

Design and deformation behavior of high strength Fe–Mn–Al–Cr–C duplex steel

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Abstract: The influence of cold rolling reduction on microstructures and mechanical properties at room temperature of the duplex Fe–28Mn–7Al–5Cr–0.3C steel was investigated. In the Fe–28Mn–7Al alloy system, the duplex microstructure was obtained by lowering the carbon content to about 0.3 wt.%. The steel was austenite-ferritic with a low to moderate stacking fault energy. Two thermomechanical cycles were performed, which included cold rolling/annealing at 1100 °C, and cold rolling/annealing at 1100 °C/cold rolling/annealing at 1000 °C. The effects produced by cold rolling on the duplex steel were grain refinement and different strain-induced marks within the ferrite and austenite phases. They were easily observed within the austenite phase at a relatively smaller reduction than within the ferrite phase. Mechanical twinning plays a dominant role within the austenite phase during deformation at room temperature, resulting in extreme mechanical properties. No edge or longitudinal cracks were observed during cold rolling of the duplex steel.

Keywords : Duplex steel, Cold rolling, Annealing, Microstructures, Austenite, Ferrite