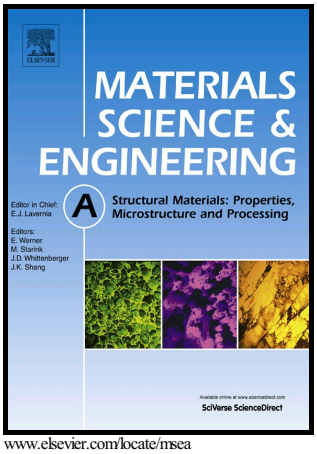

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PII: S0921-5093(18)30354-X
DOI: https://doi.org/10.1016/j.msea.2018.03.018
Reference: MSA36211

To appear in: *Materials Science & Engineering A*

Received date: 7 September 2017
Revised date: 4 March 2018
Accepted date: 5 March 2018

Cite this article as: S.V. Dobatkin, W Skrotzki, O.V. Rybalchenko, V.F. Terent'ev, A.N. Belyakov, D.V. Prosvirnin, G.I. Raab and E.V. Zolotarev, STRUCTURAL CHANGES IN METASTABLE AUSTENITIC STEEL DURING EQUAL CHANNEL ANGULAR PRESSING AND SUBSEQUENT CYCLIC DEFORMATION, *Materials Science & Engineering A*, https://doi.org/10.1016/j.msea.2018.03.018

STRUCTURAL CHANGES IN METASTABLE AUSTENITIC STEEL DURING EQUAL CHANNEL ANGULAR PRESSING AND SUBSEQUENT CYCLIC DEFORMATION

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Abstract

The paper reports a substantial improvement of the static and cyclic strength of a Cr-Ni-Ti austenitic stainless steel nanostructured by equal channel angular pressing (ECAP). After ECAP at room temperature or 673 K, the mean grain size decreased from 14 μm to 430 nm or 940 nm, respectively; corresponding ultimate tensile strength increased from 610 MPa to 1230 MPa or 940 MPa, and the fatigue limit increased from 275 MPa to 375 MPa or 475 MPa. These enhanced strength properties result from the grain refinement assisted by the intensive twinning in the austenite during ECAP at room temperature and 673 K as well as partial martensitic transformation during ECAP at room temperature. Moreover, the partial martensitic transformation and an increase in the fraction of high angle grain boundaries during subsequent high-cycle fatigue tests were particularly favorable for the improvement of fatigue properties.

Keywords: Stainless steel; equal channel angular pressing; ultra-fine grained structure; deformation-induced martensite; twinning; mechanical and fatigue properties

1. Introduction