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Magnetic multilayers on nanospheres.

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In modern magnetic recording materials the ‘superparamagnetic effect’ [1] has become increasingly important as new magnetic hard disk drive products are designed for higher storage densities. In this regard, nanoparticle media [2], where two-dimensional arrays of monodisperse nanoparticles with high magnetic anisotropy are used, is assumed to be the ideal future magnetic recording material. In this presentation a novel magnetic gradient nanomaterial, which has been created by depositing Co/Pd multilayers onto two-dimensional arrays of self-assembled nanoparticles [3] will be introduced. The magnetic nanostructures formed on top of the particles are in a magnetically exchange-isolated quasi-single-domain state. This nanoscale system is quite distinct from the classical geometries: Neither extrinsic properties nor the intrinsic properties are uniform in space. The film is extended over a wide region of the sphere and thus shows substantial curvature. The film thickness varies and so do the intrinsic magnetic properties most notable the magneto-crystalline anisotropy, which is a key factor affecting the fundamental nature of the reversal process. The specific magnetic characteristics of such a gradient nanomaterial and in particular its impact on the reversal mechanism will be discussed. Angle-dependent reversal studies were performed for different particle sizes and the experimental results were interpreted using micromagnetic simulations. The simulations account for the angular dependence of the hysteresis loops and provide a detailed picture of how the local magnetization evolves during reversal, offering new opportunities in the functionalization of magnetic nanostructures for storage applications. [1] A. Moser et al., J. Phys. D: Appl. Phys. 35, (2002) R157. [2] S. Sun et al., Science 87, (2000) 1989. [3] M. Albrecht et al., Nature Mater. 4, (2005) 203.