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Enhancing Magnetic Hardness in Self-Assembled Island Superlattices, Harald Brune (EPFL)

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We show that the blocking temperature of Co double layer islands arranged in a self-assembled superlattice on Au(11,12,12) with a density of 15 Tera/in2 can significantly be enhanced by interfacing them with small amounts of Fe.
The magnetic ground state of each island is a single domain ferromagnet. Magnetic torque measurements on pure Co double layer islands containing 600 atoms reveal that also the transition state during thermal magnetization reversal is monodomain, namely, the reversal takes place by coherent rotation of all magnetic moments [1]. As a consequence, the blocking temperatures are proportional to the magnetic anisotropy energies. Former measurements of such islands on Au(788), where the density is 24 Tera/in2, have revealed uniaxial out of plane magnetization and the absence of dipolar interactions [2].
A good benchmark for hard magnetic nanostructures is the ratio of the number of constituent atoms to the blocking temperatures that has to be minimized. For this number we achieve 7.1 for pure Co islands and it goes down to 4.7 for Co core –Fe shell islands [3, 4]. Since Fe grows in single layer not much Fe can be added before coalescence sets in. However, decoration of the islands with Pd from the top gives rise to a further enhancement of the magnetic hardness [4].

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Primary author: BRUNE, Harald (EPFL)

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