EFFECT OF TEMPERATURE AND CHROMIUM CONTENT ON TENSILE PROPERTIES AND FRACTURE MECHANICS PARAMETERS OF CR-MO STEEL WELDED JOINTS

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Abstract

Cr-Mo steels A-387 Gr. B and SA-387 Gr. 91 are intended for the production of pressure vessels, steam pipelines and gas installations in the chemical and petrochemical industry, as well as thermal power plants, which work in conditions of elevated temperature and corrosive environment. Due to their exceptionally good mechanical properties, as well as their excellent resistance to the presence and propagation of cracks in operational conditions, their use also results in significant material savings compared to conventional steels. This paper presents an analysis of the influence of temperature and Cr content on the measure of resistance to brittle fracture of the welded joint of Cr-Mo steel from the aspect of applying parameters obtained from tensile tests and parameters obtained from fracture mechanics tests.

Analyzing the test tube tensioning results of butt-welded joint, it can be seen that with an increase in the test temperature, there is a decrease in the value of the yield stress and tensile strength (for both welded joints), an increase in the elongation of the welded joint of steel A-387 Gr. B and elongation reduction in the welded joint of steel SA-387 Gr. 91. All test tubes broke in the parent metal (at both welded joints), which gave us the tensile characteristics of the parent metal (PM). Based on the obtained test results of test tubes extracted from PM, weld metal (WM) and heat affected zone (HAZ), it can be seen that with increasing test temperature there is a decrease in the value of the critical J_{Ic} integral, hence fracture toughness K_{Ic}. Likewise, the value of the critical crack length a_c decreases or changes slightly in the welded joint of steel A-387 Gr. B and increases in the welded joint of steel SA-387 Gr. 91.

Keywords: *welded joint, crack, tensile properties, fracture toughness in plane deformation, critical crack length.*