PRESENTED ON 19-07-2023 AT COMMISSION III IN THE 76TH ANNUAL ASSEMBLY OF INTERNATIONAL INSTITUTE OF WELDING HELD AT M/S MARINA SANDS CONVENTION CENTRE, SINGAPORE

Effect of Rotational Speed on Mechanical Properties and Microstructural Characteristics of Rotary Friction Welded Low Alloy Steel Tube Joints

R. Selvaraj[a*], K. Shanmugam[b], P. Selvaraj[c], Prasanna Nagasai Bellamkonda[d], Balasubramanian Visvalingam[d]

[a,b,d]Centre for Materials Joining and Research (CEMAJOR),
Department of Manufacturing Engineering,
Annamalai University, Annamalainagar
[c]Department of Mechanical Engineering,
MAM College of Engineering and Technology,
Tiruchirappalli, India.

Abstract

SA213 T12 and SA213 F12 low alloy steel (LAS) tubes have been successfully welded using the rotary friction welding (RFW) process. The effect of the rotational speed on the microstructure and the mechanical properties of the joints has been studied. With increasing rotational speed, the tensile strength first increases to a certain extent and then decreases. Weld samples with the highest tensile strength (488 MPa) and maximum elongation (40.01%) are achieved at 60 rps. Using higher rotational speed (68 rpm) increased grain size in the heat-affected zone (HAZ). The samples joined at different rotational speeds failed in the HAZ. The hardness profile showed that the interface (IF) has a higher hardness than the other zones and base metal. The highest hardness of welded joints (198 HV) was observed in the 60 rps sample. The phase transformation of bainite and acicular ferrite at the weld interface was attributed to the high strength of the weld joint. Weld joint defects are observed at 55 rpm and 65 rpm, where high heat inputs and impurities at the weld interface cause incomplete metallurgical bonding, resulting in defects in the weld seam.

Keywords: Rotary friction welding, Low alloy steel, Rotational speed, Microstructure, Mechanical properties.