MATER PER TECHNOL JOIN XXX(XX) VXX-XX



Available online at www.sciencedirect.com





**Original Article** 

Efficiency of dissimilar friction welded 1045 medium carbon steel and 316L austenitic stainless steel joints

Gawhar Ibraheem Khidhir\*, Sherko A. Baban

Department of Mechanical and Mechatronics Engineering, Salahaddin University, Erbil, Iraq



## ARTICLE INFO

Article history: Received 29 October 2018 Accepted 7 January 2019 Available online xxx

Keywords: Friction welding AISI 1045 AISI 316L Tensile strength Hardness SEM

## ABSTRACT

This study investigated the effects of frictional welding parameters on the microstructure and mechanical properties of dissimilar steel materials, namely, AISI 1045 medium carbon steel and AISI 316L austenitic stainless steel. The welded joints were produced by changing the forging pressure while the friction pressure, friction time, forging time and rotational speed were kept constant to achieve a constant range of temperature (780–800°C). Experimental results showed that when the forging pressure increases, the hardness value of the weld interface increases whereas the tensile strength decreases. The hardness profiles also indicated that the welds exhibited higher hardness numbers than the two base metals. The highest weld joint efficiency obtained was 90% while the lowest was 63%. The joints failed in the thermo mechanical affected zone on the 316L austenite stainless steel side. Scanning electron microscopy attached with energy dispersive spectroscopy was used to analyse the fracture surface in the tensile test.

© 2019 Brazilian Metallurgical, Materials and Mining Association. Published by Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (http://

creativecommons org/licenses by c nd/4 0).

## Introduction

Iron-based alloys, including stainless steels with a significant chromium content of 12–30% chromium and 8–25% nickel, display characteristic resistance to both corrosion and high temperature [1]. The largest stainless-steel group produced and the most preferable are the austenitic stainless steel (ASS), due to their excellent mechanical properties and corrosion resistance [2,3]. ASSs have found a wide range of

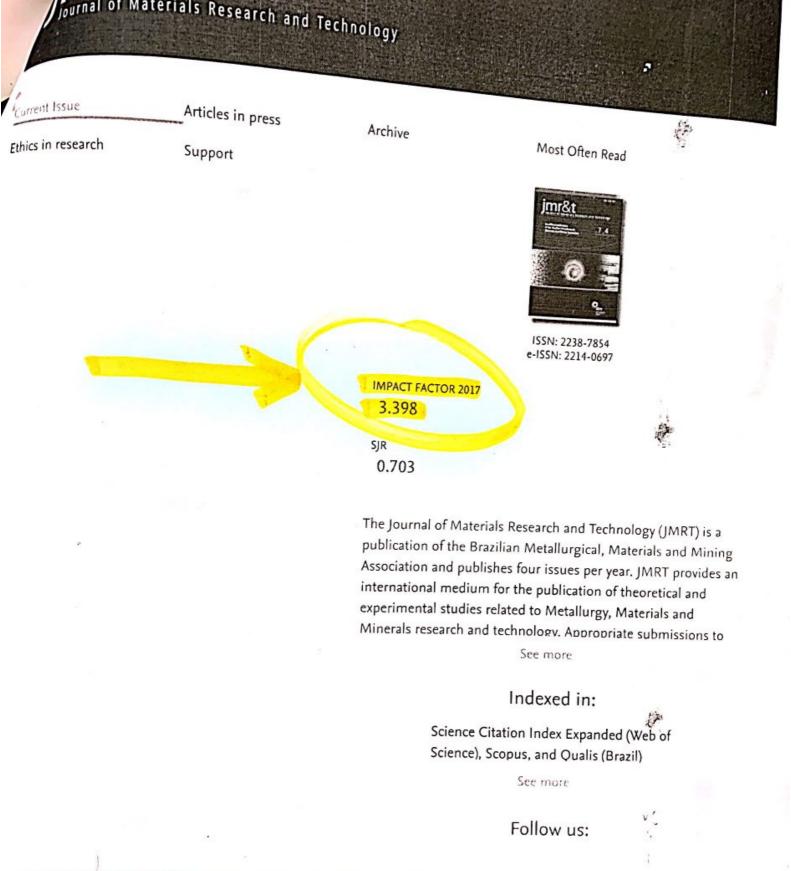
applications. For instance, they are extensively used in applications in which they are subjected to high temperatures, such as boilers, heat exchangers, and nuclear facilities. 4. The only way to increase the traction resistance of ASSs is through hardening by cold plastic deformation. In general, austenitic alloys are considered excessively weldable materials. The 316L ASS is a chromium-nickel-molybdenum alloy. As a modified form of AISI 316, it contains minimal carbon (about 0.03%) and has limited sensitivity to carbide precipitation. The addition of molybdenum (approximately 2–3%) improves pitting corrosion resistance [5]. Friction welding (FW) is a solid-state welding process, in which the relative rotation produces friction between the two parts and heat is released

E-mail: gawhar.eng@yahoo.com (G.I. Khidhir). https://doi.org/10.1016/j.jmrt.2019.01.010

2238-7854/© 2019 Brazilian Metallurgical, Materials and Mining Association. Published by Elsevier Editora Ltda. This is an excess article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Please cite this article in press as: Khidhir Gl, Baban SA. Efficiency of dissimilar friction welded 1045 medium carbon steel and 316L austenitic stainless steel joints. J Mater Res Technol. 2019. https://doi.org/10.1016/j.jmrt.2019.01.010

<sup>·</sup> Corresponding author.



Cookies policy

To improve our services and products, we use cookies (own or third parties authorized) to show advertising related to client preferences through the analyses of navigation customer behavior. Continuing navigation will be considered as acceptance of this use. You can change the settings or obtain more information by clicking .

Ok

http://www.jmrt.com.br/