Abstract

Title of Document:

EFFECT OF TOOL SHOULDER DIAMETER ON THE FRICTION STIR WELDING OF AA 5083-CU ETP AND AA 6061-CU ETP

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Advised By: **Dr. Amit Arora, Assistant Professor,**

Materials Science and Engineering

Joining of dissimilar materials are widely used in industries such as marine, aerospace, ship building industries to get the specific advantages of both the materials. Friction Stir Welding (FSW) is a solid state welding process used for joining of similar/dissimilar materials. It is an appropriate for joining dissimilar materials due to numerous advantages over fusion welding process such as no solidification cracking, free from porosity, and pollution free. This process shows multiple benefits for welding dissimilar materials such as Aluminium (Al) and Copper (Cu) due to possibility of porosity-free welds with high joint strengths using an environment friendly approach. Aluminum (Al) and Copper (Cu) are extensively used in electrical and aerospace industries, resulting in inclination towards joining them amongst the researchers. Al-Cu joints are used to transmit electricity. Welding Al and Cu is very difficult using conventional fusion welding techniques due to large amounts of intermetallics being

formed in the weld zone, which result into embrittlement of materials, hence FSW is being used for this application.

In the current work, microstructural and mechanical of welds between heat treatable and non-heat-treatable aluminium alloys and ETP Copper are analysed. AA 5083-ETP Cu welds (non-heat-treatable Al) and AA 6061-ETP Cu welds (heat-treatable Al) were performed to do this comparative analysis. To validate the results for multiple input parameters, tool Shoulder diameter was changed in an attempt to modify the heat input into the weld and plunge load. The analysis proved that AA 5083-ETP Cu welds showed superior mechanical properties, although amount of intermetallics was higher in them as well. It can be concluded that same set of parameters can be used to weld these two weld systems which are used in different applications.

Keywords: FSW, AA 5083, AA 6061, Cu ETP, XRD, SEM, EDS