

Accepted Manuscript

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PII: S0263-8223(17)30547-0
DOI: <http://dx.doi.org/10.1016/j.compstruct.2017.04.053>
Reference: COST 8484

To appear in: *Composite Structures*

Received Date: 16 February 2017

Revised Date: 28 March 2017

Accepted Date: 20 April 2017



Please cite this article as: Pabandi, H.K., Movahedi, M., Kokabi, A.H., A New Refill Friction Spot Welding Process for Aluminum/Polymer Composite Hybrid Structures, *Composite Structures* (2017), doi: <http://dx.doi.org/10.1016/j.compstruct.2017.04.053>

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A New Refill Friction Spot Welding Process for Aluminum/Polymer Composite Hybrid Structures

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Abstract:

A new refill friction spot welding process called *Threaded Hole Friction Spot Welding (THFSW)* was introduced to join AA5052 aluminum to short-carbon-fiber-reinforced polypropylene (PP-SCF) composite sheets. The process was based on filling of the pre-threaded hole by melted and re-solidified polymer. The results showed that THFSW was successful to join aluminum to polymer sheets and the hole was completely filled with melted polymer. Formation of a reaction layer composed mostly of Al, C and O as well as interlocking between the threaded hole and the re-solidified polymer were recognized as main bonding mechanisms. Maximum shear-tensile strength of the joints reached to ~80 percent of the composite base strength. Moreover, Mechanical strength and fracture energy of the joints increased with enhancement of tool rotational speed. Variation of the joint strength was explored in light of the fracture surface features as well as crystallinity percent of the re-solidified polymer inside the hole.

Keywords: Friction spot welding; Refill; Polymer; Aluminum; Joint strength; Fracture energy

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