Abstract

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Microstructural refining during friction stir welding of SAF 2205 duplex stainless steel

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Abstract

Friction stir welding (FSW) was conducted on a SAF 2205 duplex stainless steel at welding speed of 50 mm/min and rotational speed of 400 rpm. Characterization of evolved material was studied using electron microscopy equipped with electron back scattered diffraction (EBSD) system. The results indicated that the severe plastic deformation and the heat generated during the FSW process developed a very fine microstructure in the stir zone (SZ) of the weldment. It was found that the finest grains with average grain size of 1 µm were formed in the bottom of the SZ where the material was more likely to receive the lowest temperature in both constituent phases of ferrite and austenite. The presence of such severe deformation along with the elevated temperature during the welding procedure inside the SZ activates the occurrence of continuous dynamic recrystallization mechanism throughout the material which seems to be responsible for grain refinement. Moreover, Texture analysis showed that the rotating tool broke the initial microstructure, modified the pre-existence rolling texture of the starting material, and introduced simple shear texture components into the SZ. This kind of modification mainly took place by activation of the {111}<110> and {110}<111> easy slip systems of austenite and ferrite, respectively.

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