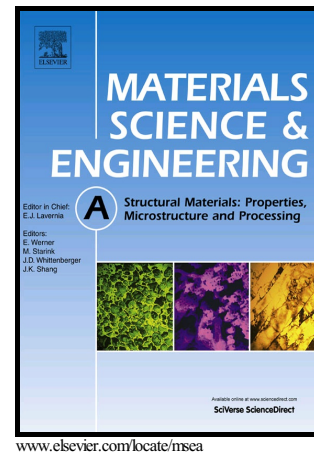


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## Microstructures and mechanical behavior of aluminum-copper lap joints

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**Abstract:** 5052 aluminum alloy and pure copper (T2) are joined, using a low heat input pulsed double-electrode gas metal arc welding (DE-GMAW)-brazing method with AlSi<sub>12</sub> filler metal. The effects of welding current (heat input) on the microstructure and mechanical behavior of the joints, which consist of Al-Al welding zone and Al-Cu brazing zone, are investigated. The Al-Cu welding zone mainly consists of  $\alpha$ -Al solid solution and Al-Cu eutectic phase in coral-like shape. There exists a layer of Al<sub>2</sub>Cu intermetallic compound (IMC) in the Al-Cu brazing zone. Using the theory of thermal activation process, a quadratic relation between the thickness of the IMC layer and welding current intensity is derived. The experimental result supports this relationship. The shear strength of the Al-Cu joints first increases with the increase of the welding current (heat input), reaches a maximum of 17.66 MPa, and then decreases with the increase of the welding current due to the dispersion of the Al<sub>2</sub>Cu IMCs of large sizes in the Al alloy. Fracture of the Al-Cu lap joints occurs at three different positions, and the corresponding failure mechanisms are discussed according to the morphologies of fracture surfaces.

**Keywords:** Al-Cu joint; microstructure; intermetallic compound; shear strength; brittle fracture.

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