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Preparation of High Purity Single-Wall Carbon Nanotubes

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Currently, there is a need for high purity samples of single walled carbon nanotubes (SWNT) to serve as standards to benchmark new synthetic and purification methods. Unfortunately, it has been difficult to purify SWNT and to quantitate their purity, especially the amorphous carbon content. Recently, near-infrared (NIR) spectroscopy has been used to characterize the electronic band structure of SWNT and to evaluate the relative amorphous carbon content (and purity) of SWNTs. In this study, NIR spectroscopy, SEM/EDX, TEM, TGA, ICP, and Raman spectroscopy will be used to characterize purified samples of SWNTs. The goal of this study is to produce a high purity sample of SWNTs that contains a low metal (<0.01 at%) and amorphous carbon content. SWNT were prepared by pulsed laser vaporization of a Dylon target containing cobalt and nickel. The crude SWNTs were purified by a multi-step purification procedure involving nitric acid reflux and thermal oxidation. After purification, the cobalt and nickel content was <0.005 at% by ICP, and the amorphous and graphitic carbon content was low by SEM, TEM, and NIR analysis. These samples appear to be some of the highest purity SWNTs produced to date. In this presentation, the synthesis, purification, and characterization of high purity SWNTs will be discussed.

This research was sponsored by the U.S. Department of Energy under contract DE-AC05-00OR22725 with the Oak Ridge National Laboratory, managed by UT-Battelle, LLC, and the Laboratory-Directed Research and Development Program at ORNL.

Presentation type: Oral

Sorting category: 7.9.5 Carbon Nanotubes and Related Nanomaterials (DMP)

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