Crystallization of Cu60Ti20Zr20 metallic glass with and without pressure - DTU Orbit (28/12/2018)

Crystallization of Cu60Ti20Zr20 metallic glass with and without pressure

Structural stability of a Cu60Ti20Zr20 metallic glass under-pressure up to 4.5 GPa was investigated by x-ray diffraction. The sample exhibited a supercooled liquid region of 33 K and a ratio of the glass-transition temperature to the liquidus temperature of 0.63. The glass crystallized in two-step transformation processes in the pressure range of 0-4.5 GPa; the first was a primary reaction to form a Cu51Zr14-type structure crystalline phase with a spacing group P6/m (175) and lattice parameters a = 11.235 Å and c = 8.271 Å, and then the residual amorphous phase crystallized into a MgZn2-type structure crystalline phase with a spacing group P6(3)/mmc (194) and lattice parameters a = 5.105 Å and c = 8.231 Å. Both crystallization temperatures increased with pressure having a slope of 19 K/GPa. The increase of the first crystallization temperature with increasing pressure in the glass can be explained by the suppression of atomic mobility. No significant structural change was detected in the Cu60Ti20Zr20 glass annealed in vacuum at 697 K for 1 h as compared to the as-prepared sample from x-ray diffraction measurements.

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