TIG spot weld bonding of 409L ferritic stainless steel

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TIG spot weld bonding of 409L ferritic stainless steel

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Abstract

Tungsten inert gas (TIG) spot weld bonding is a hybrid joining process, which combines the conventional tungsten inert gas welding with adhesive bonding to achieve a better quality joint with superior joint performance than any single technique. The present research aims to study the effect of input process parameters i.e. welding current, weld time and gas flow rate on weld penetration, bead width and tensile shear strength of the weld bonds using design of experiment (DOE) approach. Further, some selected samples were characterized by optical microscopy and hardness testing. It was observed that weld time most significantly affect the weld performance followed by welding current and gas flow rate. The tensile results showed failure of weld bond in two ways namely interfacial failure and button pull out failure.

Keywords

Ferritic stainless steel; Weld bonding; Adhesive joining; Lap joints; Shear strength

1 Introduction

In the field of hybrid joining, weld bonding is an innovative and useful technique for metal joining in aerospace and automobile industry [1,2]. The main advantage of weld bonding over the spot welding is that it reduces the stress concentration at the weld spot resulting in improved weld performance in terms of tensile, fatigue strength and stiffness [3–8]. However, the interaction of welding heat with adhesive may result in serious issues due to gas generation and sometimes explosion of weld metal, yet the various welding process like laser beam welding (LBW), metal inert gas welding (MIG), friction stir welding (FSW), ultrasonic welding (USW), plasma arc welding (PAW) and resistance spot welding (RSW) [9–15] are mainly used for weld bonding. There are two approaches used for developing weld-bonds, named as flow in and flow