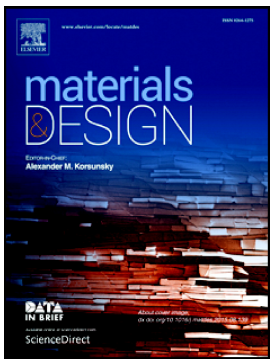

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PII:	S0264-1275(18)30578-1
DOI:	doi:10.1016/j.matdes.2018.07.046
Reference:	JMADE 7279
To appear in:	*Materials & Design*
Received date:	23 May 2018
Revised date:	8 July 2018
Accepted date:	23 July 2018

Please cite this article as: Rani Agarwal, Reshma Sonkusare, Saumya R. Jha, N.P. Gurao, Krishanu Biswas, Niraj Nayan , Understanding the deformation behavior of CoCuFeMnNi high entropy alloy by investigating mechanical properties of binary ternary and quaternary alloy subsets. Jmade (2018), doi:10.1016/j.matdes.2018.07.046

Understanding the deformation behavior of CoCuFeMnNi high entropy alloy by investigating mechanical properties of binary ternary and quaternary alloy subsets

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Abstract

Combinatorial approach has been employed to understand the deformation micro-mechanisms and strength evolution of FCC equiatomic CoCuFeMnNi high entropy alloy using equimolar subset alloys, judiciously unearthed by thermodynamic modelling using CALPHAD. A series of mechanical tests indicate absence of one-to-one correlation between entropy of mixing and mechanical properties for the alloys. Optimum combination of strength and ductility was observed in ternary equiatomic FeMnNi alloy, although quinary alloy exhibits the highest strength among all the four alloys. The deformation of all the alloys is dominated by octahedral slip as well as partial slip with the absence of deformation twinning. TEM investigation on the deformed samples reveals profuse dislocation activity. Strain rate sensitivity in the range of 0.005-0.008 and activation volume of 100-150 b^3 indicate cross slip as the dominant operative mechanism for all the alloys. Nevertheless, quinary CoCuFeMnNi HEA manifests unique behavior by showing increase in strength even after long term annealing at 1273 K for 7 days.