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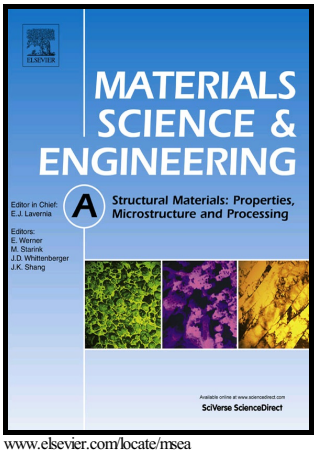

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High-temperature high-entropy alloys $Al_xCo_{15}Cr_{15}Ni_{70-x}$ based on the Al-Ni binary system

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 $Al_xCo_{15}Cr_{15}Ni_{70-x}$ (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 $Al_xCo_{15}Cr_{15}Ni_{70-x}$ 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 $L1_2$ 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/cm^3, 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.