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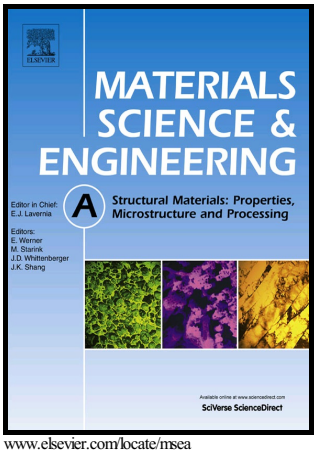
Mohammad Moallemi, Abbas Zarei-Hanzaki, Hojjat Samaei Baghbadorani



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Evolution of microstructure and mechanical properties in a cold deformed nitrogen bearing TRIP-assisted duplex stainless steel after reversion annealing

Mohammad Moallemi[a,b], Abbas Zarei-Hanzaki[a*], Hojjat Samaei Baghbadorani[c]

[a]The Complex Laboratory of Hot Deformation & Thermomechanical Processing of High-Performance Engineering Materials, School of Metallurgy and Materials Engineering, College of Engineering, University of Tehran, Tehran, Iran.

bGraduate Institute of Ferrous Technology, Pohang University of Science and Technology, Pohang, South Korea

[c]Department of Materials Engineering, Isfahan University of Technology, Isfahan, Iran.

[*]Corresponding author. Tel.: +98 21 61114167; fax: +98 21 88006076; zareih@ut.ac.ir

Abstract

The effects of cold working and subsequent reversion annealing treatment were studied on the microstructural evolution and mechanical properties enhancement of a new cost effective nitrogen bearing duplex stainless steel (DSS). The cold rolling-reversion annealing cycles were carried out at various temperatures in the range of 1023-1373 K (750 °C-1100 °C). The mechanical properties of processed materials were investigated by the tensile testing method at room temperature. A series of characterization methods including X-ray diffraction, ferritescope measurement, scanning electron microscopy and dilatometry examination were applied to phase analysis and interpreting the martensite to austenite reversion mechanisms. The results showed that the ferrite would recover and recrystallize prior to any austenite reversion transformation. The non-diffusional reaction was recognized as the predominant reversion mechanism in the entire range of annealing. The diffusional transformation was also activated during isothermal annealing, but as the secondary reversion mechanism. The mechanical behavior evolution of specimens subjected to the partial, incomplete and complete reversion transformation showed that the specimen partially reversed at 650 °C/180 s reveals a low work hardening capability owing to diffusional reversed stable austenitic phase as well as the high fraction of ά-martensite in the microstructure. In addition, comparing work hardening behavior of incomplete reversed specimen (annealed at 800 °C/180 s) and completely reversed fully recrystallized one (annealed at 1050 °C/180 s) indicated that the former possesses a higher potential to be strengthened by strain induced martensite formation than latter, due to the existence of less stable austenite phase. However, the work hardening capacity and plasticity of alloy continually increased by raising the annealing temperature.