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# Spin Structure in Magnetic Nanospheres

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We will present a combined study of X-ray and neutron small-angle scattering (SAXS/SANS) and magnetization measurements, which resolves in detail the chemical and magnetic morphology of magnetic nanoparticles. In particular, polarized small-angle neutron scattering allows to resolve the spatial magnetization distribution inside of magnetic nanoparticles and to discriminate the spin disorder contribution at the particle surface and in the magnetic core[1]. Usually, the reduced magnetization in magnetic nanoparticles is attributed to the surface spin canting or formation of a magnetic deadlayer.
Field-dependent polarized SANS experiments on the spherical magnetic nanoparticles under study result in a reduced and field-variable magnetized particle volume, which indicates significant deviations from single domain behavior with constant particle moment. Even at a high magnetic field of 1.2 T, spin disorder at the nanoparticles surface amounts to 11% of the particle volume. In-depth analysis shows that the overall reduced magnetization in spherical magnetic nanoparticles results not only from surface spin disorder, but also from reduced magnetization inside the magnetized core. HRTEM indicates a defected structure in the particle core, which may lead to a non-homogeneously magnetized spin structure.

[1] S. Disch *et al.*, New J. Phys. **14** (2012) 013025

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