Microstructures and mechanical properties of friction stir welded lap joints of commercially pure titanium and 304 stainless steel

K. Ishida, Y. Gao, K. Nagatsuka, M. Takahashi, K. Nakata

PII: S0925-8388(15)00009-2
DOI: http://dx.doi.org/10.1016/j.jallcom.2015.01.004
Reference: JALCOM 33007

To appear in: *Journal of Alloys and Compounds*

Received Date: 2 October 2014
Revised Date: 3 December 2014
Accepted Date: 2 January 2015

Please cite this article as: K. Ishida, Y. Gao, K. Nagatsuka, M. Takahashi, K. Nakata, Microstructures and mechanical properties of friction stir welded lap joints of commercially pure titanium and 304 stainless steel, *Journal of Alloys and Compounds* (2015), doi: http://dx.doi.org/10.1016/j.jallcom.2015.01.004

Microstructures and mechanical properties of friction stir welded lap joints of commercially pure titanium and 304 stainless steel

K. Ishida[a*], Y. Gao[a], K. Nagatsuka[b], M. Takahashi[b] and K. Nakata[b]

[a]Graduate School of Engineering, Osaka University, 11-1 Mihogaoka, Ibaraki 567-0047, Japan

[b]Joining and Welding Research Institute, Osaka University, 11-1 Mihogaoka, Ibaraki 567-0047, Japan

*Corresponding author:

Tel: +81-6-6879-8666, Fax: +81-6-6879-8689

Email: k.ishida@jwri.osaka-u.ac.jp

ABSTRACT

Friction stir welding was performed to accomplish dissimilar lap joining of commercially pure titanium (CP-Ti) to 304 stainless steel (SUS304). The joining speed was varied from 25 to 100 mm min^{-1}. At a joining speed of 50 mm min^{-1}, the morphology of the interface was a flat and simple interfacial reaction layer whose thickness was less than 1 μm. The reaction layer consisted of four layers: β-Ti (+ ω-Ti), Ti_2Ni, FeTi + Fe_2Ti, and σ-FeCr, listed in order from the CP-Ti side to the SUS304 side. At a joining speed of 25 mm min^{-1}, the interface consisted of a macroscopically mixed and laminated structure approximately 300 μm thick consisting of multiple reaction layers. During the tensile shear test, joint fractures occurred in the CP-Ti base material at every joining speed. However, during the peel test, joint fractures occurred at the joint interface.

Keyword: Friction stir welding, dissimilar joint, mechanical properties, microstructure, TEM