Carbon Nanotubes (CNTs) have been the subject of intense research for their potential to improve a variety of material properties when developed as nano-composites. This research aims to address the challenges that limit the ability to transfer the outstanding nano-scale properties of CNTs to bulk nano-composites through Raman characterization. These studies relate the vibrational modes to microstructural characterization of CNT composites including stress, interface behavior and defects. The formulation of a new fitting procedure using the pseudo-Voigt function is presented and shown to minimize the uncertainty of characteristics within the Raman G and D doublet. Methods for optimization of manufacturing processes using the Raman characterization are presented for selected applications in a polymer-MWNT composite and laser-sintered ceramic-MWNT composite. In the first application, the evolution of the MWNT microstructure throughout a functionalization and processing of the polymer-MWNT composite was monitored using the G peak position and D/G intensity ratio. Processing parameters for laser sintering of the ceramic-MWNT composites were optimized by obtaining maximum downshift in stress sensitive G-band peak position, while keeping disorder sensitive D/G integrated intensity ratio to a minimum. Advanced Raman techniques, utilizing multiple wavelengths, were used to show that higher excitation energies are less sensitive to double resonance Raman effects. This reduces their influence and allows the microstructural strain in CNT composites to be probed more accurately. The use of these techniques could be applied to optimize any processing parameters in the manufacturing of CNT composites to achieve enhanced properties.

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The public is welcome to attend.