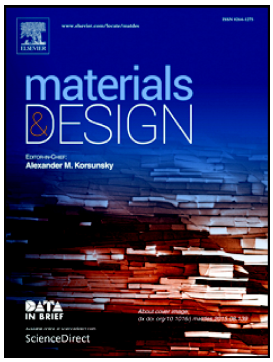

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Nanoindentation testing as a powerful screening tool for assessing phase stability of nanocrystalline high-entropy alloys

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Abstract

The equiatomic high-entropy alloy (HEA), CrMnFeCoNi, has recently been shown to be microstructurally unstable, resulting in a multi-phase microstructure after intermediate-temperature annealing treatments. The decomposition occurs rapidly in the nanocrystalline (NC) state and after longer annealing times in coarse-grained states. To characterize the mechanical properties of differently annealed NC states containing multiple phases, nanoindentation was used. The results revealed besides drastic changes in hardness, also for the first time significant changes in the Young's modulus and strain rate sensitivity. Nanoindentation of NC HEAs is, therefore, a useful complementary screening tool with high potential as a high throughput approach to detect phase decomposition, which can also be used to qualitatively predict the long-term stability of single-phase HEAs.

Keywords: Nanoindentation; high-entropy alloys; severe plastic deformation; high-pressure torsion; phase stability; nanocrystalline