Ota S., Shimamura J., Yasuda K., Ishikawa N., **Liu M., Degen C., and Wang Y.Y.**, "Multi-scale ductile fracture modeling for dual-phase high strength steel - part 1: characterization of dual-phase high strength steel for improved toughness and deformability," Materials Science & Technology 2015, October 4-8, 2015, Columbus, OH, USA.

Abstract

Dual-phase microstructure control is an essential measure for improving strain capacity of linepipe steels. High strength steels with bainite-MA dual-phase microstructure have been developed and applied to many pipeline projects. However, dual-phase steels tend to have lower Charpy energy in the upper shelf region than single-phase steels. In order to improve Charpy energy through microstructure control, in-depth investigation on ductile fracture behavior in the bainite-MA steels was conducted. It was found that void nucleation was enhanced in the bainite phase adjacent to the bainite/MA boundary of large MA particles, resulting in lower Charpy energy. On the other hand, void nucleation was less prominent in the steels with small MA. Therefore, Charpy energy can be improved by keeping the size of MA particles small in bainite-MA steels. In this paper, the behavior of void nucleation, growth and coalescence which leads to ductile cracking is discussed in detail.

Keywords

Bainite, MA, Dual-phase steel, Stress-strain curve, Y/T ratio, Charpy absorbed energy, Ductile crack initiation, Void nucleation and growth