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Magnetic Interaction Study on Multi-Walled Carbon Nanotubes filled with Core/Shell Iron/Iron Oxide Nanoparticles[1] K. STOJAK REPA, D. ISRAEL, H. KHURSHID, Univ of South Florida-Physics, J. ALONSO, Univ of South Florida-Physics; BC Materials (Spain), M.H. PHAN, H. SRIKANTH, Univ of South Florida-Physics — 1-dimensional magnetic nanostructures composed of carbon nanotubes (CNTs) filled with magnetic nanoparticles (NPs) are promising for a variety of applications such as electromagnetic interference shielding and biomedical engineering. Here, we present results from CNTs synthesized using commercial 200nm pore-size templates filled with core/shell (CS) Fe/γ-Fe_2O_3 NPs of $\sim$ 10 nm diameter. CS NPs were synthesized using thermal decomposition; CNTs were made by following a catalyst-free CVD. CNTs were filled with CS NPs using magnetically-assisted capillary action. TEM results indicate spherical NPs with core/shell morphology inside CNTs. Magnetometry results indicate that free-standing CS NPs and filled CNTs share a similar magnetic interaction mechanism. However, the overall magnetic properties appear to have been enhanced after filling CNTs with CS NPs. This is observed from increased blocking temperature ($\sim$ 50K) when CS NPs are enclosed within CNTs, increased anisotropy and longer relaxation time due to enhanced dipolar interparticle interactions as probed by Vogel-Fulcher fitting of AC susceptibility data. Both 0- and 1-dimensional structures retain room-temperature superparamagnetism.

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