IN-PLANE ANISOTROPY EFFECT ON CRITICAL TRANSITION FIELD IN NANOGRANULAR FILMS WITH PERPENDICULAR ANISOTROPY

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S u m m a r y

The influence of the in-plane anisotropy on the magnetization of a nanogranular film with perpendicular anisotropy has been studied. It is shown that if a magnetic field is tilted with respect to the film normal, a critical transition from the inhomogeneous magnetic state of granules with noncollinear directions of their moments to the homogeneous one with parallel orientation of granular magnetic moments takes place. The in-plane anisotropy is found to affect the angular dependence of the critical field. The ensemble of oriented biaxial particles is theoretically described in the double-well potential approximation. Despite the biaxial magnetic anisotropy of particles, their ensemble, if in the inhomogeneous state, is divided into two subensembles, with the magnetic moments of particles being collinear in each of them. In the critical field, a transition from the inhomogeneous state with two subensembles into the homogeneous one takes place. The results of theoretical calculations are compared with experimental data for a nanogranular Co/Al_2O_n film with perpendicular anisotropy containing 74.5 at.% Co, which exceeds the percolation threshold. The magnetic moment of this film is a sum of two contributions: from nanogranules with biaxial anisotropy and a phase forming the percolation cluster. The magnetic properties of nanogranules, whose contribution is separated from the total film magnetization, agree well with the calculation data.