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Magnetic Guinier Law

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The so-called Guinier law represents the low- q approximation for the small-angle scattering curve from a dilute assembly of identical and randomly oriented particles. This relation has been derived for nonmagnetic particle-matrix-type systems; an important prerequisite for it to apply is the presence of a sharp interface separating particles and matrix. On the other hand, it is well known that the magnetic microstructure of nanocrystalline magnets is highly nonuniform on the nanometer length scale and characterized by a spectrum of continuously varying long-wavelength magnetization fluctuations. This results in a large and strongly field-dependent magnetic small angle neutron scattering (SANS) cross section. In this work we introduce the Guinier law for the case of magnetic SANS and provide an analysis of experimental data on a hard magnetic Nd-Fe-B-based and a soft magnetic Fe-based nanocomposite.

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