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Microstructural evolution and recrystallization behavior of cold rolled austenitic stainless steel with dual phase microstructure during isothermal annealing

G.S. Sun^a, L.X. Du^{a,*}, J. Hu^{a,*}, R.D.K. Misra^b

^aThe State Key Laboratory of Rolling and Automation Northeastern University, Shenyang 110819, China

^bLaboratory for Excellence in Advanced Steel Research, Department of Metallurgical, Materials and Biomedical Engineering, University of Texas at El Paso, 500W. University Avenue, El Paso, TX 79968, USA.

Abstract

In the present study, the concept of phase reversion developed by Misra's group (references 2, 4,14-16,25) was adopted to process a 304 austenitic stainless steel and explore the microstructural evolution, recrystallization behavior, and relate to mechanical properties. Dual phase structure, including strain-induced martensite and hardened austenite, was obtained by two-stage cold rolling at room temperature. Subsequently, the reversion of martensite to austenite during annealing was carried out and studied in terms of microstructural evolution and recrystallization behavior using a combination of X-ray diffraction, optical microscopy, and electron backscatter diffraction techniques. The Vickers hardness and tensile properties of samples annealed at different conditions were also determined. The X-ray diffraction study indicated that reversion of martensite occurred rapidly at temperatures greater than 750°C because of the change in the reversion mechanism to shear-type reversion. The variation in hardness of annealed samples at 750-850°C exhibited three distinct stages and corresponded to different process. Depending on the grain size and annealing conditions, different combination of yield strength (466-1758 MPa) and ductility (6.6-57.5%) were obtained.

Keywords: Austenitic stainless steel; thermo-mechanical processing; reversion; recrystallization; texture.

*Corresponding authors.

E-mail addresses: dulx@ral.neu.edu.cn (L.X. Du), hujun@ral.neu.edu.cn (J. Hu).

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