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Temperature Dependence of Electron Spin Dynamics in Oxygen-Free Single-Walled Carbon Nanotubes WILLIAM RICE, Rice University, RALPH WEBER, Bruker BioSpin Corp., ASHLEY LEONARD, Rice University, AH-LIM TSAI, University of Texas Medical School, JUNICHIRO KONO, Rice University — Using electron spin resonance (ESR), we have measured the spin susceptibility and coherence time of electron spins in bulk powder single-walled carbon nanotubes (SWNTs) before and after removing oxygen via annealing. Removal of oxygen resulted in an increase of the spin susceptibility by roughly two orders of magnitude. In addition, the spin susceptibility was found to increase with decreasing temperature, both in the as-prepared and oxygen-free SWNTs, indicating localization at low temperatures. However, the temperature dependence does not exhibit a standard Curie law (i.e., a $\frac{1}{T}$ trend); deviation from this behavior may be due to strong electron-electron correlations. Furthermore, through the temperature dependence of the ESR lineshape, linewidth, and conductivity, we demonstrate quasi-one-dimensional variable range hopping between nanotubes in the oxygen-free sample. Specifically, the hopping conduction produced a motional narrowing of the ESR linewidth at elevated temperatures, resulting in an estimated hopping frequency on the order of 100 GHz.

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