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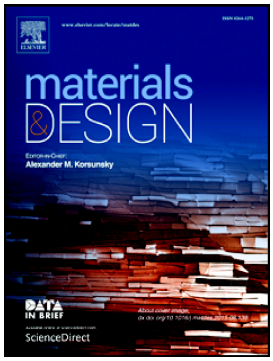


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A. Ebrahimian, A.H. Kokabi

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# Friction Stir Soldering: A Novel Route to Produce Graphite-Copper Dissimilar Joints

A. Ebrahimian*, A. H. Kokabi

Department of Materials Science and Engineering, Sharif University of Technology, Azadi Avenue, P.O. Box 11365-9466, Tehran 14588, Iran

(*corresponding author, Tel: +98 9137890961, Email: ebrahimiana@yahoo.com)

## Abstract

In this study, friction stir soldering (FSS) as an emerging joining process with the aid of a preliminary electroplating process was utilized for the first time to fabricate graphite-copper lap joints aimed at investigation of rotational speed influence on joint interface microstructure and mechanical behaviour. To do so, an Sn-37Pb solder foil was placed between a copper sheet and a copper-coated graphite substrate after which a rotating pin-free tool was plunged into the copper sheet and allowed to travel along the joint. Results indicated that adhesive strength between the electroplated copper coating and graphite substrate was strongly affected by surface roughness and plating current density due to effect of these parameters on coating/substrate mechanical interlocking and contact surface area. Shear strength of the joint was first increased to the maximum value of 12.1MPa and then was decreased by enhancement or decrease of rotational speed. Decrement of the shear strength from the maximum was rationalised to the domination of void generation and excessive thichness of intermetallic compounds (IMCs) layer in low and high rotational speed regimes, respectively. These two phenomena were attributed to the twofold effect of heat-input and induced maximum temperature on solder flow and solder-copper interaction.

**Keywords:** friction stir soldering; graphite-metal joint; electroplating; Pb-Sn solder; heat-input; intermetallic compounds