Nanocrystalline high entropy $Cr_5CoFeNiMn$ alloys with carbon additions and their mechanical properties

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Cantor type high entropy alloys with addition of carbon (0, 0.5 and 2 at.%) were processed by high pressure torsion (HPT) under 6.5 GPa by three turns at room temperature. The microstructures and mechanical properties of samples before and after HPT were investigated, upon that crystallite size and dislocation density were evaluated using a Convolutional Multiple Whole profile fitting, developed by Prof. T. Ungar. In all alloys, HPT deformations leads to dramatic grain size refinement down to nanoscale range. High dislocation density appeared in all nano-grained specimens after HPT. In the alloy with 2 at. %C, carbon atoms segregated to the boundaries of nanocrystalline grains. The yield strength of HPT processed samples increased significantly and reached 1788 MPa, 2042 MPa and 2333 MPa, respectively, in alloys with 0, 0.5 and 2 at.% C, but uniform elongation was significantly reduced. Hardening and deformation mechanisms in nanocrystalline high entropy alloys are discussed based on the microstructure analysis [1].

Keywords: High entropy alloy, nanocrystalline, high pressure torsion, strength and ductility, stacking fault energy

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References:

[1] Y. Lu, A. Mazilkin, T. Boll, N. Stepanov, S. Zherebtzov, G. Salishchev, É. Ódor, T. Ungar, E. Lavernia, H. Hahn, Yu. Ivanisenko, *Influence of carbon on the mechanical behavior and microstructure evolution of CoCrFeMnNi processed by high pressure torsion,* Materialia, 16, 2021,101059.