

Thermo-mechanical physical simulation of friction melt bonding for dissimilar Al/steel joints

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Friction Melt Bonding (FMB) is a recent joining technique, that has the primary objective of joining dissimilar metals. Dissimilar Al/steel joints are of interest for the automotive industries to improve the fuel efficiency by reducing the weight. In order to improve the quality of the weld, by minimizing the intermetallic thicknesses and to suppress the hot-tears that occur in the weld pool under certain welding conditions, a physical simulation was performed in a Gleeble thermo-mechanical simulator, by mimicking the thermal and loading cycles of the welding cases. The physical simulation allows to better understand the thermal and pressure cycles leading to the intermetallic formation under various process parameters. A good agreement is found between the physical simulation and the actual FMB welds in terms of reproducing the intermetallic thicknesses, and their different constituting layers. Hot tears and the nano-hardness variation in the bond layer are also reproduced by the physical simulation and closely resemble the FMB joints.

Keywords: *Dissimilar welding, Interface, intermetallic, physical simulation, nano indentation*