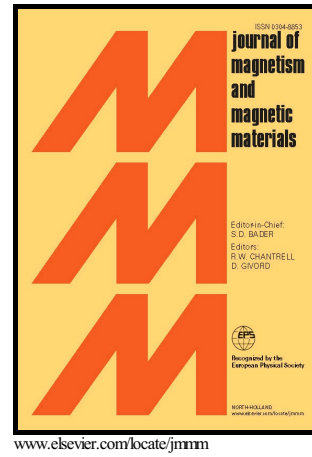


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Surface spin-glass in cobalt ferrite nanoparticles dispersed in silica matrix

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Abstract

Surface effects in cobalt ferrite (CoFe_2O_4) nanoparticles dispersed in a silica (SiO_2) matrix were studied by using AC and DC magnetization. Nanoparticles with different concentration of SiO_2 were synthesized by using sol-gel method. Average crystallite size lies in the range 25 nm – 34 nm for different SiO_2 concentration. TEM image showed that particles are spherical and elongated in shape. Nanoparticles with higher concentration of SiO_2 exhibit two peaks in the out-of-phase ac-susceptibility. First peak lies in the high temperature regime and corresponds to average blocking temperature of the nanoparticles. Second peak lies in the low temperature regime and is attributed to surface spin-glass freezing in these nanoparticles. Low temperature peak showed SiO_2 concentration dependence and was vanished for large uncoated nanoparticles. The frequency dependence of the AC-susceptibility of low temperature peak was fitted with dynamic scaling law which ensures the presence of spin-glass behavior. With increasing applied DC field, the low temperature peak showed less shift as compared to blocking peak, broaden, and decreased in magnitude which also signifies its identity as spin-glass peak for smaller nanoparticles. M-H loops showed the presence of more surface disorder in nanoparticles

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