Ductile to brittle transition in pipeline steels: quantitative investigation of delamination and cleavage fracture

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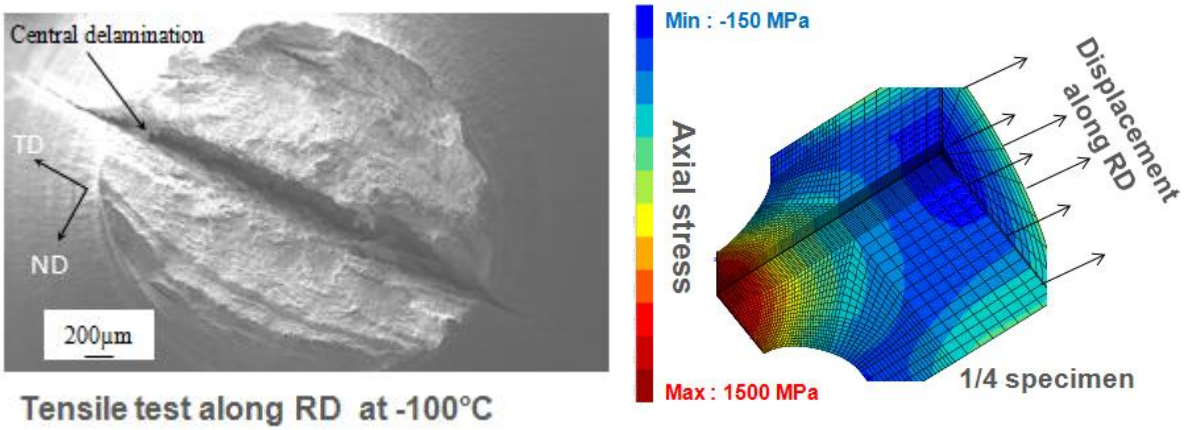
Abstract: Delamination cracking is commonly observed during Charpy or Battelle impact tests on high strength pipeline steels. It involves brittle cracking parallel to the rolling plane and tends to reduce the steel toughness at low temperatures [1-3].

Cleavage fracture anisotropy has been studied on a ferrite-bainite low alloy pipeline steel plate. Mechanical tests have been performed on smooth and notched bars taken along the three principal directions of the plate at temperatures between 20°C and -196°C, and analyzed by finite element calculations with an anisotropic plasticity model. The fracture mode of specimens tested along the normal direction differs from that of specimens taken along the two other directions, together with a lower critical cleavage stress. This difference seems to be related to microtexture anisotropy and might explain the sensitivity of this steel to delamination at low temperatures.



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