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Spin-dependent tunnelling in magnetite nanoparticles

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Abstract

Fe₃O₄ nanoparticles have been made by a co-precipitation method with an average size of 13 nm. Raman measurements show that there is also a small fraction of maghemite that is not seen in the XRD data. The saturation magnetization is high for this preparation method and the coercive field is low at 300 K. The high field magnetic moment cannot be fitted to a Bloch temperature dependence over the full temperature range, which is likely due to the effect of the Verwey transition at 120 K. Pressed powders shows a magnetoresistance of up to -6.5% at 8 T and 300 K. The magnetoresistance can be fitted to a model where there is a spin-dependent tunnelling between nanoparticles with a spin-disordered shell. The temperature dependence of the resistivity can be attributed to nanoparticle electrostatic charging effects.

Keywords: magnetite, nanoparticles, magnetization, magnetoresistance, Raman.

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