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Magnetic Correlations In A Magnetite Nanoparticle Assembly Investigated Using Polarized SANS KATHRYN KRYCKA, NCNR, NIST, CHARLES HOGG, Carnegie Mellon University, YUMI IJIRI, Oberlin College, RYAN BOOTH, Carnegie Mellon University, JULIE BORCHERS, WANGCHUN CHEN, MARK LAVER, THOMAS GENTILE, BRIAN MARANVILLE, NCNR, NIST, BENJAMIN BRESLAUER, SARA MAJETICH, Carnegie Mellon University
— Using small angle neutron scattering (SANS) with polarization analysis, we have studied ferromagnetic magnetite monodisperse nanospheres in order to determine the field (0 and 1.3 Tesla) and temperature (50, 100, and 200 K) dependence of the magnetic interparticle correlations. These particles were 7 nm in diameter with an average edge-to-edge separation of 2.5 nm. Preparation techniques are described elsewhere [1]. An FeSi supermirror polarized the incident neutrons, and a polarized 3He cell was used as a spin analyzer. While a typical magnetic SANS experiment observes the convolution of the nuclear and magnetic terms, we have implemented and further developed an algorithm to separate the four spin dependent cross sections. This provides an unambiguous separation and measurement of magnetic and nuclear contributions. At low temperatures, magnetic correlation lengths have been found to be significantly larger than at high temperatures.
[1] J. Am. Chem. Soc. 2002, 124, 8204-8205.

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