

Optimization of Friction Stir Welding Parameters for Joining of Ti-Al Laminated Metal Composite to AA 5754 Alloy

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Several aspects of similar and dissimilar friction stir welding of lightweight alloys have been studied including by the authors [1-4]. This study aimed for optimizing the friction stir process parameters in joining Ti-Al laminated metal composites obtained through ultrasonic additive manufacturing to AA 5754 aluminum alloy. Upon initial studies it was concluded that lower the tool rotation speed and deeper the initial and second pass depth led to more homogeneous welded zone and relatively higher ductility. In the current study, tool rotational speed and first and second pass depth optimization were performed. To this goal, first, a successful welding that provides no worm hole formation was aimed. Upon a systematic approach successful welding of dissimilar materials was realized at a tool rotational speed of 750 rpm, 29 mm/min advancement speed, tool angle of 7°, and pass depths of 2.38, and 2.56 mm, respectively. Furthermore, it was aimed to make the process faster with a single pass which was successful at a pass depth of 2.35 mm (Figure 1).

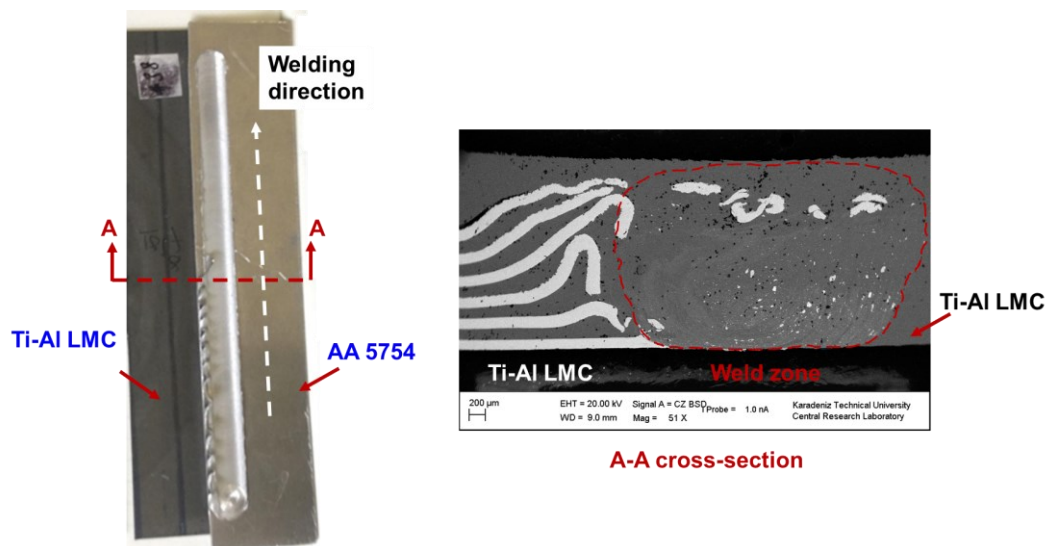


Figure 1. Single-pass friction stir welding of Ti-Al laminated metal composite and AA 5754 plates (left), and typical SEM of the A-A cross-section (right)

1. Acar et al., *Welding in the World*, **2020**, 64, 1553-1564.
2. Trdan et al., *Journal of Materials Research and Technology*, **2023**, 25, 2333-2352.
3. Ayad et al., *Materials & Design*, **2022**, 222, 111080.
4. Klobčar et al., *Materials*, **2022**, 15, 6812, 1-12.