Impact of aligned carbon nanotubes array on the magnetostatic isolation of closely packed ferromagnetic nanoparticles

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Abstract. We investigate the influence of carbon nanotubes (CNT) aligned array on the magnetic properties of ensemble of densely packed Co nanoparticles (NPs) embedded inside CNT. Each CNT contains only

one nanosized Co. Such a special structure was formed by catalyst chemical vapor deposition (CCVD) activated by current discharge plasma and hot filament. The Co NPs, previously deposited onto SiO2/Si substrate, acted as a catalyst. By varying the parameters of the CCVD process, we were able to also sputter the substrate instead of CNT growth. Co NPs were used as a mask and the structure of Si-based nanocones with Co NPs on the top of each cone was formed. Exhaustive investigation of the structural, morphology and crystalline properties of Co nanoparticles were performed. The magnetic properties of two kinds of samples, Co on the Si-based nanocone and Co inside CNT, were differ drastically. In the former case, the magnetic anisotropy of thin-film-type has been observed with large magnetic domains. Whereas for the Co-CNT samples ferromagnetic NPs were magnetically isolated. It was established that the magnetic anisotropy of nanosized Co plays more dominant role than the dipole interaction between Co NPs. The role of the CNT container in this is discussed.

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