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Fabrication and magnetic properties of carbon nanotubes filled with Fe_3O_4 nanoparticles S. PAL, K. STOJAK, S. CHANDRA, M.H. PHAN, P. MUKHERJEE, H. SRIKANTH, PHYSICS DEPARTMENT-UNIVERSITY OF SOUTH FLORIDA TEAM — Carbon nanotubes (CNTs) filled with magnetic nanoparticles (NPs) are interesting systems for potential applications in electromagnetic sensing and nanomedicine. We report on the synthesis, structural and magnetic properties of hollow, straw-like CNTs (5-6 μm length, $\sim$ 300 nm diameter, 30 nm wall thickness) filled with the Fe_3O_4 NPs ($\sim$ 6 nm). The Fe_3O_4 NPs were synthesized by chemical co-precipitation and multi-walled CNTs grown by CVD in porous alumina templates. A novel magnetically assisted capillary action method was used to obtain uniform dispersion of Fe_3O_4 NPs inside the hollow portion of the nanotubes. XRD and TEM images of the samples were analyzed. DC and AC magnetization measurements were conducted using a Physical Property Measurement System (PPMS). Saturation magnetization ($M_s\sim$65emu/g) was found to be enhanced in Fe_3O_4-CNTs compared to Fe_3O_4 ($M_s\sim$60 emu/g). The M-H curves displayed superparamagnetic behavior at room temperature and conventional blocking at low temperature. We will also present the measurements and analysis of the temperature and field dependent AC susceptibility that points to strong inter-particle interactions within the confined nanotube structures.

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