J MATER RES TECHNOL 2019;xxx(xx):xxx–xxx

Available online at www.sciencedirect.com

jmr&t Journal of Materials Research and Technology

www.jmrt.com.br

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.

1. 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 [1]. 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

* Corresponding author.
E-mail: gawhar.eng@yahoo.com (G.I. Khidhir).

https://doi.org/10.1016/j.jmrt.2019.01.010

Please cite this article in press as: Khidhir GI, 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

ISSN: 2238-7854
e-ISSN: 2214-0697

IMPACT FACTOR 2017
3.398

SJR
0.703

The Journal of Materials Research and Technology (JMRT) is a publication of the Brazilian Metallurgical, Materials and Mining Association and publishes four issues per year. JMRT provides an international medium for the publication of theoretical and experimental studies related to Metallurgy, Materials and Minerals research and technology. Appropriate submissions to

See more

Indexed in:

Science Citation Index Expanded (Web of Science), Scopus, and Qualis (Brazil)

See more

Follow us: