Effect of Wobbling Loops with Laser Welding Characteristics to the Shear Strength of Cu/Al Lap Joints for Battery Applications

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Abstract Manufacturing, automotive, and aerospace industries choose fibre laser welding. These industries prefer fibre laser welding because the technology requires less space, has low setup and maintenance costs, and produces high-quality welds without surface conditioning. Fibre laser welding produces joints with a small heat-affected zone (HAZ), deep penetration, and good seam quality, making them visually appealing and high-grade. Since intermetallic phases formation and joint efficiency pose issues, thus, welding parameter control is essential. In this work, the tensile shear strength testing results were obtained based on the variation in the laser scanning marking loops of Cu/Al joints. Despite obstacles, the work shows that wobbling can weld thin dissimilar Cu/Al alloys. Mark loop configurations affect welded joint properties. Mark loop 6 boosts tensile strength to 25.19 MPa, followed by mark loops 4 and 3 at 15.13 and 13.22 MPa, respectively. After tensile strength testing, optical microscopy image analysis illuminates the morphological characteristics, failure modes, and mechanical properties of Al/Al, Cu/Cu, and Cu/Al joints. The findings of this study can result in improvements in joint design and fabrication procedures, enhancing industry dependability and performance. In conclusion, welding dissimilar metals has a high potential and parameter modifications are crucial for strong joints and optimal mechanical properties.

Keywords Laser · Micro-welding · Automotive · Battery applications · Wobbling technology

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