Melting and Solidification Behaviors in High Entropy Alloys

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A new class of structural and functional materials, labeled high-entropy alloys (HEAs), was developed. High entropy alloys (HEAs) were recognized as the multi-component alloys whose number of the constituent elements were at and above 5 and composition was same or similar to the equiatomic for the increase in the mixing entropy of the alloys. In HEAs, the increase in the mixing enthalpy was considered to be effective to stabilize the solid solution phase. The main route for the fabrication of the bulk specimens in HEAs was the casting process with melting and crystallization of the thermal melt. The crystallization behavior of the thermal melt including the nucleation and the crystal growth was also the important factor for the formation of solid solution in HEAs. The characteristics of the crystallization behavior of the thermal melt in HEAs was discussed in the present study.
HEAs can be classified some groups based on the taxonomy of HEAs and multicomponent alloys, where HEAs can grouped based on the main constituent element and the relationship between the main constituent elements and the position of periodic table. 3d-transition metal type high entropy alloys (3d-HEAs) were mainly constructed with the 3d-transition metal elements of Cr, Mn, Fe, Co, Ni, Cu and Al elements. The main constituent elements of refractory high entropy alloys (RHEAs) and HEAs for metallic biomaterials (bio-HEAs) were 4 (Ti, Zr, Hf), 5 (V, Nb, Ta), and 6 (Cr, Mo, W) group elements. HE Brasses and HE Bronzes were mainly constructed by Cu, Zn, Sn and Al elements. The crystal growth behavior during the solidification of thermal melt in 3d-HEAs, RHEAs, bio-HEAs, HE Bronzes and HE Brasses were discussed for clarifying the general tendency of the crystal growth behavior in HEAs.

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