ELECTRON SPIN RESONANCE IN TWO-PHASE MAGNETIC SYSTEMS

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The materials, in which magnetically ordered and disordered components coexist, have drawn more and more attention in recent years. The coexistence of such type may be created artificially or it may simply be a result of magnetic inhomogeneity. The research effort is primarily directed towards the investigation of the behavior of magnetically ordered component; its action on magnetically disordered one is usually neglected. This, however, is inadmissible for the case where magnetic resonance is studied in the system, since the fields induced by the former can strongly modify the resonance conditions for the latter.

The analysis of the behavior of the system in which paramagnetic (PM) and ferromagnetic (FM) phases coexist over a wide temperature range was carried out in Ref. [1]. Drastic transformations of the resonance spectra are predicted for the region of the phase coexistence. The fact that the FM phase doesn't occupy the whole volume of a particle changes the resonance conditions for the FM phase, as they in the first place are governed by the shape of FM regions. On the other hand, the magnetic fields created by the FM regions strongly transform the resonance conditions for the PM phase.

It was shown in paper [1] that the features of the phase interference strongly depend on a sample shape. The case of a spherical sample was analyzed in detail but for slabs or thin films this effect was studied neither theoretically, nor experimentally. The present paper contains the extension of the previously developed model to the case of a slab and presents the experimental results on the samples of doped manganites, for which the PM and FM phases coexist over a wide temperature range.

It is demonstrated that the resonance field of the PM phase becomes dependent on the shape of the sample, the saturation magnetization and the fraction of the FM phase. As a result, the effect is strongly dependent on the orientation of the external magnetic field with respect to the film plane, which well agrees with the results of the experiment. It is shown that the features of the effect observed can be varied by means of the variation of the fabrication conditions.

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References

[1] Yu.I. Dzhezherya and A.I. Tovstolytkin, J. Phys.: Condens. Matter **19**, 246212 (2007).