GRAIN SIZE EFFECT ON ELECTRIC AND MAGNETIC PROPERTIES OF R{R=Sc,Y,La}-Fe-Ge THIN FILMS

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9.7 cm

The data on the crystal structure, electric and magnetic properties of R-Fe-Ge {R=Sc,Y,La} thin films composition are presented depending on the preparartion conditions {annealing temperatures and the effects of the applied electric field on a molecular vapour}, thickness, and sizes of crystalline formations in amorphous matrixes. In most cases the binary Fe-Ge nanostructures at a certain temperature are double phased, i.e. in the germanium amorphous matrix the clusters of a metallic constituent may be segregated. An excess of approximately 20 wt. % of the rare earth metal in the deposited condensate stabilizes an amorphous phase at a certain temperature interval. The film condensates, in which the cluster sizes are commensurate with the distances between them, are very attractive. In these films a conductivity mechanism is predetermined by a tunneling of electrons through small gaps between nanoparticles and so the resistivity depends on these particles sizes, width and configuration of the tunnel barriers, temperature and origin of the substrate materials. Exchange interaction between iron and rare earth atoms in the films of the ternary R-Fe-Ge {R=Sc,Y,La} systems is a main factor which determines the low temperature electric and magnetic properties. The equilibrium radius of clusters was calculated at vapor supersaturation during the process of condensation taking into account the influence of the electric field using the Gibbs energy change.
The experimental dependencies of the resistivity and coercivity in the 77-500 K temperature range enable us to predict the evolution of the films properties for application them as the soft magnetic materials.

13.4 cm

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