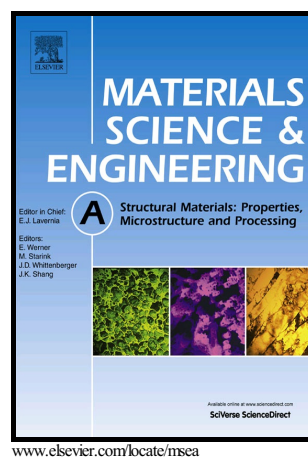


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NbTaV-(Ti,W) Refractory High-entropy Alloys: Experiments and Modeling

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Abstract

This study reports the design and development of ductile and strong refractory single-phase high-entropy alloys (HEAs) for high temperature applications, based on NbTaV with addition of Ti and W. Assisted by CALPHAD modeling, a single body-centered cubic solid solution phase was experimentally confirmed in the as-cast ingots using X-ray diffraction and scanning electron microscopy. The observed element segregation in each alloy qualitatively agrees with CALPHAD prediction. The Vickers microhardnesses (and yielding strengths) of the alloys are about 3 (and 3.5-4.4) times that those estimated from the rule of mixture. While NbTaTiVW shows an impressive yielding strength of 1,420 MPa with fracture strain of 20%, NbTaTiV exhibits exceptional compressive ductility at room temperature.

Keywords: high-entropy alloys; refractory; single-phase; design; ductile

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