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**High-strength titanium alloy/steel butt joint produced via friction stir welding**

Shuhan Li<sup>1</sup>, Yuhua Chen<sup>1,\*</sup>, Xingwen Zhou<sup>1,2,\*</sup>, Jidong Kang<sup>3</sup>, Yongde Huang<sup>1</sup>, Huaibo Deng<sup>1</sup>

<sup>1</sup>School of Aerospace Manufacturing Engineering, Nanchang Hangkong University, 696 Fenghe Road South, Nanchang, Jiangxi Province, 330063, China

<sup>2</sup>School of Mechanical Engineering and Automation, Beihang University, Beijing 100191, China

<sup>3</sup>CanmetMATERIALS, 183 Longwood Road South, Hamilton, ON L8P 0A5, Canada

\*Corresponding author: ch.yu.hu@163.com (Yuhua Chen), xingwenzhou@buaa.edu.cn (Xingwen Zhou)

**Abstract**

For the first time, defect-free butt welds of titanium alloy/steel were successfully fabricated via friction stir welding. Joints were produced by employing rotation speed varied at 600 and 950 rpm with a constant travel speed of 47.5 mm/min. An increasing of rotation speed leads to thicken the intermetallic compound layer, coarsen the grain size and thus decrease the joint microhardness. Thanks to the solid-state joining process, only a thin FeTi layer was formed at the interface even rotation speed increased to 950 rpm. As a result, all obtained joints fractured at the base steel material. The work carried out clearly shows the good weldability of titanium alloy to steel via friction stir welding.

**Keywords:** Titanium alloy; Steel; Welding; Microstructure; Intermetallic compound

**1. Introduction**

Hybrid titanium/steel structures provide cost saving by allowing titanium to be used in selected critical areas, which let dissimilar titanium/steel joining be an attractive topic in industrial manufacturing [1, 2]. However, the mismatch in their thermophysical properties and the tendency to form brittle intermetallic compounds (IMCs), such as FeTi and Fe<sub>2</sub>Ti, lead poor fusion weldability for Ti/steel joining [3]. As a solution, the use of solid-state joining techniques (i.e., friction welding [4, 5], friction stir welding [1, 2, 6-9], diffusion bonding [10-12]) helps in reducing IMCs because no melting

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