CMT 15P ANALYSIS OF PHASE TRANSITIONS IN THE PRESENCE OF AN INTERMEDIATE STATE. THE MODEL WITH TWO ORDER PARAMETERS

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The main propose of this report is to present the analysis of phase transitions in the presence of an intermediate state by using the model with two order parameters. The parametric modelling of phase transitions and analysis of the role of an intermediate liquid state in irreversible relaxation processes at low temperatures were performed. As an example, one can consider the systems with two stable states *L1* and *C* that means liquid and crystalline, respectively, and the third one – intermediate fluid state, namely *L2* [1]. Such *L2* state has been experimentally discovered in supercooled liquids [2]. The model includes two order parameters and three control parameters in the Landau-type kinetic general potential of 6^{th} degree, and has been developed to study the impact of heterogeneity on phase transitions in the presence of an intermediate fluid state [3]. We noticed that the presence of the intermediate liquid state may indeed enhance the nucleation rate, and, furthermore, an increase in the heterogeneity of system accelerates the transition dynamics. In the previous works, we have shown that, depending on the values of its control parameters, the potential has one, two or three possible minima, and the problem dealt with the construction of the equilibrium phase diagrams. It is also worth mentioning that the previously obtained results are general and suggest a complete set of different transition scenarios in the entire parameter plane with two control parameters [4].

We study next the stability and bifurcation of equilibrium states in the kinetic processes corresponding to the first-order phase transitions in systems which can be characterized by several order parameters. Along with general analysis when the kinetic processes corresponding to phase transitions in systems characterized by r number of order parameters $x_1,x_2,\ldots,x_r$ and m number of control parameters $\alpha_1,\alpha_2,\ldots,\alpha_m$ are described by a system of ordinary differential equations of the form $\frac{dx_r}{dt} = f_r(x_1,x_2,\ldots,x_r;\alpha_1,\alpha_2,\ldots,\alpha_m)$, where t is time, the results of specific calculations for systems described by the kinetic Landau-type potential with two parameters are also presented. In general, the largest and smallest values of order parameter for the bifurcation analysis correspond to minima of free energy functional *F*, while the intermediate value corresponds to an unstable state (*F* has a local maximum or saddle point), and these three extrema are identified with the crystalline and two liquid phases [5]. In case of a single - component glass which can be characterized in terms of the pressure *P* and volume *V*, the relation between *P* and *V* could be obtained using the equation $P(V,T,x,y) = -(\partial F/\partial V)_{T,x,y}$. Note that $P(V,T,x,y,)$ can be derived from experimental data and this equation may be further used to determine the *V*-dependence of $F(V,T,x,y,)$ Then *F* can be applied to get the entropy $S = -(\partial F/\partial T)_{V,x,y}$, and in this way specific heats and other thermodynamic quantities for the system can be defined [6].

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