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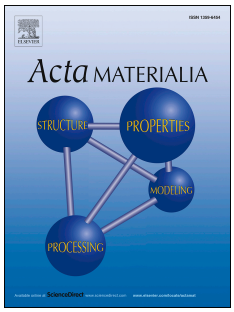

Elastic properties of $Al_xCrMnFeCoNi$ ($0 \le x \le 5$) high-entropy alloys from *ab initio* theory

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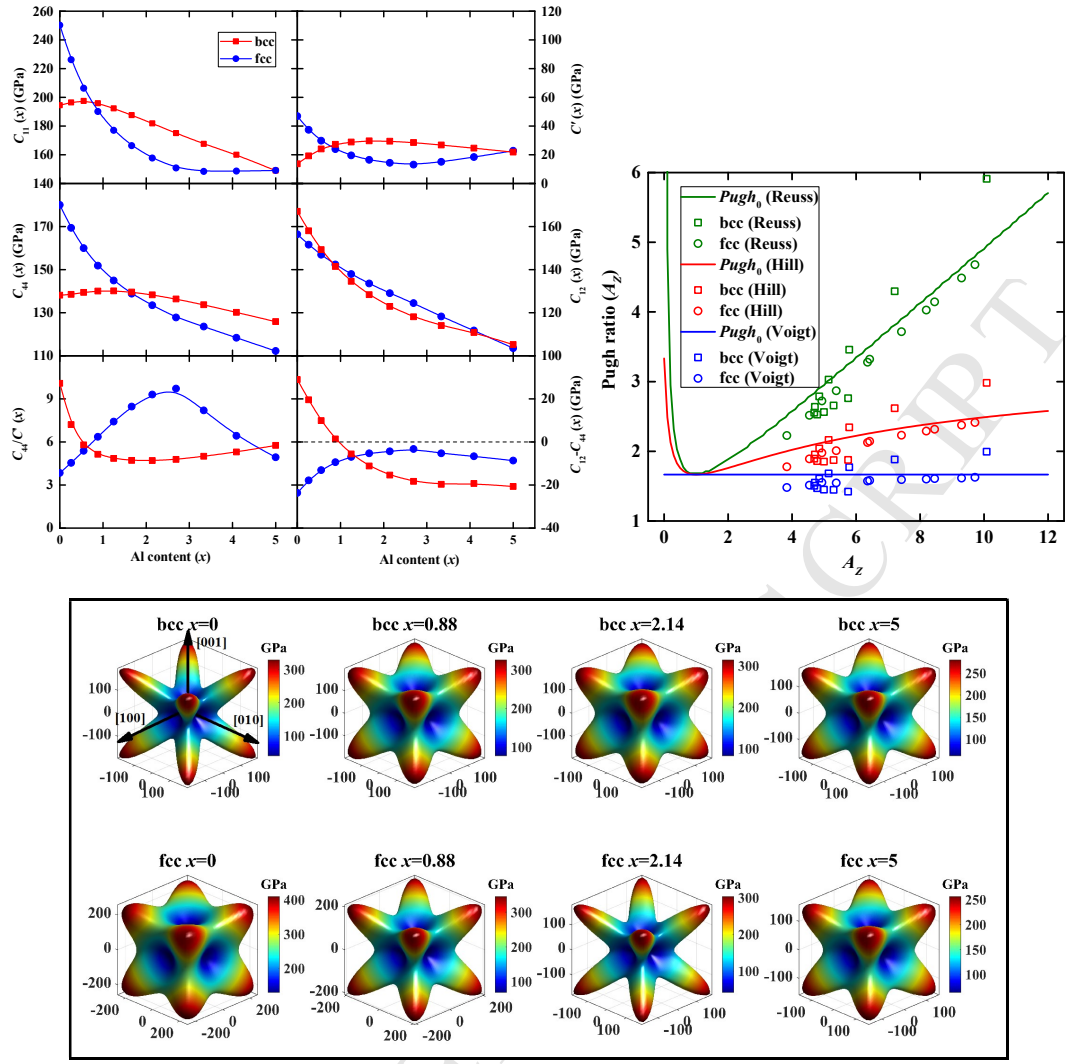

The elastic properties (left upper panel) of paramagnetic bcc and fcc Al$_x$CrMnFeCoNi ($0 \leq x \leq 5$) high-entropy alloys have been systematically investigated by using the first-principles alloy theory method. Despite the calculated lattice constants for both phases increase linearly with increasing Al content, the theoretical elastic properties and Zener anisotropy possess complex composition dependences. Pugh criterion (*Pugh*$_0$) (right upper panel) are shown as a function of Zener anisotropy A_Z in the Voigt, Reuss and Hill averaging methods. The brittle/ductile transitions formulated in terms of the Cauchy pressure and the Pugh ratio become consistent only when the strong elastic anisotropy is considered. Moreover, Three-dimensional surface plots of the single-crystal Young's moduli (lower panel) for Al$_x$CrMnFeCoNi alloys indicate that the largest (smallest) value of *E* is along the <111> (<100>) direction in both phases.