

Accepted Manuscript

Friction stir welding of titanium alloys: A review

Kapil Gangwar, M. Ramulu



PII: S0264-1275(17)31138-3

DOI: <https://doi.org/10.1016/j.matdes.2017.12.033>

Reference: JMADE 3584

To appear in: *Materials & Design*

Received date: 28 July 2017

Revised date: 1 December 2017

Accepted date: 16 December 2017

Please cite this article as: Kapil Gangwar, M. Ramulu , Friction stir welding of titanium alloys: A review. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. *Jmade*(2017), <https://doi.org/10.1016/j.matdes.2017.12.033>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Friction stir welding of titanium alloys: A review

Kapil Gangwar¹, M.Ramulu*

¹University of Washington, 98195, Seattle, USA,

Abstract

The candidacy of ninth earth abundant material, titanium is supreme when it comes to the higher strength to weight ratio, and higher corrosive resistance. Next generation of jet engines for aerospace industry clearly depends on the manufacturability and improved ability of titanium alloys that can withstand the high temperatures. However, the primary sheets, plates, billets, ingots, or rods are of limited sizes that need to be either machined or welded in order to produce a desired structure with optimal the buy-to-fly ratio. This article primarily summarizes the research in the field of joining of titanium sheets with a direct focus on friction stir welding (FSW). The industrial requirements, whether to weld similar or dissimilar titanium alloys, or of different thicknesses, or even with composites, are often challenged by the selection of the tool, position of the alloying sheets, cooling of the weld nugget, material composition, complex material flow in the wake of the rotating, and traversing tool etc. This article provides a review of FSW of similar and dissimilar titanium alloys focusing on surface, and subsurface properties, such as microstructural, and mechanical properties, texture evolution, current challenges summarizing a possible remedy, encompassing the recent development and research in the field.

Keywords : Friction stir welding; Titanium alloys; Microstructural and mechanical properties; Texture

* Corresponding Author: *Tel.:* +1- 206-543-5349; *fax:* +1- 206-685-8047.

E-mail address: ramulum@u.washington.edu (M.Ramulu)

Contents

Abstract.....	1
1) Introduction.....	4
2) Titanium Alloys	10
3) FSW Process	11
3.1) Tool selection, and thickness variation of alloying titanium sheets.....	13
3.2) Parameters Selection.....	13
3.3) Material Flow.....	14
3.4) Temperature Distribution.....	16
4) Microstructural evolution during FSW of titanium alloys	18
4.1) Microstructure in WN, and TMAZ.....	18
4.2) TMAZ and HAZ (Deformation mechanism).....	20
4.3) Microstructural evolution in the WN, TMAZ, and HAZ.....	22
5) Mechanical Properties of FSW joints of titanium alloys	24
5.1) Tensile properties.....	25

Download English Version:

<https://daneshyari.com/en/article/7217417>

Download Persian Version:

<https://daneshyari.com/article/7217417>

[Daneshyari.com](https://daneshyari.com)