Tailoring the Properties of Magnetic Nanoparticles from the Gas Phase

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To a largely growing extend, the physical properties of advanced functional materials are tailored by controlling their size and/or the size of their constituents on the nanometer scale. Inert gas condensation in combination with size fractionation and in-flight thermal annealing has proven to allow for the preparation of very clean nanoparticles, since no chemical additions are involved in the synthesis process. The method provides substantial control over the particle morphology and crystal structure and thereby over the particles' physical properties. In the present talk, the versatility of this method is highlighted with some examples of our recent work which comprises (i) the investigation of the $L1_0$ ordering kinetics in FePt nanoparticles close to the stoichiometric composition [1], (ii) the potential and challenges of using bio-templates for the regular arrangement of nanoparticles from the gas phase on a substrate [2], (iii) the tailoring of both the diameter and the number of walls in catalytically grown carbon nanotubes [3], and (iv) the possibility to control the size and the density of pinning centers for flux vortices in thin film high temperature superconductors towards an improvement of the critical current density.

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