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Thermal kinetics and short range order parameters of Se₈₀X₂₀ (X = Te, Sb) binary glasses

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Abstract

Bulk Se₈₀Te₂₀ and Se₈₀Sb₂₀ glasses were prepared using the melt-quench technique. Differential scanning calorimetry (DSC) curves measured at different heating rates (5 K/mina parts per thousand currency sign alpha a parts per thousand currency sign50 K/min) and X-ray diffraction (XRD) are used to characterize the as-quenched specimens. Based on the obtained results, the activation energy of glass transition and the activation energy of crystallization (E (g), E (c)) of the Se₈₀Te₂₀ glass are (137.5, 105.1 kJ/mol) higher than the corresponding values of the Se₈₀Sb₂₀ glass (106.8, 71.2 kJ/mol). An integer n value (n=2) of the Se₈₀Te₂₀ glass indicates that only one crystallization mechanism is occurring while a non-integer exponent (n=1.79) in the Se₈₀Sb₂₀ glass means that two mechanisms are working simultaneously during the amorphous-crystalline transformations. The total structure factor, S(K), indicates the presence of the short-range order (SRO) and the absence of the medium-range order (MRO) inside the as-quenched alloys. In an opposite way to the activation energies, the values of the first peak position and the total coordination number (r (1), eta (1)), obtained from a Gaussian fit of the radial distribution function, of the Se₈₀Te₂₀ glass are (2.42 nm, 1.99 atom) lower than the corresponding values (2.55 nm, 2.36 atom) of the Se₈₀Sb₂₀ specimens.

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