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P H Y S I K K O L L O Q U I U M

Fachbereich für Physik

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über

Magnetic Hybrids: from Molecules and Graphene to Multiferroic Nanocomposites

Abstract:

In the on-going process of electronic device miniaturization new concepts are developed by utilizing hybrid systems. For this purpose the tailoring of the magnetic properties in these nanoscale systems is essential. We make use of hybrid systems that consist of a combination of magnetic molecules, graphene, thin films as well as magnetic nanopillars. Surface and interface effects are crucial to achieve new functionalities in these structures. This shall be demonstrated by means of two examples: 1) The magnetic coupling of paramagnetic molecules to ferromagnetic surfaces can be tailored by the help of an intermediate layer of atomic oxygen or graphene [1-5]. The fundamental understanding of the relevant interactions for the coupling is possible by combination of experimental element specific investigations (e.g. by X-ray magnetic circular dichroism studies) and theoretical results utilizing ab initio calculations. 2) Ferrimagnetic $CoFe_2O_4$ (CFO) nanopillars embedded in a ferroelectric $BaTiO_3$ (BTO) matrix are an example for a two-phase magnetoelectrically coupled system [6]. In particular, the electric properties can be tuned by magnetic fields and the magnetic properties by electric fields. We demonstrate that an in-plane magnetic field breaks the tetragonal symmetry of the CFO/BTO structures. This coupling creates staggered in-plane components of the electric polarization (as determined by X-ray linear dichroism investigations), which are stable even at magnetic remanence due to hysteretic behaviour of structural changes in the BTO matrix [6]. These concepts can be extended towards ceramic composites [7].

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