EXPERIMENTAL INVESTIGATION OF RESIDUAL STRESS IN LASER SHOCK PEENED FRICTION STIR WELD JOINTS

Omar Hatamleh[1], Adrian T. DeWald[2], and Michael R. Hill[2]

[1]NASA – Johnson Space Center, Houston, TX, USA
[2]Hill Engineering, LLC, 5022 Bailey Loop, McClellan, CA, USA

Friction stir welding (FSW) is currently being used to join materials from plastics to high-strength steels in industries including automotive, aircraft, and shipbuilding. The FSW technique employs a non-consumable cylindrical pin that rotates at high speeds, which is plunged into butting edges of the work pieces to be joined. This process transforms the metal into a plastic state at a temperature below the melting temperature of the material, and then mechanically stirs the material together under pressure to form a welded joint. Although the thermal input during FSW is relatively low compared with conventional welding techniques, residual stresses still develop during the FSW process. The magnitude and distribution of these residual stresses can be detrimental to performance and can be a significant contributor to the durability of the FSW joints and surrounding material.

This paper investigates the residual stress generated by friction stir welding on 2195 and 7075 aluminum alloy samples. Residual stress measurement data was obtained using the contour method. This paper also investigates the ability of mechanical surface treatments (e.g., shot peening and laser shock peening) to mitigate the tensile residual stresses in these FSW joints.
