

Exchange-bias effect in core-shell nanoparticles with non-spherical shape and imperfect shell

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The isothermal magnetic hysteresis of composite nanoparticles with FM core - AF shell morphology and various sizes and shapes is studied, in order to elucidate the sensitivity of the exchange bias effect on the shape of the particles and the structural imperfections of the interface and the shell. We use classical Heisenberg Hamiltonian with different local anisotropy terms for the core, the shell and the surface. The field-cooled process and the isothermal hysteresis loop are simulated implementing the Metropolis Monte Carlo algorithm. The coercive and exchange bias fields for spherical and cubical nanoparticles with similar nominal sizes are compared. We find that interface roughness smears out the differences between spherical and cubical particles, while incomplete shells lead to degradation of the exchange bias effect.

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