MAGNETIC ANISOTROPY OF BI-METALLIC NANOSTRUCTURES – INTERFACE *VS.* ALLOY CONTRIBUTION

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We use self-assembly during atomic beam epitaxy to create two-dimensional bi-metallic islands on single crystal metal substrates. Size, morphology, and composition of these islands are determined at the atomic scale with STM, and can be deliberately varied by the growth conditions. The magnetic properties, such as temperature-dependent zero-field susceptibility, are measured for an ensemble of islands with magneto-optical Kerr effect (MOKE). Linking the magnetic properties to the morphology enables one to identify the effect of atomic coordination **[1-3]** and chemical environment **[4]** for instance on the anisotropy energy.

We focus on the interface and alloy contribution to the blocking temperature of FeCo islands grown on a Pt(111) surface. The blocking temperature of Fe_xCo_{1-x} alloy islands is highest for $x = 0.5$ and with $T_b = 160$ K two times higher than for clean Co ($x = 0.0$, $T_b = 90$ K) or clean Fe islands ($x = 1.0$, $T_b = 80$ K) of identical size and shape. Taking the size into account this yields to an alloy contribution to the barrier for thermally induced magnetization reversal of $E_{alloy} = 0.14$ meV/atom on top of the 0.14 meV/atom barrier for the mono-metallic islands. For magnetization reversal by coherent rotation these energies are equivalent to the magnetic anisotropy, composed of shape and magneto-crystalline anisotropy. The shape contribution can easily be calculated thus revealing the magneto-crystalline anisotropy.

Co-core–Fe-shell islands reveal a steep increase of T_b, starting with minute amounts of Fe and coming to an end at a shell being 2 atomic rows wide. Further addition of Fe leads to a much more shallow increase of T_b similar to the one of pure Fe or Co. From this behavior we infer that the interface between Co and Fe contributes by $E_{interface} = 0.9$ meV/pair. Altogether this suggests that abrupt 1D interfaces between two metals have much higher anisotropies than homogeneous alloys.

The experimental findings are discussed in the light of DFT calculations using the spin-polarized relativistic version of the Korringa–Kohn–Rostoker (KKR) multiple scattering formalism. These calculations confirm the experimental findings and give absolute numbers of the anisotropy energies in very good agreement with experiment.

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