

Friction stir welding of similar and dissimilar magnesium alloys

Friction stir welding (FSW) is a solid state welding process gained wide popularity in the manufacturing industry. FSW eliminates several issues such as oxidation, handling of liquid material, thermal stresses and formation of secondary phases usually associated with fusion based processes. Recently, magnesium based alloys have proven as promising candidates for structural applications. Joining of similar and dissimilar magnesium alloys is difficult through fusion welding techniques. In the proposed research work, welding of similar and dissimilar magnesium alloys is done by FSW and the joint formation at different process parameters is evaluated. Among all magnesium alloys, AZ series are the most widely used commercial alloys in automobile and aerospace applications. Welding of dissimilar materials is a difficult task by conventional fusion based welding processes. Hence, Dissimilar AZ31 and AZ91 magnesium alloys are welded by FSW and the joint characteristics are evaluated. The microstructure evolution during welding and the effect of the microstructure on the mechanical behavior and corrosion properties of the weld joint are investigated. Microstructure studies are carried out by using optical microscope and scanning electron microscope. The starting material and the weld joints are further characterized by X-ray diffraction method. To evaluate the mechanical behavior, microhardness and tensile tests are conducted at different regions of weld joints. To understand the corrosion behavior of the joints, electrochemical tests are conducted in the presence of 3.5% NaCl solution.

Keywords: Friction stir welding, magnesium alloys, solid state, mechanical behavior, corrosion