1. Experimental and Numerical Study ofMechanical Properties and Fracture Mechanics Analysis of AISI1010 LowCarbon Steel Welded Joints

By Muthanna Jaber Abdulsada

ABSTRACT

The low carbon steel AISI1010 using in many industrial like the pipe line, the storage tank, shipbuilding and many important uses. The study of the mechanical properties and behavior of the fracture for this type metal is importantand useful for the designers who use this metal in their designs.

The experimental work involved the preparation of specimens fromcommercial metal low carbon steel AISI1010, to evaluate and study some mechanical properties such as properties of tensile test such as yield strength, tensile strength and percentage elongation are calculated , the hardness, the fracture parameter such as stress intensity factor SIF and crack mouth opening displacement CNOD . By used the hardness technique which bounded the heat effected zone HAZ. After find the boundary of HAZ the tests were performed where the firstly found mechanical properties and then the fracture parameters were obtained through applied the test single edge crack tension SECT. Welded specimens preparation by method the Shielded Metal Arc Welding

SMAW were used in two types electrodes of welding E7018 and E6013 .The results of the tensile test ultimate tensile stress for the base metal specimen is (426MPa),(419MPa)(432MPa) for the welded specimens E7018 .E6013 respectively, from the test single edge crack tension SECT obtained the stress intensity factor and the crack mouth opining displacement CMOD for all specimen at a differences loads. Using the capabilities of Finite Element ABAQUS software and The Extended Finite Element Method (XFEM) capabilities, simulation of a tension teston a specimen was first executed to determine the numerical results of tensile test,and the test single edge crack tension SECT 3D analysis of specimens. The validation of the numerical analysis was performed by using a previous experimental study. Finally the numerical results is compared with the results of the experimental, the simulation results demonstrated a good agreement with experimental results. Using the electrode E6013 to welding the low carbon steel AISI1010 enhance the strength and increase resistance to crack propagation, using the electrode E7018 to welded metal that lead to increase the hardness significant.