ORDERING AND DISORDERING UNDER THE TRANSITION GLASS TO CRYSTAL

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Crystallization of glass is usually considered in terms of ordering, formation of denser atom packing that provides lowering of materials free energy. The present work was aimed at the detailed study of crystallization in glassy materials of systems $MgO-Al_2O_3-SiO_2$ and Bi-Sr-Ca-Cu-O. XRD, DTA, internal friction and Young modulus measurements as well as pycnometer density measurements were used to study the structural transformations occurred within the tested glassy materials at wide temperature range. Annealing of glassy material at its vitrification temperature was found to be generating the differing amorphous structures. For each such structural state the degree of ordering revealed non-monotonous dependence on the exposure at the annealing temperature. Values of internal friction and Young modulus, also changed non-monotonously upon annealing, showing, however, general tendency to increasing and decreasing, respectively. Time dependence of density was rather oscillating at vitrification temperature. Activation energy of crystallization was also found to be influencing by the structural state of crystallizing amorphous material. Presented experimental results are discussed in terms of structural relaxation, which is considered as a continuous array of transitions within the hierarchically organized glassy structure towards the lower energy level. Based on this approach, the observed disordering/ordering series are considered as elementary transitions due to the formation and interaction between the internal structural defects of glass.