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TECHNICAL ARTICLE

Microstructural Characterization and Mechanical Properties of Friction-Welded IN718 and SS410 Dissimilar Joint

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Abstract
Continuous drive friction welding studies on IN718 and SS410 dissimilar combination have been investigated. The influence of friction-welded parameters on microstructure and mechanical properties was dealt in detail. Six different joints were fabricated by varying rotational speed and friction pressure, by keeping forging pressure and friction time as constant. The microstructural study revealed the formation of different zones in the weld region of the dissimilar joint. Tensile and microhardness tests were conducted in order to examine the impact of process parameters of the joint and to define the ideal welding condition. The fractography images exposed the ductile fracture mode for all the samples. The friction-welded joint fabricated with the rotational speed of 1500 rpm and frictional pressure of 189 MPa yielded higher tensile strength and hardness.

Keywords Friction welding · Microstructure · Tensile strength · Hardness · IN718 · SS410

Introduction

Joining of disparate metals has increased significant consideration because of rapid development of new materials for various structural applications in the fields of aerospace, nuclear power plants and chemical industries. This demand has motivated to the exploration of joining IN718 (Inconel) alloy with martensitic steel of SS410. IN718 has high-strength and good corrosion-resistant nickel chromium material used at high temperature. IN718 alloy can be easily fabricated, along with good tensile, fatigue, creep, and rupture strength, and it is used in wide range of applications like gas turbine applications, aerospace components of rings, disks, shaft, casing and fasteners which are subjected to severe service conditions at high temperature [1]. However, the Inconel alloy has a major limitation of being expensive and it can be used as bimetallic joint with low-cost materials. Steels are one of the durable high-strength and low-cost structural materials. SS410 is the most commonly used martensitic stainless steel with high strength and toughness and having better corrosion resistance in the hardened condition [2].

Fusion welding of Inconel super alloy to martensitic stainless steel is thought to be significant issue because of variation in coefficient of thermal expansion, which may prompt microfissuring at the interface; large difference in hardness between the hard and soft zones and probable difference in material flow behaviors may lead to failure in service [3]. Solid-state welding is a potential solution to overcome these problems. Among the solid-state welding processes, friction welding and friction stir welding (FSW) are very well known advanced joining technique. In an instance of FSW, heaps of understanding needs to be there on the selection of proper tool material and it is limited to

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