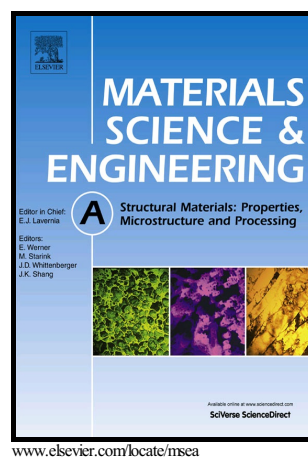


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High-temperature high-entropy alloys $\text{Al}_x\text{Co}_{15}\text{Cr}_{15}\text{Ni}_{70-x}$ based on the Al-Ni binary system

Dajin Liu^a, Pengfei Yu^a, Gong Li^{*,a}, P.K. Liaw^b, Riping Liu^a

^a State Key Laboratory of Metastable Materials Science and Technology, Yanshan University, Qinhuangdao, 066004, PR China

^b The University of Tennessee, TN, 37919, USA

ABSTRACT

To find high-temperature high-entropy alloys, a series of quaternary non-equimolar $\text{Al}_x\text{Co}_{15}\text{Cr}_{15}\text{Ni}_{70-x}$ (x in atomic ratio, $0 \leq x \leq 35$) alloys was designed, based on the Al-Ni binary system and prepared by arc-melting. The crystal structure, microstructure, and compressive properties of these alloys at both room and high temperatures were characterized. This $\text{Al}_x\text{Co}_{15}\text{Cr}_{15}\text{Ni}_{70-x}$ system showed a lattice structure transition from face-centered cubic (FCC) to body-centered cubic (BCC), as the Al content was increased. In the Al content range of 12.5 at.% to 19.3 at.%, the L_{12} structured γ' phase formed and strengthened of the alloys greatly at both room and elevated temperatures. The alloy with an Al content of 19.3 at.% has lamellar eutectic structure composed of γ' and B2 phases. Due to the high γ' phase fraction of 70 vol.%, this alloy has a compressive yield strength of 924 MPa and a fracture strain of 29% at room temperature as well as good yield strength at high temperatures. Due to its high Al content, this alloy has a density of 7.25 g/cm³, 20% lower than that of the Inconel 718 alloy. At 1, 123 K, its specific yield strength is about twice that of the Inconel 718.

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