Abstract

Friction Stir Welding (FSW) is a solid-state welding technique and has been extensively used for the joining of high strength Aluminum Alloys that are hard to weld using conventional techniques. AA2219 is one such alloy that has high applicability in the automotive and aerospace industry. The present work identifies the optimum tool dimensions, pin profile, and process parameters – tool rotation rate and tool traverse speed for FSW of AA2219 to obtain defect-free welds. Mechanical and microstructural analyses are conducted on the obtained welds, and the relation between weld properties and process parameters is investigated. The weld plates are heat-treated, and defects, porosity, and blisters on the weld are studied. The steady-state heat-transfer and material-flow model is used for thermal analyses for FSW of AA2219. The temperature distribution in XY and YZ plane is found to increase with an increase in tool rotation rate and shows the circular shape. At higher tool traverse speed, the temperature distribution shows the elliptical shape due to the effect of cooling at the trailing edge. The computed results show that the peak temperature increases with an increase in tool rotation rate at constant tool traverse speed and decreases with an increase in tool traverse speed at constant tool rotation rate.

Keywords: Friction Stir Welding, AA2219, Process Parameter Optimization, Heat treatment, Numerical Simulation