Nanostructured surfaces

Kinetics of concentration separation in amorphous alloys outside the spinodal region

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It is known that spinodal decomposition takes place in the cases when we succeed to transfer a system into a region characterized by an absolute instability of a homogeneous state, i.e. under the spinodal curve. If the such transfer to realize by a rapid quenching, then it needs very high quenching rates that phase separation did not occurs in the binodal region yet. It follows that spinodal decomposition is actual first of all for metallic amorphous alloys which are formed over the very short times $10^{-9} – 10^{-3}$ s.

For a description of spinodal decomposition in these systems we are used a phenomenological approach, in the framework of which a generalized, nonlinear diffusion Cahn-Hilliard equation has been received. To this equation it should be added the initial condition connected with a presence of concentration fluctuations immediately after quenching. Considering that a function appearing in the initial condition is a random function of the coordinates, so thereafter a statistical approach was used to describe the evolution of the amorphous alloy. As a result the system of evolution equations for the correlators of second and third orders was obtained. In distinction to [1-2] in the present work the "gradient" terms were included, result in a system equations of fourth order.

The solution of this system enables to get quite total information about a process of concentration separation. In particular, evolutional behavior of correlation radius, dispersion and the asymmetry parameter has been obtained. It is shown that dispersion and asymmetry parameter decreases with time, but correlation radius increases by the law $\tau^{1/2}$. This indicates that initial concentration fluctuations are blurred with time.

1. *E.P. Feldman, L.I. Stefanovich.* Evolution of “frozen” concentration fluctuations during decomposition of glasses with near-spinodal compositions// Zh. Eksp. Teor. Fiz.–1989.–**96**.–P. 1513–1521.
2. *E.P. Feldman, L.I. Stefanovich.* Kinetics of the spinodal decomposition of glasses// Zh. Eksp. Teor. Fiz. –1990.–**98.**–P. 1695–1704.