Experimental Determination of J_{IC} for a HSLA Steel Welded Joint

A. Maksimović[1]*, B. Petrovski[2], Lj. Milović[3], B. Aleksić[1], V. Aleksić[4], S. Bulatović[4]

[1]Innovation Centre, Faculty of Technology and Metallurgy, 4 Karnegijeva St, 11120 Belgrade, Serbia
[2]Innovation Centre, Faculty of Mechanical Engineering, 16 Kraljice Marije St. 11120 Belgrade, Serbia
[3]Faculty of Technology and Metallurgy, University of Belgrade, 4 Karnegijeva St, 11120 Belgrade, Serbia
[4]Institute for Testing of Materials-IMS Institute, 43 Bulevar Vojvode Mišića St.11040 Belgrade, Serbia
*corresponding author: aprodanovic@tmf.bg.ac.rs

Abstract

Most serious weldment failures have catastrophic consequences in terms of damage to other equipment, loss of production, and risks to worker health and safety. For the above reasons, there is a tendency to find the line between safety and disaster, and this requires a guarantee of the integrity of the welded structure even if a crack is present.

The structural and mechanical heterogeneity of a welded joint affects its resistance to cracking in both the elastic and plastic regions. Therefore, it is important to define the test method and the position of the fatigue crack. The behavior of an elasto-plastic material, during stable crack growth can be described by the J-Δa diagram. As the crack propagates, a point on the curve is defined, which represents the critical value of the J-integral. The aim of this experiment is to determine JIC value and the procedure is reflected in the determination of the R curve, i.e. the J–Δa curve, which consists of the value of the J integral for uniform crack increments Δa. In this paper, two SEN(B) specimens with the fatigue crack in the parent material (PM) and weld metal (WM) were tested according to standard ASTM E1820 at room temperature (RT) as well as three specimens with the fatigue crack in the weld metal (WM) at RT, -20 0C, -30 0C.

Keywords: J-integral; J-R curve; HSLA steel; welded joints