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Friction stir lap welding of stainless steel and plain carbon steel to enhance corrosion properties

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Abstract

Friction stir lap welding -a precursor to the friction stir cladding- stainless steel on plain carbon steel was attempted. Refined microstructure with fully recrystallized austenitic grains with ~3 μm grain size and intermixing with base steel sample resulted in defect free lap weld. The pin affected region of the base carbon steel resulted in grain refinement from initial grain size of 8 μm to 2 μm. The microhardness values across the joint line showed stable values of ~250 HV on the stainless steel side and ~200 HV on the carbon steel side. Lap shear tests showed consistent load bearing capacity of ~7 kN for the stainless steel-carbon steel joint. The weld between stainless steel and carbon steel showed 100% joint efficiency with similar yield strength of ~440 MPa as the base steel sample and with an increase in ultimate tensile strength to ~600 MPa as compared to ~500 MPa for the base steel sample. The failure of clad tensile samples occurred in the base