

# Nanocomposites and nanomaterials

## Conditions of forming nanocrystallites for GaSb in amorphous films of the GaSb-Ge system

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Using a method of the flesh evaporation in vacuum, the films have been prepared, from previously synthesized powder GaSb-Ge, with the thickness approximately 50 nm. Glass, ceramic and spallings NaCl monocrystals were served as substrates. Structure, substructure, concentration areas of existence of metastable solid solutions and an amorphous state and kinetics of structural transformations depending on technological conditions of evaporation of thin films of system GaSb-Ge were studied by methods of electronography and transmission electron microscopy. Equilibrium of system GaSb-Ge in a massive state is featured by the diagram of the eutectic type, and mutual solubility of components on the molar composition does not exceed 1 %. The composition of films is more convenient to represent using the formula  $(\text{GaSb})_{1-x}(\text{Ge}_2)_x$  because in the investigated system solid thin-film solutions are formed by substitution.

The temperature of a substrate supported in a precipitation process of films has dominant effect on structure formation of explored films. Films of all explored compositions, precipitated on substrates at room temperature, were amorphous. The linear relation of the proximate interatomic distance (from 2.72 Å for a-GaSb to 2.45 Å for a-Ge) in amorphous films from composition is observed. The linear relation of the proximate interatomic distance in coordinate  $\text{Ge}_2$  specifies random distribution of atoms with forming "alloyed" structure such as a solid solution of substitution. In amorphous films GaSb threefold coordination in distribution of the proximate atoms is observed. The magnification of concentration Ge gives in conversion of allocation of the proximate atoms. At concentrations  $\text{Ge}_2$  about 20 % transferring from threefold coordination to tetrahedral is observed.

Amorphous films at heat crystallized, but phases of a solid solution it is not observed. Initial crystallization phases are crystal grains GaSb. With an increase of temperature of a substrate there is a forming the nonuniform amorphous films. Areas of initial ordering on a basis GaSb are observed. Forming of areas of initial ordering on basis GaSb proves to be true their etching in bromine - methanol etching agent with its heightened reactivity to connections Ga-Sb.

With the further increase of temperature of substrates on the isotropic substrates polycrystalline films of a metastable solid solution of substitution are formed, and on spallings NaCl monocrystals are formed epitaxial films.