Chen, Y., Wang, Y.-Y., Microstructure Modeling of HAZ Softening in Microalloyed High Strength Linepipe Steels, Proceedings of the 17th International Offshore and Polar Engineering Conference (ISOPE 2007), Lisbon, Portugal

Abstract

The heat-affected zone (HAZ) of modern low-carbon low alloy TMCP linepipe steels can soften in the presence of welding thermal cycle, even at the relatively low heat input of pipeline girth welding. The possibility of strain concentration in the softened zone and low HAZ toughness can have negative impact on the integrity of pipelines. The present study describes a microstructure model capable of predicting HAZ softening. Modern pipeline steel grades X70, X80, and X100 were selected to study their propensity of HAZ softening. The model was first benchmarked against the hardness measurements of X70 and X80 steels which underwent simulated thermal cycled with different peak temperatures. It was further applied to a multi-pass girthweld made on an X100 steel. The predicted HAZ hardness was compared to the microhardness mapping obtained from the girth weld.

Keywords

Heat-affected zone (HAZ), Grain size, TMCP steels, HAZ softening, Microhardness