PAPER ID:145

WELDING OF POLYPROPYLENE SHEETS BY NOVEL SELF-HEATED FSW TOOL: EFFECT OF TOOL ROTATIONAL SPEED

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ABSTRACT

By the growing development in industrial applications of commodity plastics, demand for quick and reliable welding methods has been increased. Friction stir welding is a newly developed joining technique for these polymer materials. In the present study, friction stir welding was carried out on 3 mm polypropylene (PP) sheet by a novel Self-Heated Friction stir welding tool in which external brake force creates additional frictional heat on the rotating tool. Tool rotational speed was varied at different levels with fixed tool traverse speed and tool tilt angle. This investigation aimed to study the forces and torque engendered on the tool during the welding and their effect on the joint quality. The microstructural morphologies of welds zones were analysed using optical microscope (OM) and field emission scanning electron microscope (FE-SEM). To evaluate the mechanical properties of the weld joints, tensile and microhardness test were performed. Though the proper bonding was achieved by this novel tool, a few micro cracks and pores were observed in the stir zones. The tool forces and spindle torque were decreased with the increment of tool rotational speed owing to greater softening of the material. This reduced forces and torque led to better mixing of materials at the interface of the butt joint. Therefore, the tensile strength and microhardness were increased with increase of tool rotational speed. All weld specimens were fractured at the weld zone in manner of ductile failure as indicated from SEM morphology of the fracture surfaces. Henceforth, these results suggest that friction stir welding using Self-heated tool was useful for joining the polymericmaterials.

Keywords: Friction Stir Welding, Polypropylene, Joint strength, Microhardness, Self-heated tool.