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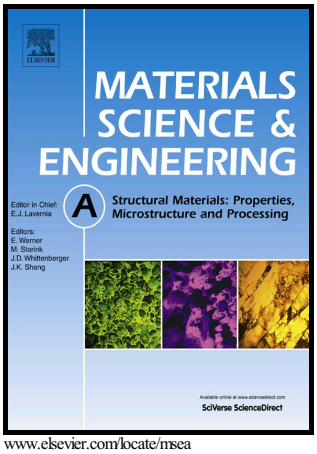

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PII: S0921-5093(18)30513-6
DOI: https://doi.org/10.1016/j.msea.2018.04.014
Reference: MSA36334

To appear in: *Materials Science & Engineering A*

Received date: 29 January 2018
Accepted date: 4 April 2018

Cite this article as: Hamed Shahmir, Mahmoud Nili-Ahmadabadi, Ahad Shafiee, Mariusz Andrzejczuk, Małgorzata Lewandowska and Terence G. Langdon, Effect of Ti on phase stability and strengthening mechanisms of a nanocrystalline CoCrFeMnNi high-entropy alloy, *Materials Science & Engineering A,* https://doi.org/10.1016/j.msea.2018.04.014

Effect of Ti on phase stability and strengthening mechanisms of a nanocrystalline CoCrFeMnNi high-entropy alloy

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Abstract

A $CoCrFeNiMnTi_{0.1}$ high-entropy alloy (HEA) was processed by high-pressure torsion (HPT) followed by post-deformation annealing (PDA) at 200-900 °C. Microstructural evaluations revealed that the initial and HPT-processed microstructures consisted of a single *fcc* phase and there was no evidence for decomposition during severe plastic deformation. However, PDA at temperatures below 900 °C promoted the formation of a multi-phase microstructure containing new precipitates and significant grain coarsening occurred after PDA at >800 °C due to a dissolution of the precipitates. PDA at 800 °C for 60 min led to very good mechanical properties with an ultimate tensile strength (UTS) and elongation to failure of >1000 MPa and ~40%, respectively. The results demonstrate that the minor addition of Ti to the CoCrFeNiMn alloy has no direct effect on the strengthening mechanisms but nevertheless this addition significantly increases the thermal stability of the precipitates and these precipitates are effective in minimizing grain coarsening. Therefore, the Ti addition plays an important role in strengthening the HEA.

Keywords: CoCrFeNiMnTi; High-entropy alloy; High-pressure torsion; Post-deformation annealing; Severe plastic deformation.