Thermal stability and non-isothermal crystallization kinetics of Ti41.5Cu42.5Ni7.5Zr2.5Hf5Si1 bulk metallic glass

In this research, an investigation has been carried out to determine the non-isothermal crystallization kinetics of Ti41.5Cu42.5Ni7.5Zr2.5Hf5Si1 bulk metallic glass prepared via copper mold casting. X-ray diffraction (XRD), energy dispersive spectroscopy (EDS), differential thermal analysis (DTA) and differential scanning calorimetry (DSC) were used to determine its characterization and non-isothermal crystallization kinetics. The DSC curves revealed three stages of the crystallization. The microstructure evolution through annealing at three-stage crystallization of the bulk glassy alloy was characterized. The apparent activation energies for the first exothermic crystallization peak were calculated as 281.33 and 279.11 kJ/mol using Kissinger and Ozawa equations, respectively. The nucleation and growth mechanisms were determined by the local Avrami exponent at heating rates ranging from 5 to 80 K/min using Jhonson–Mehl–Avrami–Kolomogrov (JMAK) method. The local Avrami exponent gradually decreases as the crystallization proceeds implying that the nucleation rate decreases. Nucleation and growth activation energies were estimated by Ozawa–Flynn–Wall (OFW) equation.

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