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Selective Growth of Single Wall Carbon Nanotubes from Superparamagnetic Maghemite RAMA BALASUBRAMANIAN, RICHARD GRANT, Roanoke College, PAOLA BARBARA, Georgetown University — The growth of carbon nanotubes in specific configurations and geometry is crucial to developing useful applications in nanoelectronics and smart coatings. We have shown that single wall carbon nanotubes (SWNT) of diameters less than 2 nanometers can be grown directly from catalyst particles comprising of maghemite ($\gamma-Fe_2O_3$) on a Silicon substrate using the conventional chemical vapor deposition process. The sizes of SWNT were measured using Atomic Force Microscopy. The average tube diameter was measured to be 1.5 ± 0.2 nm. Scanning Electron Microscopy measurements revealed that the catalyst oxide particles formed in clusters of 100 nm diameters. Transmission Mössbauer measurements at room temperature showed the presence of a magnetic sextet corresponding to maghemite with a particle size > 100 nm and a superparamagnetic phase with particle size less than 20 nm. Our results also indicate that the superparamagnetic phase of maghemite with average particle size of about 5 nm plays a critical role in the formation of SWNT with specific tube dimensions. Experiments are currently underway to characterize the relaxation rates of the superparamagnetic phase of maghemite. The fundamental role of arrays of metal nano-catalysts and superparamagnetic nanoclusters of maghemite in the selective growth of single wall carbon nanotubes will be presented.

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