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Effect of Tool Geometry and Welding Parameters on Macrostructure and Weld Strength in Friction Stir Welded of High Density Polyethylene Sheets

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Abstract : Friction stir welding is a solid-state joining process that has gained acceptable progress in recent years. This method which was first used for welding of aluminum and its alloys is now employed for welding of other materials such as polymers and composites. The aim of the present work is to investigate the mechanical properties of butt joints produced by friction stir welding (FSW) in high density polyethylene sheets of 4 mm thickness. The effects of critical welding parameters and tool design have affected on mechanical properties, weld surface and macrostructure of friction stir welded polyethylene. Experiments were performed at tool rotational speeds of 600, 900, 1200 and 1500 r/min and traverse speeds of 30, 45 and 60 mm/min, tool diameters (d) of 4, 5, 6 mm and tool shoulder diameters (D) 20, 25, 30 mm. A strength value of 80 % of the base material was achieved at the isolated optimum welding condition. According to the tool design, the welding parameters and the mechanical properties changed to a great extent. The highest tensile strength was achieved at low feed rates, high tool rotation speeds and shoulder diameters/pin diameters ratio.

Keywords : friction stir welding, mechanical properties, polyethylene, high density polyethylene, tool design
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