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Ultra-Fine Grained Structure Formation through Deformation Induced Ferrite Formation in Duplex Low-Density Steel

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Abstract

In the present study, the applicability of compressive straining for grain refinement in a duplex low-density steel was evaluated. The microstructure of the steel deformed at 1000 °C under strain rate of 1 s^{-1} was characterized by the presence of micro-shear bands formed as a result of flow localization along the prior austenite grain boundaries. Electron backscattered diffraction analysis indicated that the shear bands were the preferred sites to trigger the dynamic recrystallization of austenite and the deformation induced ferrite transformation. As a result, a trimodal microstructure consisted of coarse austenite grains (~10 µm), refined austenite grains (~2 µm) and a network of ultra-fine ferrite grains (~0.3 µm) was achieved. Consequently, a superior combination of strength and ductility was obtained as a result of considerable grain refinement.

Keywords: *Trimodal grain size; Duplex low-density steel; Deformation induced ferrite transformation; Dynamic Recrystallization; Mechanical Properties.*