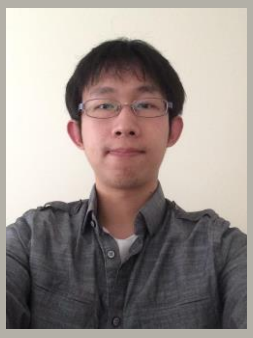
WPI MATERIALS SCIENCE & ENGINEERING

Yi Pan

PhD Doctoral Proposal

Monday, December 11, 2017
10.00 AM
Higgins Lab 102



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Friction Stir Welding of Wrought and Cast Al Alloys: Weld Quality Evaluation, Thermo-Mechanical Modeling and Microstructure Prediction

Abstract

Friction stir welding (FSW) is a solid-state technique widely used for joining and repairing in the transportation sector, and understanding its effects on static and dynamic properties is critical for structural integrity. In this study, four aluminum alloy systems (wrought 6061 and cast A356, 319, and A390) were processed using various controlling parameters in both as-fabricated and pre-weld heat treated conditions. The effects of processing and heat treatment on the resulting microstructures, macro/micro-hardness, and static properties were systematically investigated and mechanistically correlated. Optimum processing parameters that provide both defect-free welds and good mechanical properties were experimentally determined for each alloy. In addition, a thermo-mechanical model was developed for simulating and predicting temperature, stress, and material flow fields, as well as microstructure evolution during FSW, through a dynamic recrystallization and secondary phase fragmentation model, under different processing conditions. The results of these studies will be systematically presented and discussed from the perspectives of both process optimization and structural design.