



Materials Considerations in CO₂ pipeline design: practical issues and ongoing work

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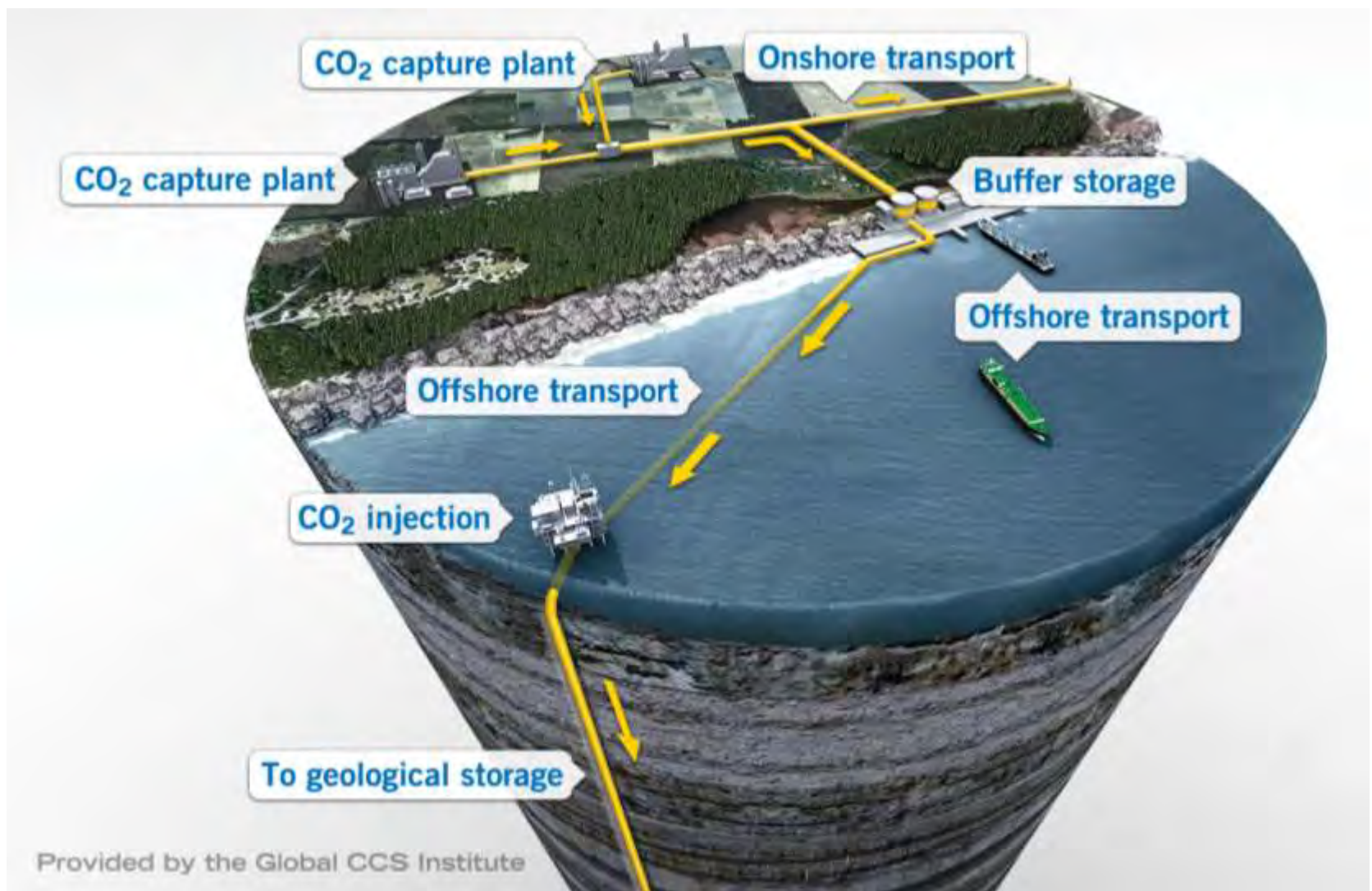


1. Background
2. Charpy V-Notch (CVN) Impact Test
3. Drop Weight Tear Test (DWTT)
4. Conclusions

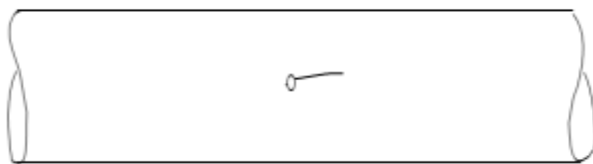
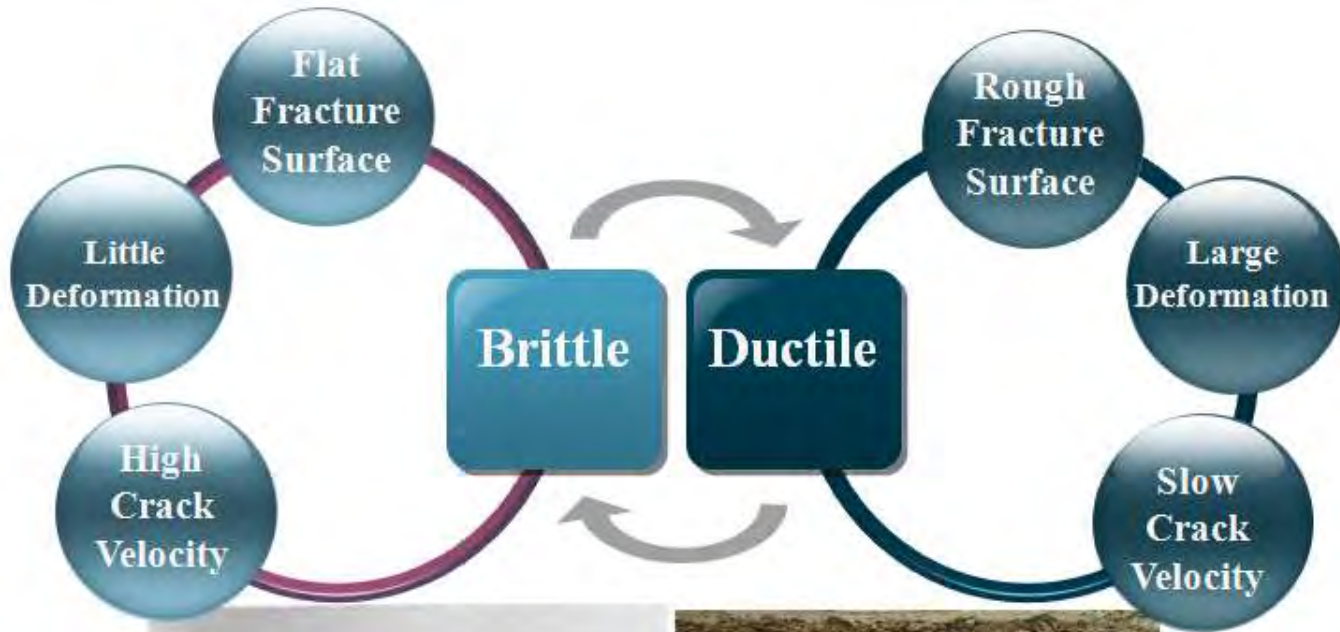


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Introduction



Fracture propagation



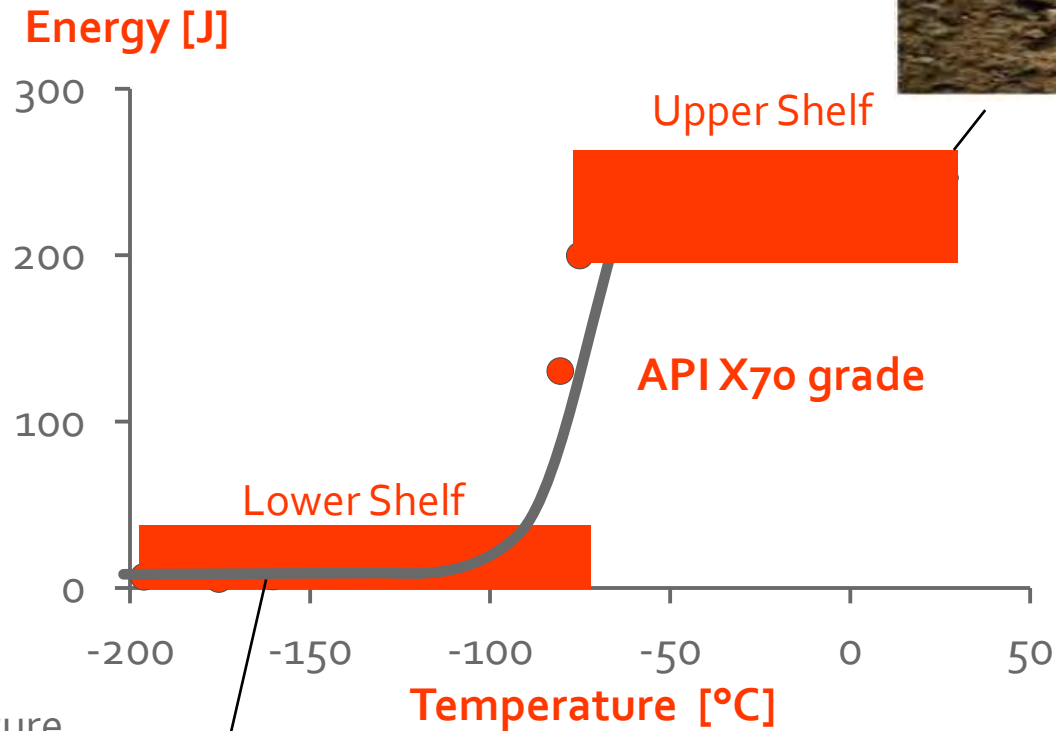
The need for material properties...



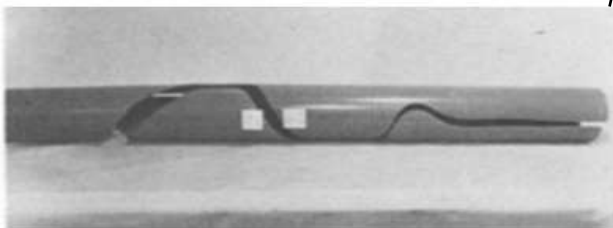
Ductile Fracture



[M. Bilio et al. 2009]



Brittle Fracture



[M. Bilio et al. 2009]

CO2Quest release experiments



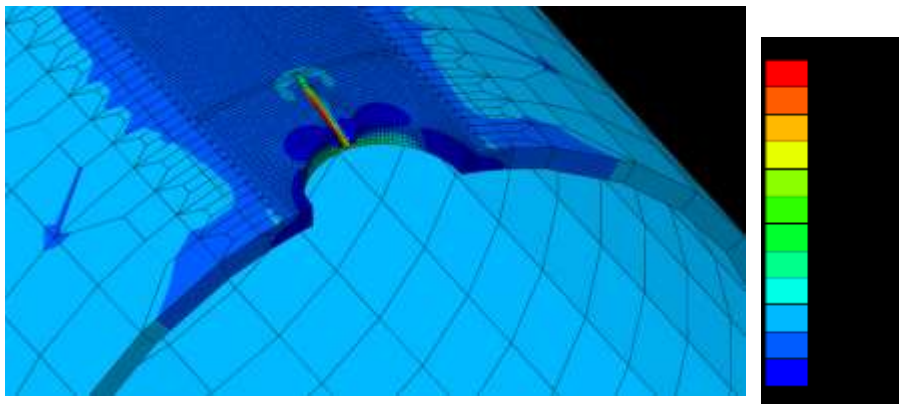
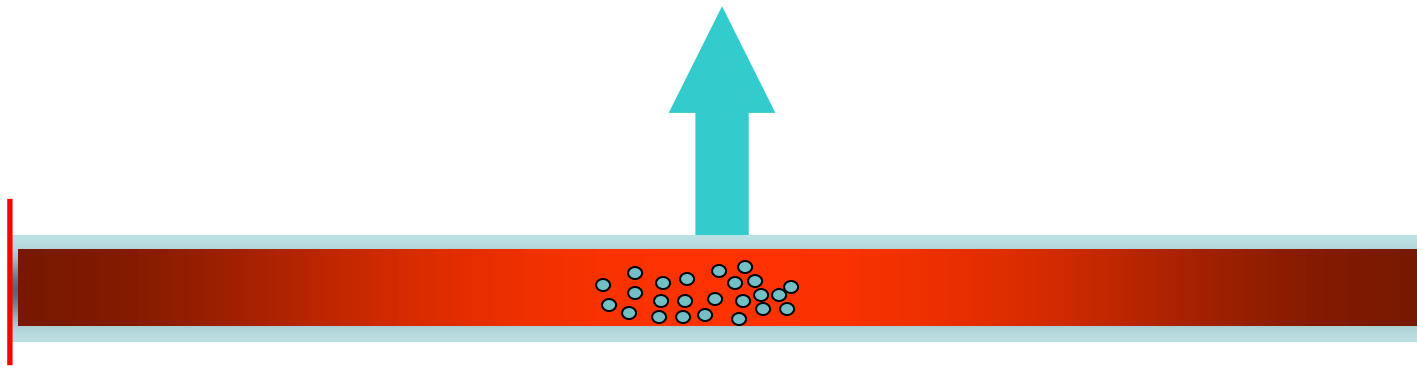
- Instrumented 45 m pipeline



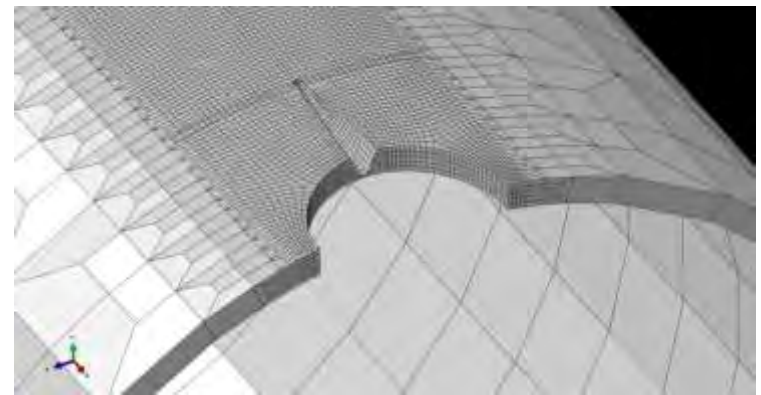
After
the test

Mathematical modelling - fluid-structure model

Exposed to: 1 atm



Maximum Principal Stress [MPa]



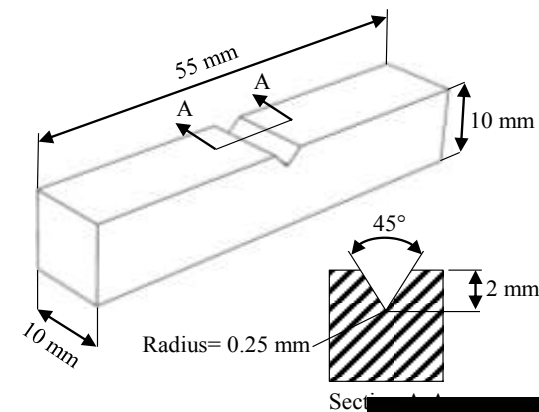
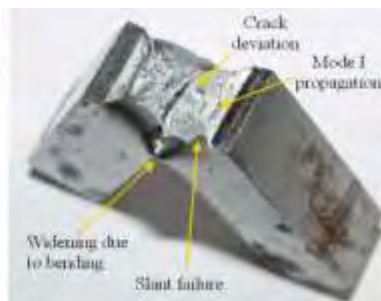
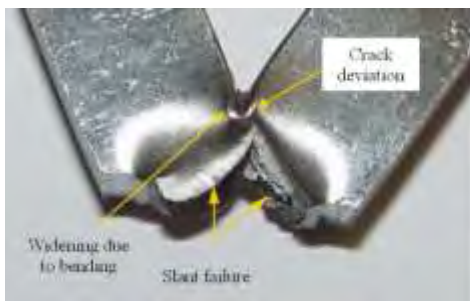
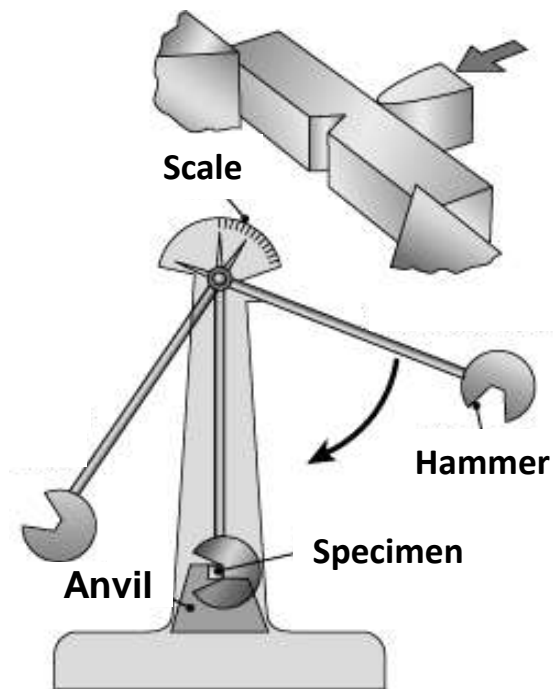


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Charpy V-Notch (CVN) Impact Test

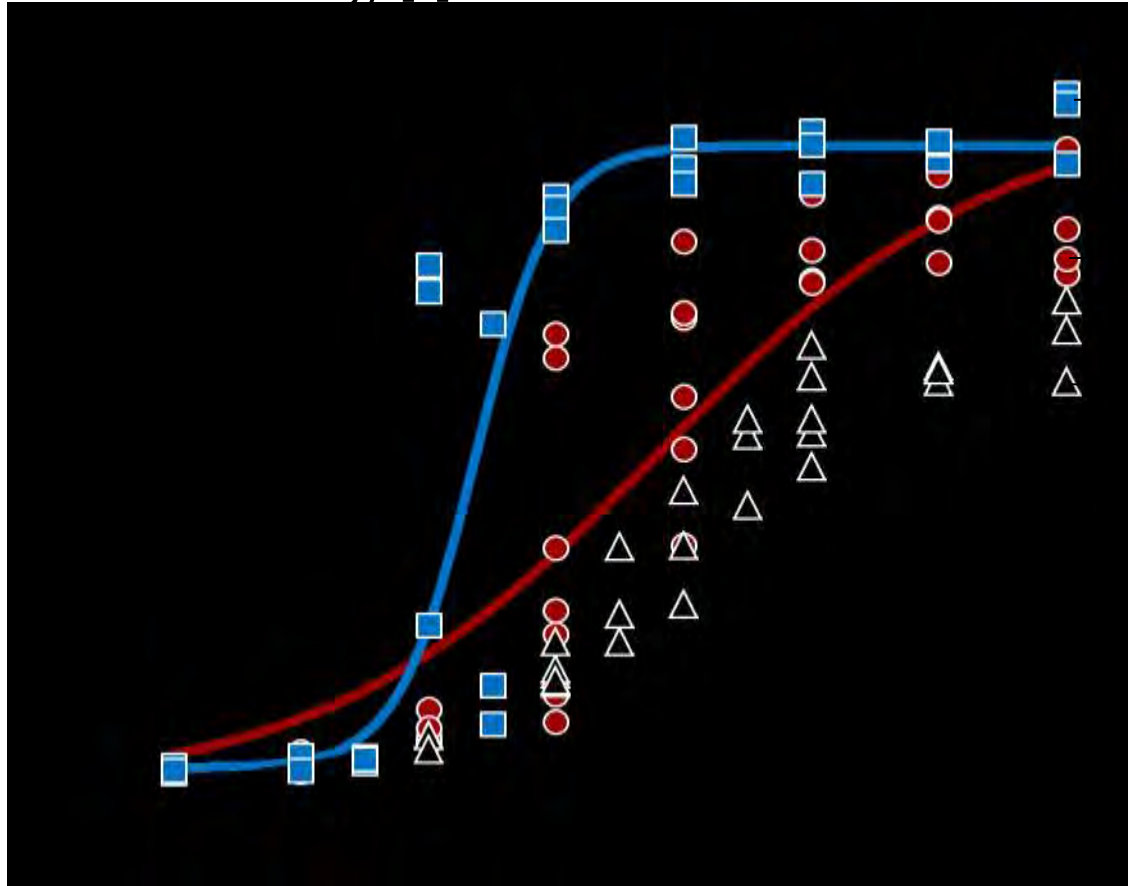


Capacity=750 J
Hammer weight=50 kg





Absorbed Energy [J]



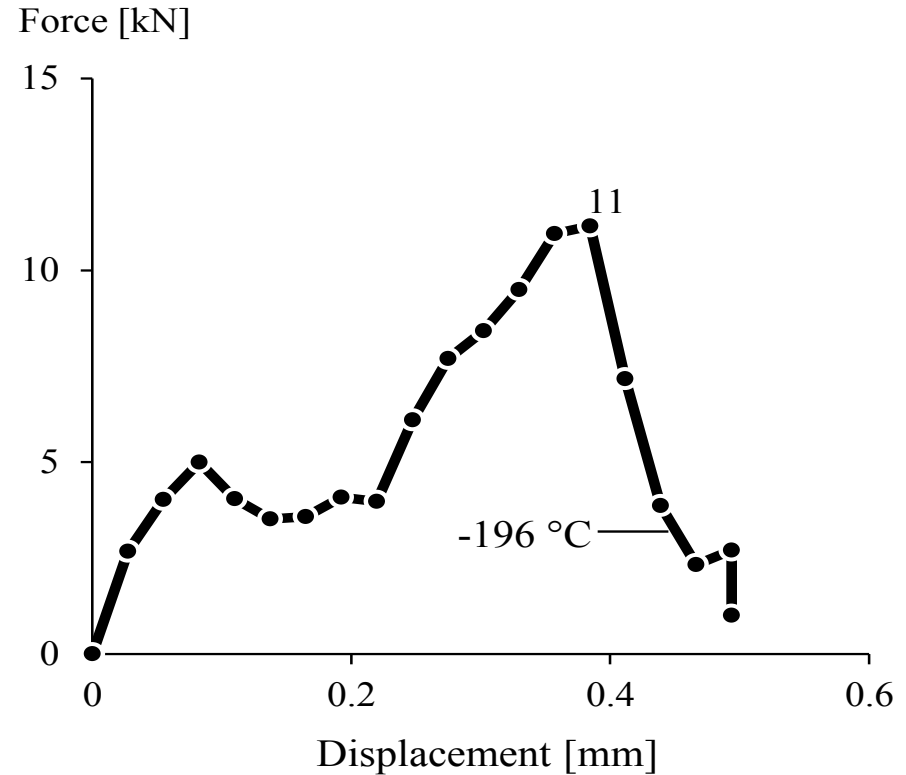
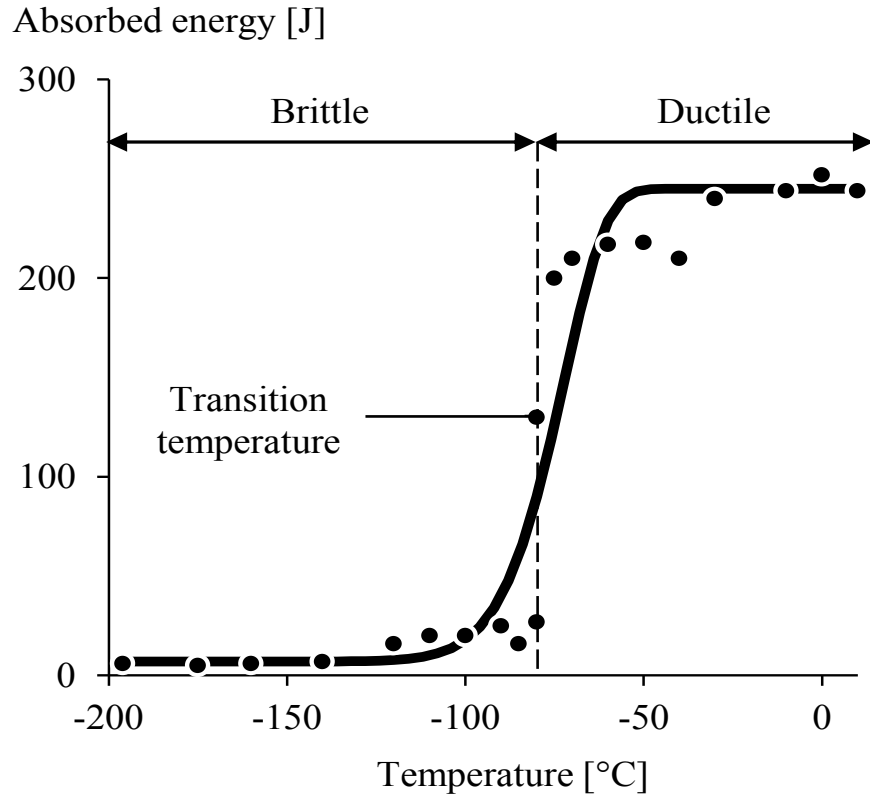
X70HIC-WT 14 mm

X65HIC-WT 12.5 mm

X80-WT 13 mm

Temperature [°C]

CVN results



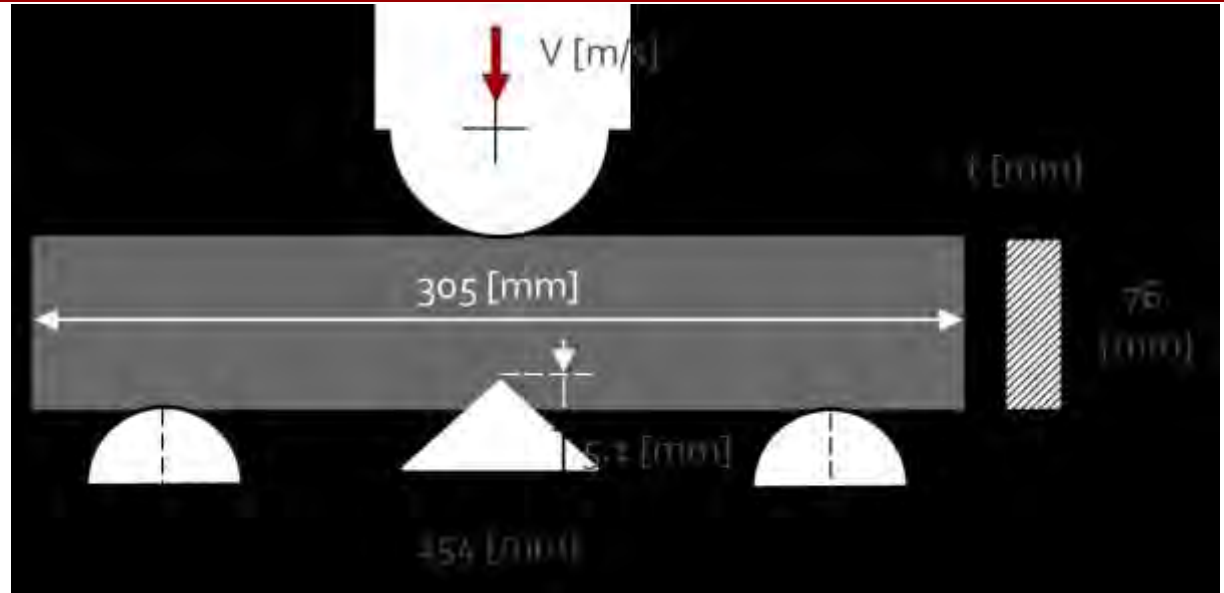


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Drop Weight Tear Test (DWTT)



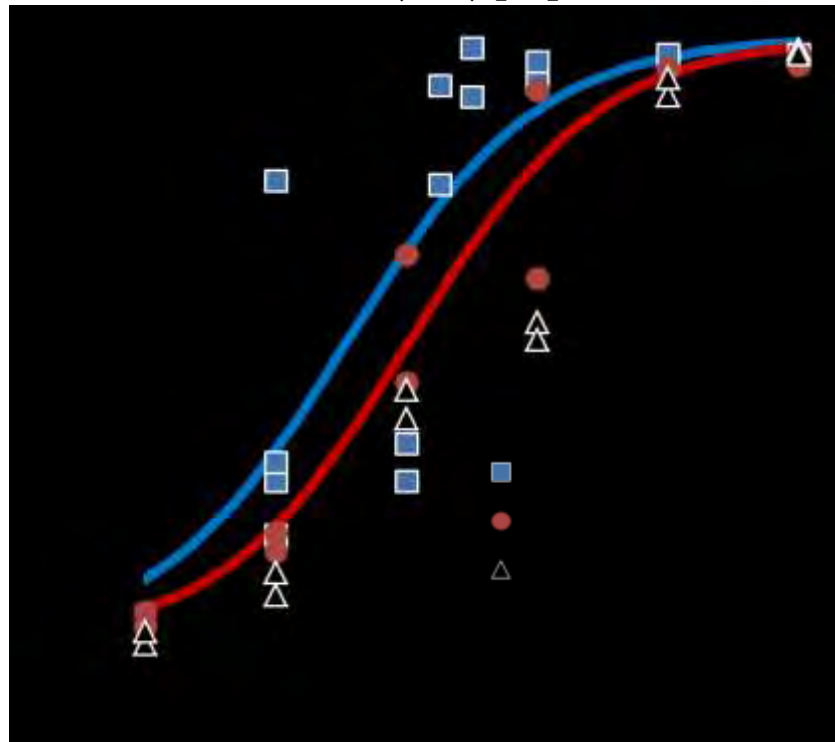
DWTT Set-up



DWTT results

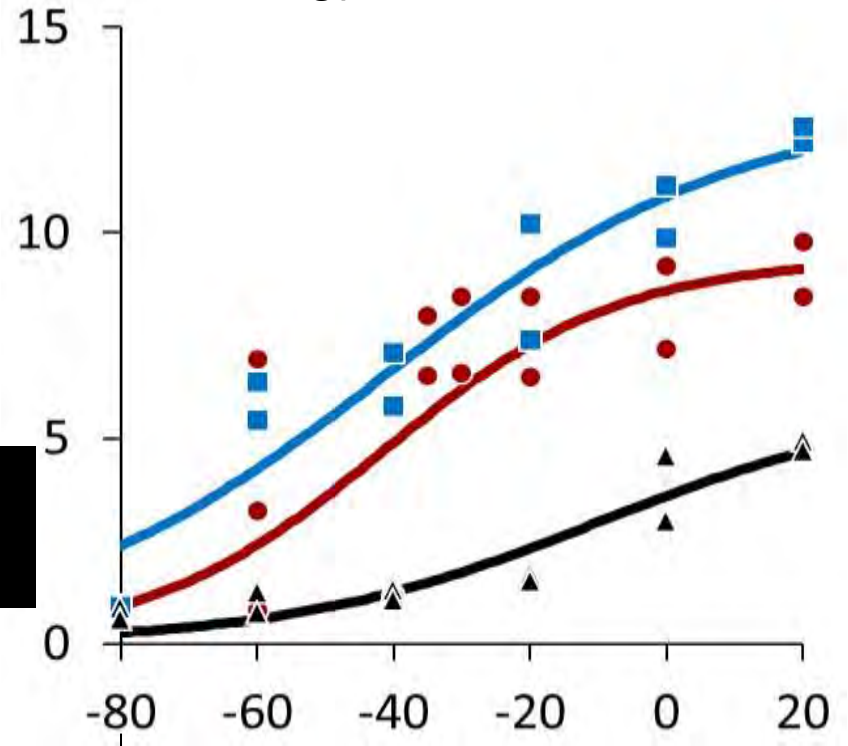


Ductile Shear Area (DA) [%]

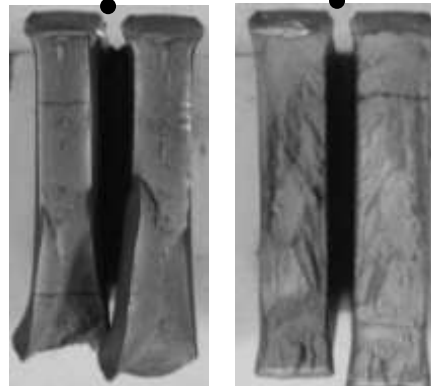


Temperature [°C]

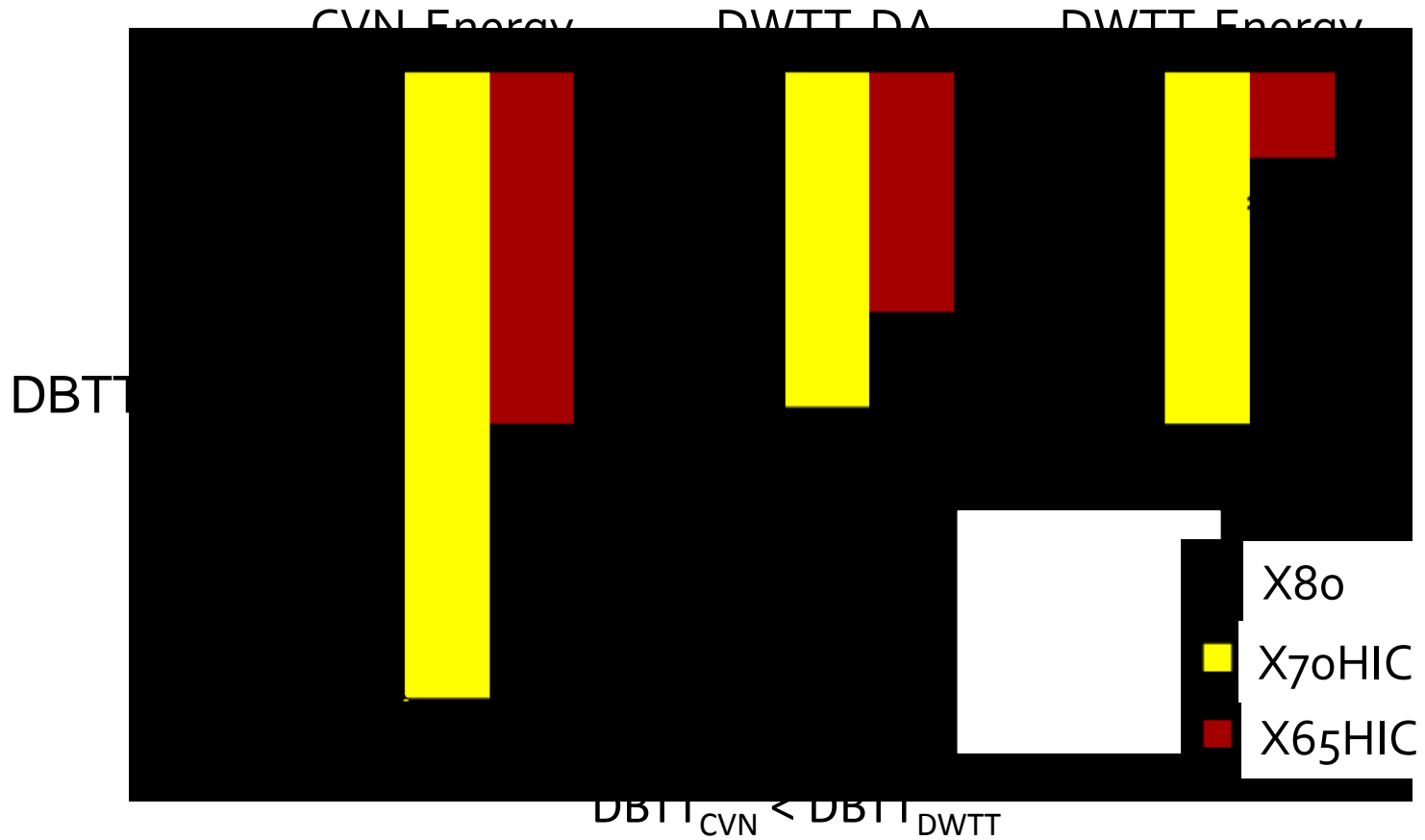
Absorbed Energy [kJ]



Temperature [°C]



CVN vs DWTT



X70MS (HIC) offers the best combination of strength, low temperature toughness and resistance to (accidental) H₂S exposure



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Conclusion

- The material properties of X65, X70 and X80 grades of steel have been studied;
- X70HIC was found to have the lowest ductile-to-brittle-transition-temperature;
- material information is being incorporated into a rigorous coupled fluid-structure model.

Thank you

Questions

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