Influence of Electron Beam Welding Parameters on Microstructure And Mechanical Properties of Boron-added Modified 9Cr-1Mo Steel Weld

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ABSTRACT

Modified 9Cr-1Mo steel is used in high temperature applications due to its good thermo-physical, mechanical, weldability and formability. This steel is susceptible to Type IV cracking, in which failure of the weld joint occurs on creep exposure in the intercritical region of the heat- affected zone (ICHAZ). Improved resistance to Type IV cracking in modified 9Cr-1Mo steel weld joints can be achieve by addition of 100 ppm boron along with controlled nitrogen. However, in the absence of boron-added welding consumables, weld joints of this steel are presently being made using boron-free welding consumables. Consequently, during creep, the microstructure of boron-free weld metal is relatively less resistant to coarsening compared to the boron-added base metal and HAZ. The objective of the present investigation is to understand the effect of electron beam welding parameters on the micro-structure and mechanical properties of the welds. Weld joints of the boron-free (P91) and boron-added (P91B) modified 9Cr-1Mo steels were prepared by varying the welding parameters during electron beam welding. The soundness of the weld joints was confirmed by radiographic examination and bend testing. The tempering behavior of weld metal and base metal was studied and compared. The test results show that the ductile-to-brittle transition temperature of the P91B steel is comparable to that of the P91 steel but lower than that of boron-free weld metal. This paper discusses the influence of electron beam welding parameters on themicrostructure and mechanical properties of boron-added modified 9Cr-1Mo steel welds.

Dilatometric Study of Phase Transformation and Thermal Expansion in T91 Steel

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ABSTRACT

A comprehensive characterization of the kinetic aspects of diffusional α′-martensite → α- ferrite+carbides → γ-austenite phase transformation that occurs during heating and that of γ→α′-martensite displacive phase transformation, which occurs upon continuous cooling has been performed using high resolution dilatometry, under varying thermal history. The results of dilatometry are analysed in terms of an appropriate thermo-kinetic framework to obtain useful information about transformation temperatures, their dependence on thermal history, and apparent activation energies involved in effecting phase changes. In addition, the results of temperature variation of dilatational strain ($\Delta l_T/l_o$) measured under slow heating scans, are used to obtain reliable estimates of thermal expansion in the temperature range, 300-1000 °C.