

# Effects of manganese addition on pressure-induced intrinsic stacking fault and phase transition in CoCrFeMnNi high entropy alloys

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The pressure-induced phase transition in CoCrFeNi and CoCrFeMnNi at ambient temperature were investigated using angle-dispersive X-ray diffraction (ADXRD) with pressure up to around 24.0(2) and 19.4(2) GPa, respectively. Using PeakFit software to de-convolve the obtained XRD patterns, both of CoCrFeNi and CoCrFeMnNi were found to consist of two face-centered cubic (fcc) regions with different lattice constants at ambient pressure, which had been conceived to arise primarily from the cellular growth of alloy during solidification. For loading run, *in-situ* ADXRD measurements revealed no evidence of structural transformation in CoCrFeNi up to the highest pressure applied (24.0(2) GPa). In contrast, adding manganese to CoCrFeNi evidently resulted in strong effects on the lattice distortion, stacking fault energy and formation of external pressure-induced intrinsic stacking fault (ISF) in the fcc-structured CoCrFeMnNi HEA, wherein the ISF began to appear at 1.7(1) GPa and sustained to 19.4(2) GPa. Moreover, in the loading run of *in-situ* ADXRD measurements as Figure 1, a fcc to hexagonal close-packed (hcp) structural phase transition was found to emerge at around 7.0(1) GPa in CoCrFeMnNi. The pressure dependence of lattice constants and volume compression yielded that the zero-pressure isothermal bulk moduli and the normalized ratio  $c/a$  are 187(4) GPa and 1.636(1) for the resultant hcp phase of CoCrFeMnNi, respectively. By examining the correlation between the diffraction intensity of ISF, it is suggestive that the existence of ISF could have disrupted the crystal lattice and triggered the sluggish fcc-to-hcp phase transition observed at around 7.0(1) GPa. Our results apparently provide some new insights into the composition design

and, more importantly, the high-pressure phase transition as well as plastic deformation mechanism in CoCrFeMnNi HEA.

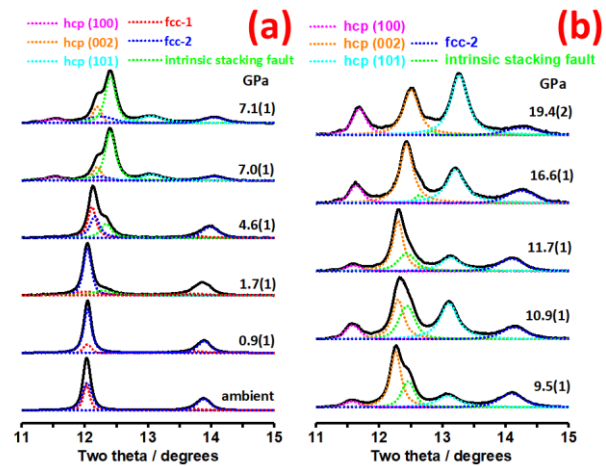


Figure 1. Representative ADXRD patterns of CoCrFeMnNi at (a) ambient to 7.1(1) GPa (b) 9.5(1) to 19.4(2) GPa, elevated pressures.

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