

## Environment-dependent phase equilibria in a small volume system in the case of decomposition of Bi-Sb solid solution

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### Abstract

Regarding phase transitions in systems of a very small volume it is necessary to take some considerable dissimilarities into account. They are due to the contribution of the all interphase boundary's surface free energy in the system's full energy, that grows as the system's size decreases. In this study, external environment influence on the phase equilibria in nanoparticles with core-shell configuration where one of the phases doesn't touch the system's external boundary, of binary stratifying solid solution with upper critical solution temperature (UCST) was investigated using the methods of equilibrium chemical thermodynamics. That configuration has two thermodynamically stable states, which differ in mutual position of co-existing phases. In macro-systems, where the contribution of the surface energy is negligible, the energies of both states are equal. In nano-systems the state, whose surface energy is higher, becomes metastable. Each state corresponds to its own phase diagram, which is different from the phase diagram of a macro-system. External environment was modeled by the value of surface free energy on the system's external boundary. It is shown, that a change of the external environment leads to a change of equilibrium composition of all co-existing phases and the UCST. The UCST can both increase and decrease, depending on what solid solution is in the shell-position. Nanosystem's phase diagram depends on its external environment, what is of interest for many nanotechnology application fields.

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