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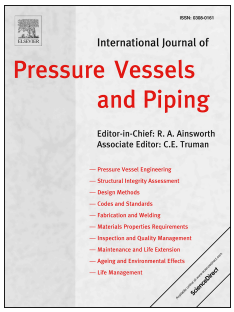

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Microstructure and impact toughness of reheated coarse grain heat affected zones of API X65 and API X80 linepipe steels

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Abstract

The effect of reheating the coarse grain heat affected zone (CGHAZ) at various second peak temperatures on microstructure and its corresponding effect on impact toughness of API X65 and X80 was studied under simulated condition. When the CGHAZ was reheated to a temperature similar to the first thermal cycle i.e. 1300 °C (unaltered CGHAZ (UA CGHAZ)), ferrite and pearlite phases were observed for X65 steel, similar to CGHAZ, due to which not much fluctuation was measured in the Charpy impact toughness. Whereas in the case of X80 steel, Martensite/Austenite (M/A) constituents were observed in grain interior and along the prior austenite grain (PAG) boundaries, due to which a slight drop in the Charpy impact toughness was measured. When the CGHAZ was reheated to the super-critical temperature i.e. 1050 °C (SCR CGHAZ), fine ferrite and pearlite was observed in both the steels, which resulted in the improved toughness at room temperature and at -20 °C. Impact toughness was significantly deteriorated in both the steels when the second peak temperature was in the intercritical range i.e. 800 °C (IC CGHAZ). This resulted in grain coarsening in the case of X65 and in X80 steel, coarsened PAGs along with M/A constituents inside the grains and the in-network arrangement along the grain boundaries combined to cause brittle failure with very low toughness.

[1]KSA and SRP equally contributed to this article

Keywords: API linepipe steel, Welding, HAZ simulation, M/A constituents, Impact toughness