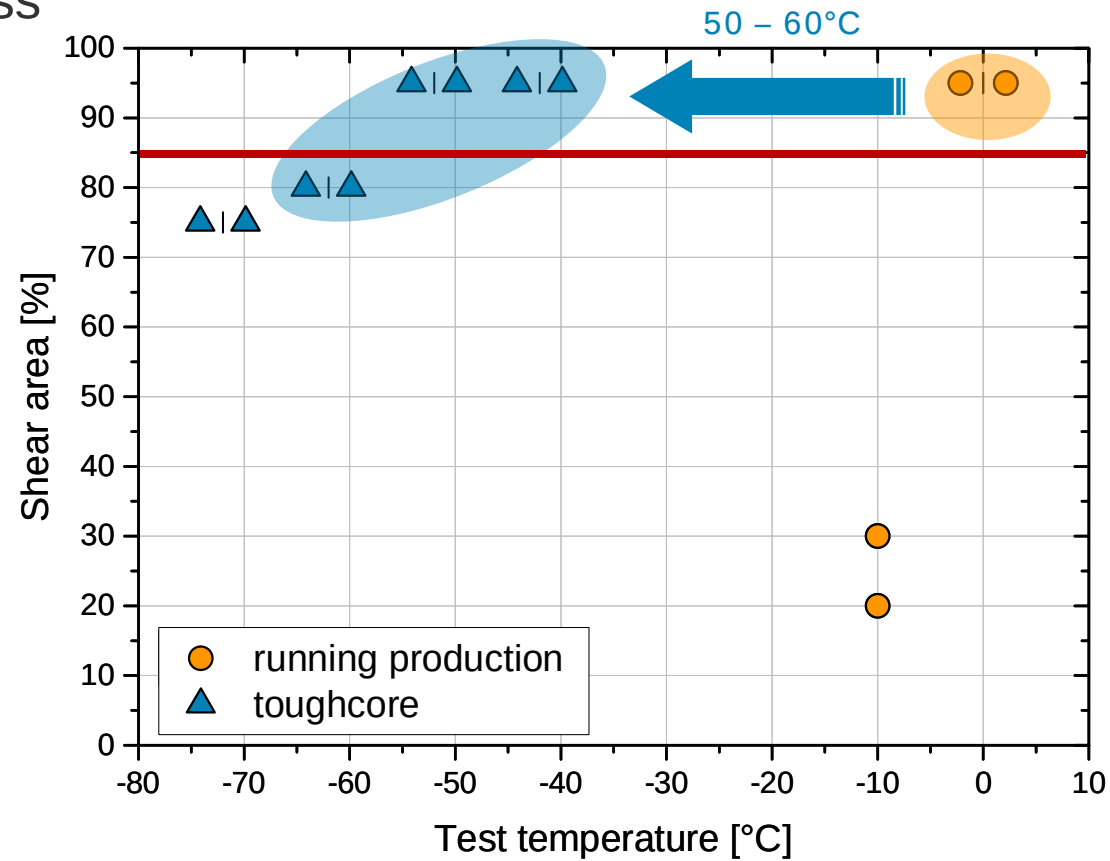
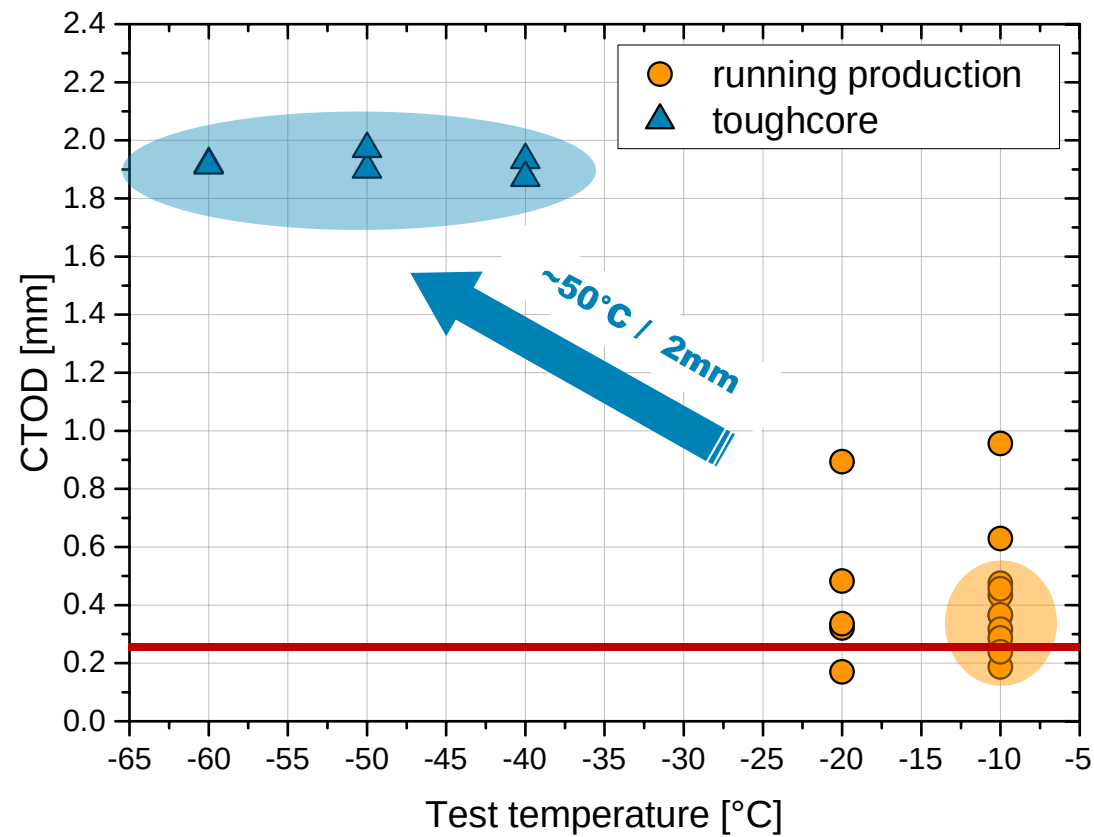


Plate – Fracture Mechanics Test

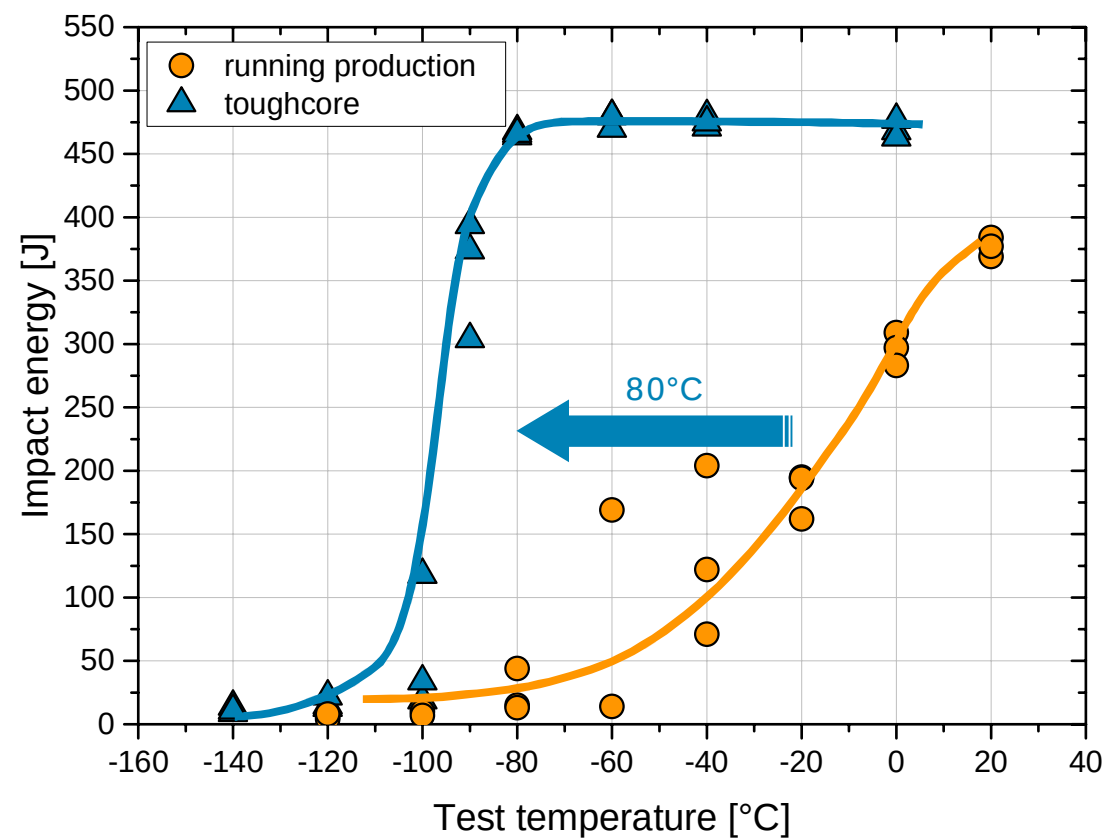


Results

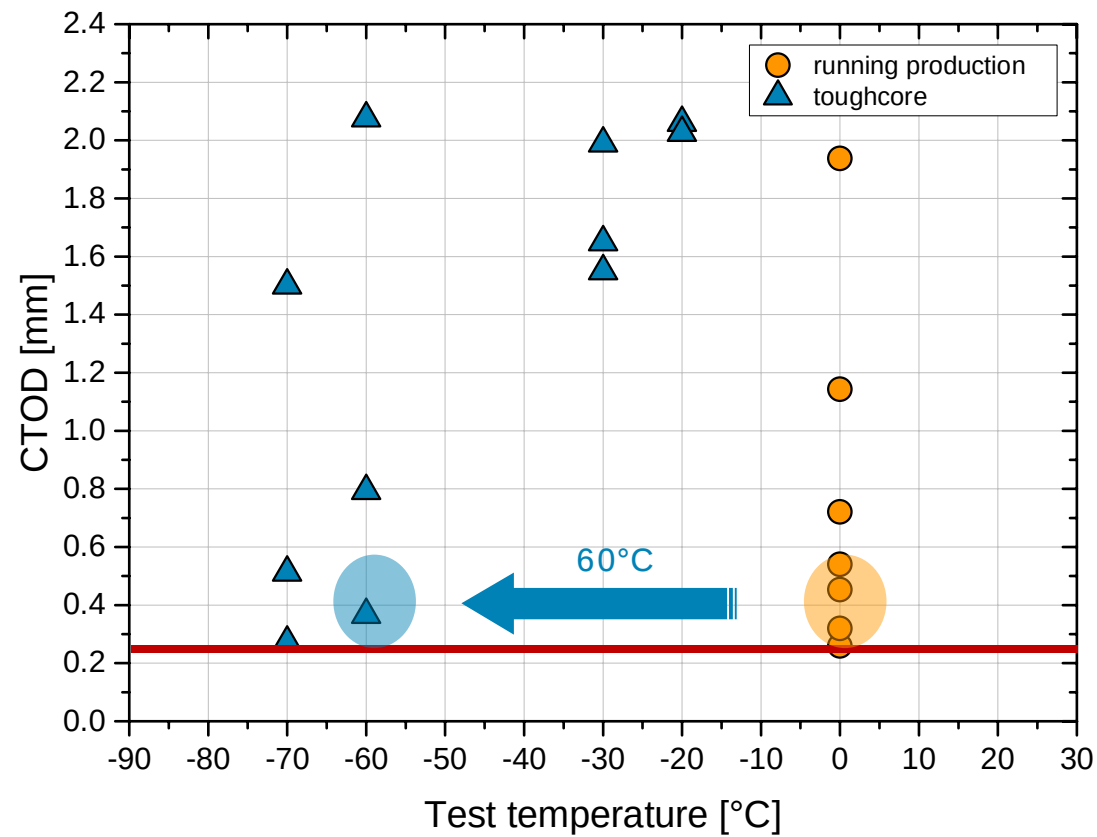
- n Plate
- n Pipe Body
- n Welded Pipe

Pipe Body – Charpy Impact Energy

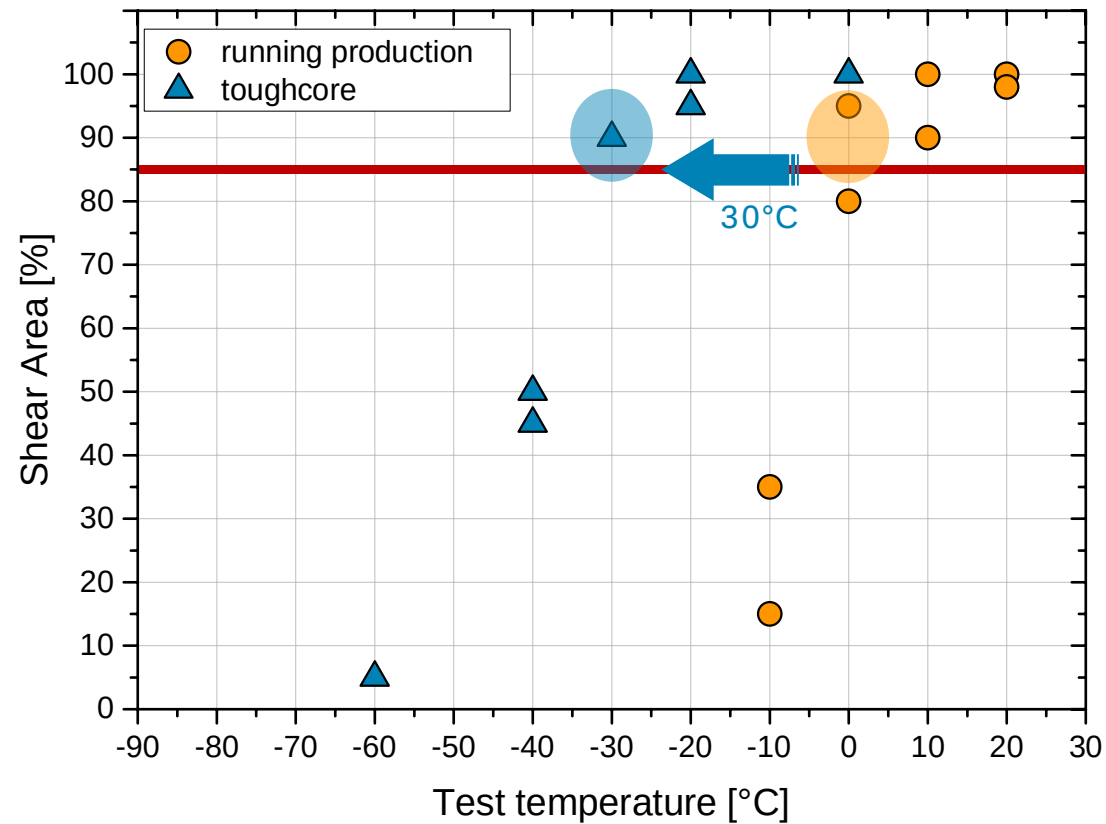
Mid-thickness



Pipe Body – Fracture Mechanics Test



Pipe Body – Battelle Drop Weight Tear Test

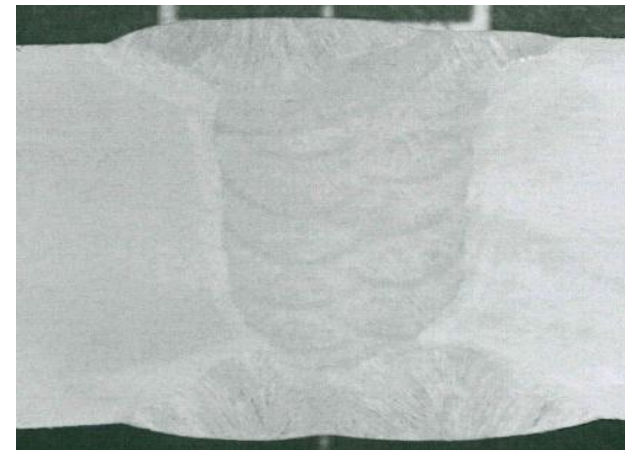
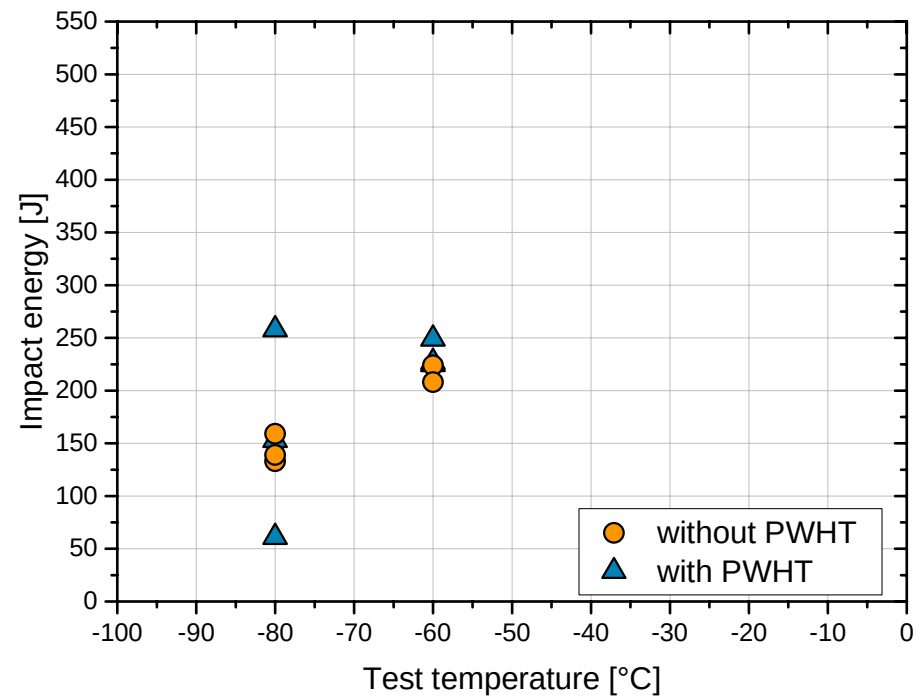


Results

- n Plate
- n Pipe Body
- n Welded Pipe

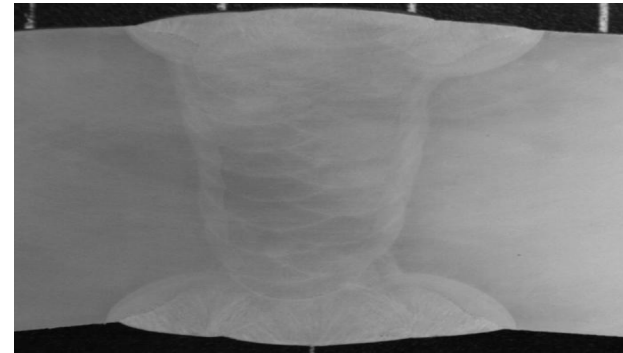
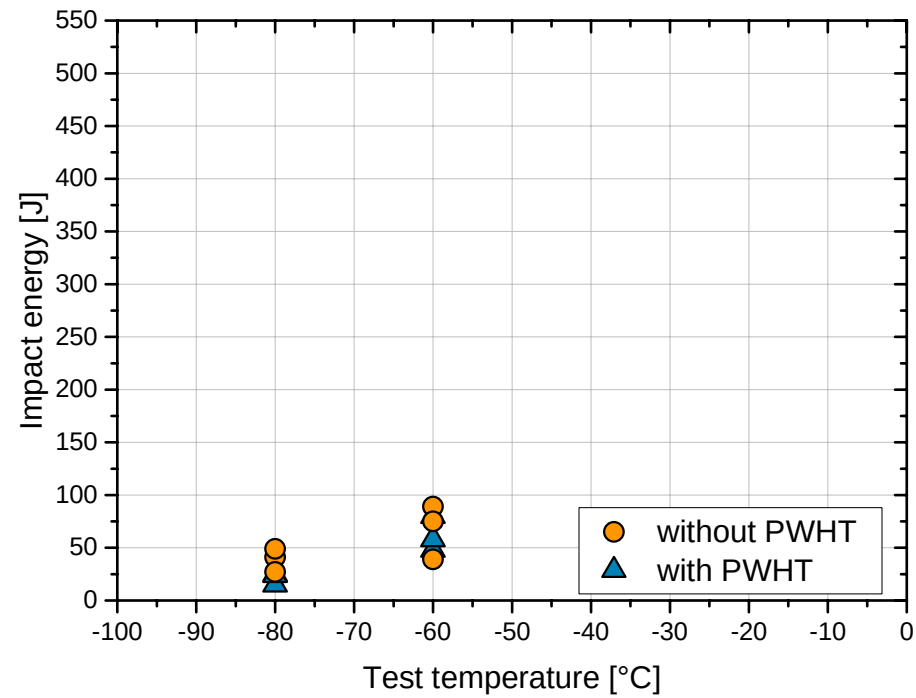
Welded Pipe – Charpy Impact Test

Weld Center Outside



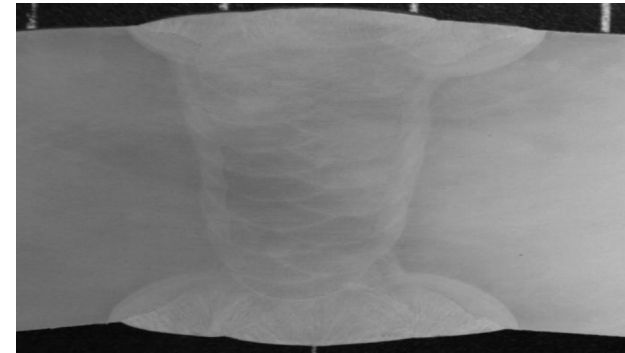
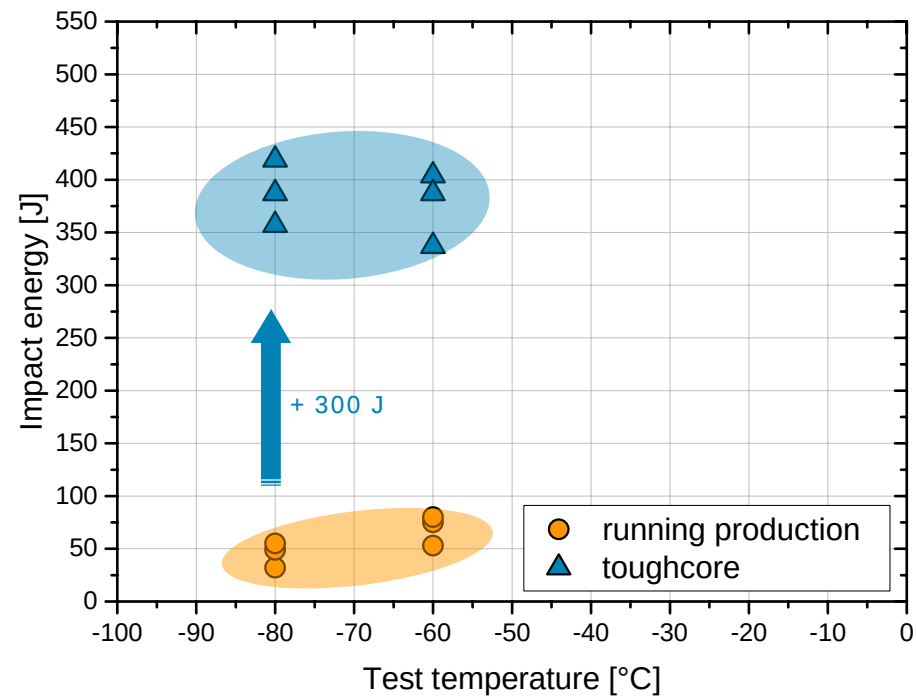
Welded Pipe – Charpy Impact Test

Weld Center Outside



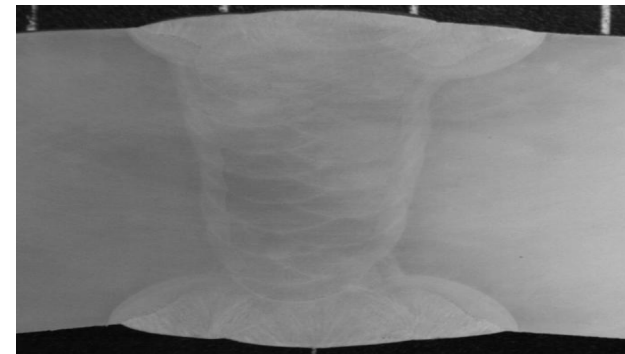
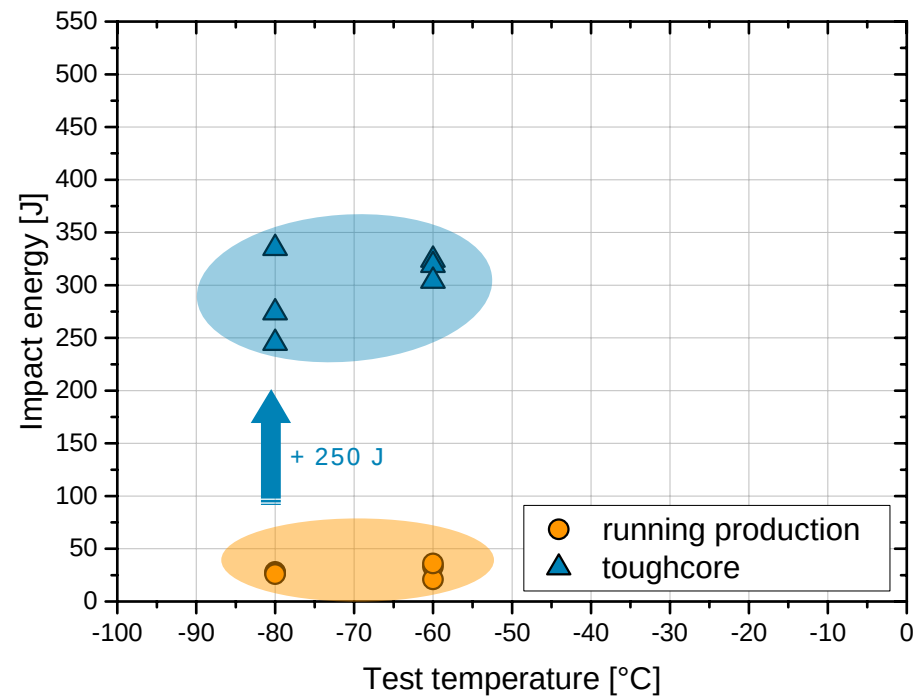
Welded Pipe – Charpy Impact Test

Fusion Line without PWHT



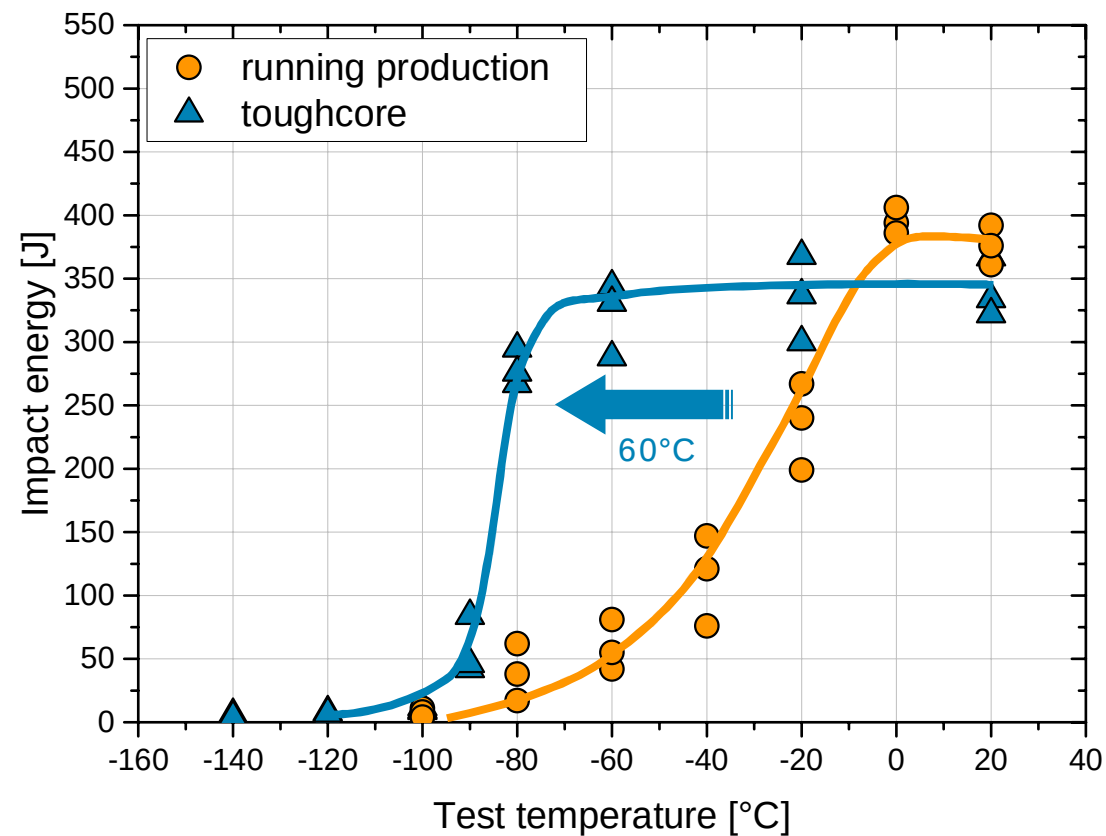
Welded Pipe – Charpy Impact Test

Fusion Line with PWHT



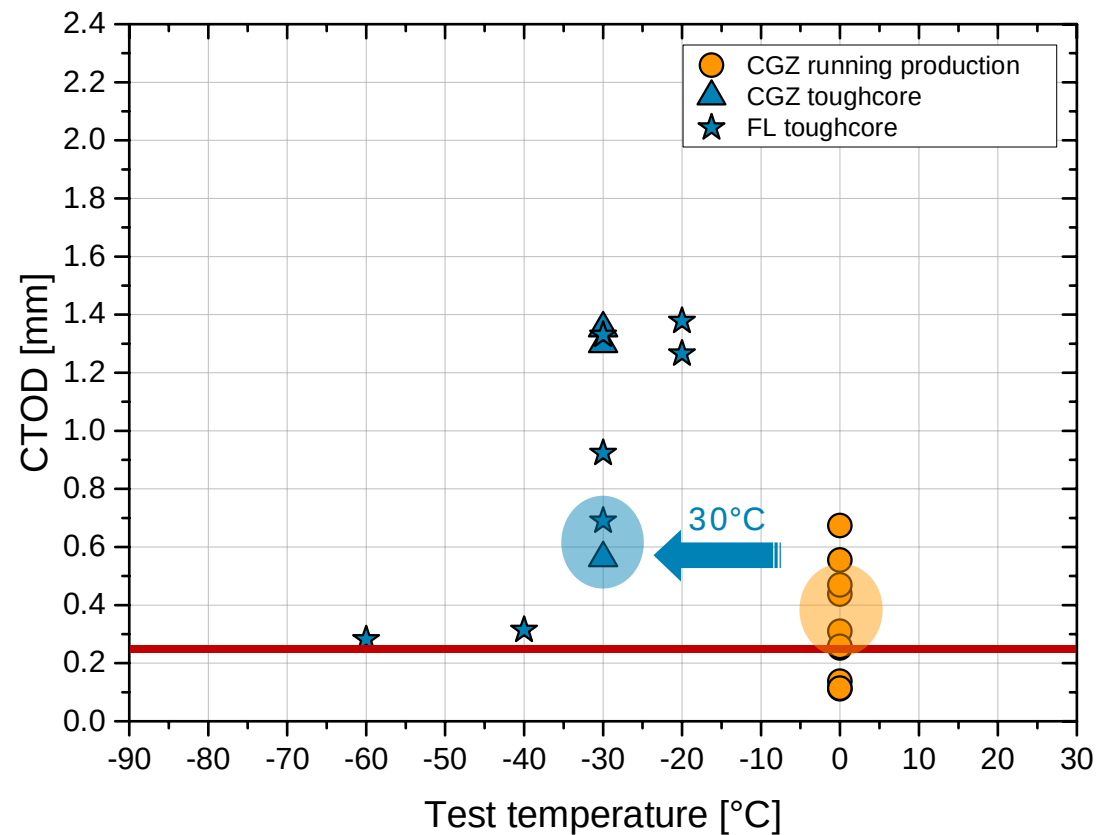
Welded Pipe – Charpy Impact Test

Fusion Line without PWHT



Welded Pipe – Fracture Mechanics Test

Longitudinal Weld Seam Fusion Line and CGZ



Prequalification of toughcore[®] pipes passed



voestalpine Grobblech GmbH, Linz / Austria, May 2016



Preproduction qualification of pipes manufactured from voestalpine toughcore[®] plates

API steel grade: X80M PSL 2 acc. API 5L
Pipe dimensions: 2 x 36 inch
Target acceptance criterion for toughness tests on pipe body and
longitudinal weld seam:

- Charpy impact energy: min. 68 Joule at -80°C
- BDWTT shear area: min. 85% at -30°C
- CTOD: min. 0.25mm at -30°C

Tests carried out on pipe sections manufactured by Erndtebrücker Eisenwerk GmbH & Co. KG
from plate manufactured by voestalpine Grobblech GmbH



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