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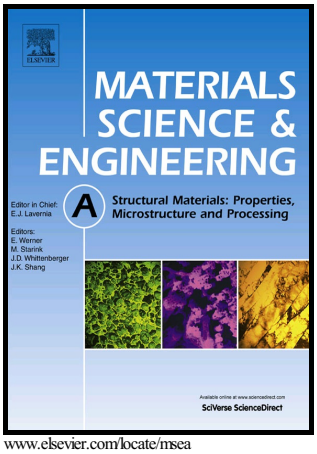

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Heterogeneous nano/ultrafine-grained medium Mn austenitic stainless steel with high strength and ductility

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Abstract

The objective of the present study is to obtain austenitic stainless steel with super-high yield strength and good ductility through a heterogeneous nano/ultrafine-grained design, fabricated by the reverse transformation of strain-induced martensite and the recrystallization of deformed austenite using two cold-rolling and annealing processes. The second cold-rolling and annealing process was performed on a bimodal microstructure obtained by the first cold-rolling and annealing process on the original microstructure. The bimodal microstructure consists of nanometer grains and a certain quantity of micrometer grains distributed in the lamella. The results of this study demonstrate that after the second process, both the coarse-grain and fine-grain areas of the bimodal microstructure formed their own finer bimodal microstructure and the lamella of the grain distribution became narrower. The yield strength (1221 MPa) and tensile strength (1376 MPa) of the heterogeneous nano/ultrafine-grained steel were greatly improved in the situation where the total elongation still remained at the high level of 45.3%. The fine-grained strengthening, back-stress strengthening, twinning induced plasticity (TWIP) effect and transformation induced plasticity (TRIP) effect were produced by the heterogeneous nano/ultrafine-grained microstructure during tensile possess synthetically contributed to the high strength and ductility.

Keywords: Austenitic stainless steel; Heterogeneous nano/ultrafine-grained; Deformation mechanism;