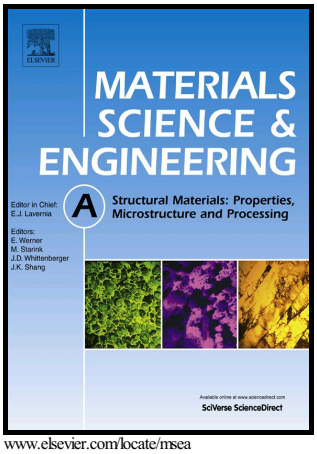
Microstructures and mechanical behavior of aluminum-copper lap joints

Xianglong Zhou, Gang Zhang, Yu Shi, Ming Zhu, Fuqian Yang



www.elsevier.com/locate/msea

PII: S0921-5093(17)31076-6
DOI: http://dx.doi.org/10.1016/j.msea.2017.08.056
Reference: MSA35404

To appear in: *Materials Science & Engineering A*

Received date: 27 May 2017
Revised date: 14 August 2017
Accepted date: 16 August 2017

Cite this article as: Xianglong Zhou, Gang Zhang, Yu Shi, Ming Zhu and Fuqian Yang, Microstructures and mechanical behavior of aluminum-copper lap joints, *Materials Science & Engineering A*, http://dx.doi.org/10.1016/j.msea.2017.08.056

Microstructures and mechanical behavior of aluminum-copper lap joints

Xianglong Zhou[1], Gang Zhang[1], Yu Shi[1]*, Ming Zhu[1], Fuqian Yang[2*]

1. State key Laboratory of Advanced Processing and Recycling Non-ferrous Metals, Lanzhou University of Technology, Lanzhou 730050, P. R. China

2. Department of Chemical and Materials Engineering, University of Kentucky, Lexington, 40506, USA

*Corresponding authors: Yu Shi, shiyu@lut.cn; Fuqian Yang, fyang2@uky.edu

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 $AlSi_{12}$ 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 α-Al solid solution and Al-Cu eutectic phase in coral-like shape. There exists a layer of Al_2Cu 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_2Cu 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.