Physical simulation of girth weld HAZ in high strength pipeline steels

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ABSTRACT

In this paper, the simulation coarse grain heat affected zone (CGHAZ) continuous cooling transformation (SHCCT) curve of high-Nb X80 pipeline steel was drew by using Gleeble 3500 simulator. The simulated CGHAZ specimens on microstructures, Vickers hardness, and Charpy impact toughness were tested and analyzed. The results show that the hardening trend of high-Nb X80 pipeline steel weld CGHAZ is significant when using the small welding heat input. When cooling rate is between 1 and 12.5°C/s, the microstructure of CGHAZ consists of granular bainite and lath bainite. When cooling times from 800 to 500°C ($t_{8/5}$) is between 15 and 30 s, the microstructure of CGHAZ consists of lath bainite and lath martensite, which means excellent low-temperature toughness and moderate hardness. The recommended girth welding heat input of high-Nb X80 pipeline (when the pipe wall thickness is 18.4 mm) is between 17 and 24 kJ/cm, and the weld preheating temperature is controlled about 100°C.