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The influence of inhomogeneities on physical characteristics of ferromagnetic clusters inside of antiferromagnetic matrix in an external field

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The problem of the influence of an external field on the magnetic moments of ferromagnetic clusters surrounded by an antiferromagnet is studied in this paper. Clusters interact with each other magneticaly. In the case of strong anisotropy such a system can be described by a one-dimensional Ising model with a random exchange in the presence of an effective local field. The inhomogeneity of the interface between clusters and an antiferromagnet represents the random effective field. The ground state of such a model turns out to be the set of domains of different lengths in fields smaller than the saturation field. In contrast to the one-dimensional Ising model in a homogeneous field, linear dependence of the magnetization on the external field in the presence of a random effective field in the region of small fields is observed. The magnitude of the exchange bias of the magnetization curve depends on the average of the random effective field, and the slope of the curve depends on the variance of the random effective field. The use of such a model allows drawing conclusions about the properties of the boundary between subsystems from experimental data. The results obtained within the framework of such model allow to estimate the properties of the boundary between subsystems basing on experimental data. A formula that estimates the quality of the interface in the case of the cylindrical geometry of the sample is obtained.

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