Contribution ID: **88** Type: **not specified**

Dzyaloshinskii-Moriya Interaction in Nanocrystalline Vitroperm

Tuesday, 29 October 2019 14:30 (30 minutes)

The Dzyaloshinskii-Moriya interaction (DMI) is believed to be operative in low-symmetry crystal lattices lacking inversion symmetry. However, already in 1963, Arrott pointed out that even in a high symmetry lattice, where the DMI would normally vanish, this interaction is present in the vicinity of any lattice defect. Based on these considerations and recent theoretical work, first experimental studies of the impact of the DMI on the spin-polarized magnetic small-angle neutron scattering (SANS) on polycrystalline magnets exhibiting a large density of microstructural defects have been performed. They demonstrated that an asymmetry in the difference between the two half polarized SANS cross sections is induced by the DMI in nanocrystalline terbium and holmium as well as in mechanically deformed microcrystalline cobalt. Here we present an additional case, the nanocrystalline soft magnet Vitroperm ($Fe_{73}Si_{16}B_7Nb_3Cu_1$), where the SANS cross section exhibits the polarization dependent asymmetric term originating from the DMI. The effect has a magnetic field dependence and is less pronounced at higher fields until it eventually vanishes reaching full saturation. The result supports the generic relevance of the DMI for the magnetic structure of defect-rich ferromagnets. Furthermore it shows that polarized SANS is a particularly powerful tool for investigating defect-induced DMI, due to it's unique dependence on the chiral interactions.

Position

Phd

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Session Classification: Poster session

Track Classification: Poster