Effect of welding parameters on the microstructure and mechanical properties of fraction stir welds of 70%Cu-30%Zn alloy

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Abstract

Friction stir welding (FWS) is a relatively new method that uses a non-consumable rotating tool in order to create fractional heat and plastic deformation in the weld zone. It causes that the joint formation of the material is in the solid state. In the present work, the effect of rotation speed and feed speed of the FWS tool on the microstructure and mechanical properties of the metal in the weld zone on a 70%Cu-30%Zn alloy was investigated. The rotation speed and feed speed of the tool was respectively in the range of 600-950 rpm and 150-300 mm/min. Microstructural change form the weld zone to the unaffected base metal were examined with optical microscopy and SEM.
The investigation of the microstructure in the welded area shows very fine grains with some deformed grains in the stirred zone (SZ) and some coarser grains in the thermo-mechanically affected zone (TMAZ). The results show that in all welding conditions the hardness in the SZ is greatly more than the base metal. Also by increasing feed speed and decreasing rotation speed the hardness in the SZ has been increased. Formation of fine grains in the SZ was the main factor of the hardness increase which has a direct relationship with the heat input.
The results also show that the tensile strength of the welded zone is more than the base metal.

Keywords: fraction stir welding (FSW), microstructure, mechanical properties, 70%Cu-30%Zn alloy