

Effect of Friction Pressure on the Properties of Friction Welded Aluminum-Ceramic Dissimilar Joints

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Abstract : The ceramic-aluminum bond is strongly present in industrial tools, due to the need to combine the properties of metals, such as ductility, thermal and electrical conductivity, with ceramic properties like high hardness, corrosion and wear resistance. In recent years, some joining techniques have been developed to achieve a good bonding between these materials such as brazing, diffusion bonding, ultrasonic joining and friction welding. In this work, AA1100 aluminum alloy rods were welded with Alumina 99.9 wt% ceramic rods, by friction welding. The effect of friction pressure on mechanical and structural properties of welded joints was studied. The welding was performed by direct friction welding machine. The welding samples were rotated at a constant rotational speed of 900 rpm, friction time of 4 sec, forging strength of 18 MPa, and forging time of 3 sec. Three different friction pressures were applied to 20, 34 and 45 MPa. The three-point bending test and Vickers microhardness measurements were used to evaluate the strength of the joints and investigate the mechanical properties of the welding area. The microstructure of joints was examined by optical microscopy (OM), scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS). The results show that bending strength increased, and then decreased after reaching a maximum value, with increasing friction pressure. The SEM observation shows that the increase in friction pressure led to the appearance of cracks in the microstructure of the interface area, which is decreasing the bending strength of joints.

Keywords : welding of ceramic to aluminum, friction welding, alumina, AA1100 aluminum alloy

Conference Title : ICWMT 2018 : International Conference on Welding and Materials Technology

Conference Location : Dublin, Ireland

Conference Dates : September 06-07, 2018