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The optimum combination of tool rotation rate and traveling speed for obtaining the preferable corrosion behavior and mechanical properties of friction stir welded AA5052 aluminum alloy

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Abstract

The effect of the welding tool rotation rate (ω) and travelling speed (υ) on the corrosion and mechanical properties of the FSWed AA5052 are investigated via Potentiodynamic polarization, open circuit potential (OCP) monitoring, test of the susceptibility to intergranular corrosion, weight loss, tension and micro–hardness tests. Optical microscope and Scanning Electron Microscopy (SEM) were employed for studying the morphology and analyzing the intergranular attacks. It was found that by increasing υ up to 200 mm/min at a constant ω = 400 rpm, the microstructural evolution is in a way that the finer grain structure intensifies the anodic reactivity of the Stir Zone (SZ). At faster υ (about 250 mm/min), further grain reinforcement resulted in a predominant effect of passive film formation and thereby a high corrosion resistant SZ with an appropriate mechanical characteristics was attained. It was found that the optimum corrosion and mechanical properties of the weld zones were obtained at (ω = 400 rpm, υ = 250 mm/min). At the next level, the combinations of (400, 50) and then (1600, 50) are introduced as the preferential welding conditions, respectively.