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Studies of properties of nanoparticles of dilute magnetic semiconductors

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Abstract

Magnetic semiconductors, consisting of nanoparticles of oxides of transition and rare earth metals possess all the properties necessary for spintronics: Curie temperature above room temperature, rather high saturation magnetization, they are semiconductors. Decrease of the size of nanoparticle leads to a considerable change in their physical properties, which transform considerably during the process of the transition from single crystal with negligible amount of surface defects to polycrystals, where surface and intergranular effects play a significant role. The subsequent transition is to the nanoparticlestate, in which the surface area, enriched with different structure defects, forms the predominant part of the nanoparticle. Nanoparticles transform to disordered systems below a certain threshold of size. Thus, there occur qualitative changes in the physical properties of nanoparticles with decreasing size. The surface is then separated from the core, crystalline area in a particular manner. In nanopowders surface coating, that is encapsulation, which protects surface structure, becomes important, whereas in nanograins of ceramics, wherein intergranular fillers, connecting various individual grains become important. All these behaviors can be investigated by EPR (electron paramagnetic resonance), which is a very powerful technique to study the environment of a magnetic ions constituting the sample. This presentation is aimed to examine the relevant experimental data.

Biography

Sushil K. Misra is a full Professor of Physics at Concordia University, Montreal, Canada. He has done extensive experimental and theoretical research in electron paramagnetic resonance, with some 270 papers to his credit. Currently, he collaborates with ACERT (Advanced Center for Electron Spin Resonance Technology) at Cornell University. He has written numerous review articles and book chapters on EPR, and has been invited frequently as a specialist to present lectures at international conferences. He was one of the early EPR researchers invited by the People's Republic of China as a foreign expert on EPR in 1985.