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A general strategy for the reliable joining of Al/Ti dissimilar alloys via ultrasonic assisted friction stir welding

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Abstract: Ultrasonic assisted friction stir welding (UaFSW) was used to join 6061-T6 aluminum and Ti6Al4V alloys. A small plunge depth endowed with the low heat input was used and the sound joints without obvious thickness reduction were achieved. A diffusion-type bonding without the intermetallic compounds layer was observed at the joint interface. The ultrasonic improved the diffusion thickness and decreased the average size of grains and titanium alloy fragments. A hook-like structure was formed at the bottom interface of the UaFSW joint, which improved the bonding length and the mechanical interlocking. The microhardness of the stir zone was increased because of the further grain refinement induced by ultrasonic. The maximum tensile strength of the UaFSW joint was 236 MPa, which reached 85% of the base 6061-T6 alloy.

Keywords: Friction stir welding; Ultrasonic; Aluminum/titanium alloys; Microstructure; Mechanical properties.