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Magnetic coupling of cobalt nanodots and rare-earth-Au₂, monolayer-thick surface compounds

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High-temperature deposition of rare-earths (RE) on noble metal surfaces, such as Au(111), gives rise to stable, REAu₂ mono and bilayers of high crystalline quality. These surface alloys exhibit characteristic, long-range moiré patterns that can be utilized as growth templates [1]. In fact, cobalt deposition on such pre-patterned REAu₂/Au(111) surfaces leads to self-organization of Co nano-dots. Depending on the RE material of the surface one can achieve different interactions that determine the magnetic properties of the dots arrays. In order to investigate the magnetic properties of the REAu₂/Au(111) support and the Co/REAu₂/Au(111) arrays, a detailed study combining X-ray Circular Magnetic Dichroism and Scanning Tunneling Microscopy was carried out. Several substrates were analyzed (SmAu₂, GdAu₂, and YbAu₂), which share the same RE-Au₂ surface structure and lattice constant, but reveal ferromagnetic, anti-ferromagnetic [2], and non-magnetic interactions with the Co nano-dot array, respectively. These interactions not only determine the magnetic properties below the Curie temperature TC of the substrate but also far above TC and lead to enhancements of the magnetic anisotropy and blocking temperature of the Co nano-dot array.

References

- [1] M. Corso, L. Fernández, F. Schiller, and J. E. Ortega, ACS-Nano 4, 1603 (2010).
- [2] L. Fernández, M. Blanco-Rey, M. Ilyn, L. Vitali, A. Correa, P. Ohresser, J.E. Ortega, A. Ayuela, and F. Schiller, Nano Letters 14, 2977 (2014).

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