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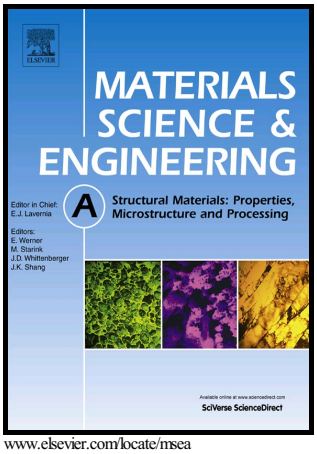

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Precipitation-hardened high entropy alloys with excellent tensile properties

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Abstract

To achieve balance of high strength and high ductility remains a difficult problem for metallic materials, especially in as-cast alloys. We combined the design concepts of high-entropy alloys (HEAs) and Ni-based superalloys, and designed two new $Ni_{48.7}Co_{17.5}Cr_{10}Fe_{9.3}Al_{7.5}Ti_7$ and $Ni_{47.7}Co_{17.5}Cr_{10}Fe_{9.3}Al_{7.5}Ti_7Mo_1$ (at%) precipitation-hardened cast HEAs. Both two alloys have face-centered cubic (fcc) high-entropy matrix + nano γ' (Ni_3(Al,Ti)-type) particles structure. Fine γ' particles with the average diameter less than 70 nm and 130 nm are homogeneously distributed in dendritic regions and inter-dendritic regions, respectively. The yield strength of $Ni_{47.7}Co_{17.5}Cr_{10}Fe_{9.3}Al_{7.5}Ti_7Mo_1$ alloy is 899 MPa, ultimate tensile strength is 1064 MPa and elongation is 14.3%. The strengthening theory is discussed. Attributable to substantial γ' precipitates, shearing strengthening mechanism plays an important role. Fracture is caused by micron-sized eutectic γ' phases that lead to stress concentration.

Keywords： High-entropy alloy, Crystal structure, Precipitation, High strength, High ductility