Effect of Particle Size on the Magnetic Properties of RE-TM Nanoparticles

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This talk will be focused on our latest studies on hard magnetic particles of $SmCo_5$, $Nd_2Fe_{14}B$ and $Sm_2Fe_{17}N_x$ made by milling. The talk will cover the influence of particle size on both the hard magnetic properties (H_c and M_r) and the fundamental properties of the particles such as the magnetocrystalline anisotropy K, Curie temperature T_c and spin-reorientation temperature T_{sr}. Our data show a substantial increase of T_c with decreasing particle size which can be explained by finite size scaling. The nanoparticles also showed lower coercivities and spin-reorientation temperatures which are attributed to the lower anisotropy (by a factor of two) of nanoparticles because of surface spin distortion. Our current efforts are aimed to make particles with a larger size, preferably between 50-100 nm, where the effect is not as large, and therefore the coercivities are expected to be much higher. These high coercivities are needed for the bottom-up fabrication of anisotropic exchange-coupled nanocomposite magnets.

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