Short Communication

Study on the Corrosion Behaviours of X80 Pipeline Steel Joints Fabricated via Hot-Wire Tungsten Inert Gas Welding

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X80 pipeline steel joints were fabricated via hot-wire tungsten inert gas welding by using ER70S-G wire with a diameter of 1.2 mm. The microstructures of the welded joints were analysed by using metallographic microscopy. Weight-loss methods, polarization curve measurements and electrochemical impedance spectroscopy (EIS) techniques were used to analyse the corrosion behaviours of the X80 pipeline steel welded joints in a 3.5% NaCl solution. The corrosion products and morphologies were characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM). The results show that the microstructure of the weld zone is composed of acicular ferrite, whereas the microstructure of the heat-affected zone is mainly composed of granular bainite, bainite ferrite, and a small amount of striated M-A. The corrosion weight-loss of the heat-affected zone is greater than those of the base metal and weld zone. Electrochemical testing results indicate that the corrosion current potential of the heat-affected zone is lower than those of the base metal and weld zone. Moreover, the corrosion current in the heat-affected zone is higher and its impedance is also lower than those of the base metal and weld zone. Furthermore, the heat-affected zone is more susceptible to corrosion than the base metal and weld zone. This susceptibility to corrosion is due to the electrochemical reaction that is driven by the potential difference between the coarse bainite ferrite and the non-equilibrium GB, which causes corrosion failure of the material in the corrosive medium.

Keywords: X80 pipeline steel; hot-wire tungsten inert gas welding; electrochemical properties; corrosion behaviour; polarization curve

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