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Synthesis and Characterization of Single-Wall Carbon Nanotube/*ta*-C Thin Film Composites C.H. Schittenhelm, D.B. Geohegan, P.F. Britt, Oak Ridge National Laboratory, Oak Ridge, TN; A.A. Puretzky, Department of Materials Science and Engineering, Univ. of Tennessee, Knoxville, TN.

Multifunctional composites which combine the exceptional electronic, mechanical or thermal properties of single-wall carbon nanotubes (SWNT) with those of a matrix material are envisioned for a wide range of applications. Here we report the first synthesis of composites which utilize ultrahard, transparent, amorphous diamond thin films as matrices to encapusulate conducting SWNT mats. This film is intended to provide a transparent, wear-resistant coating to shield the SWNT against mechanical deformation and adsorption of many common ambient gases or liquids which have been observed to strongly modify their electronic properties.

SWNT were synthesized by laser vaporization and chemically purified to > 95 wt. % SWNT as measured by TGA analysis. A dichloroethane suspension of these nanotubes was sprayed onto Si, quartz, and other substrates in to form mats of varying areal densities. Pulsed laser deposition (PLD) of tetragonally-coordinated amorphous carbon was then performed in vacuum using a pyrolytic graphite target irradiated at 193-nm, generating a plume containing carbon ions with kinetic energies up to 100 eV.

\indent The interactions of these high energy ions with the SWNT are of fundamental interest for the general use of PLD to form SWNT thin film composites. The resistance of the mats was measured in situ during film deposition, while ex situ measurements before and after deposition included I-V measurements, along with FESEM, TEM and resonant Raman scattering analyses. Resonant Raman spectra from the SWNT (\lambda = 633 nm) before and after deposition showed that a large fraction of SWNT survive the energetic deposition process, with the characteristic tangential and breathing modes remaining unchanged in shape and position but decreased in magnitude. An enhanced disorder band was observed, as expected. Preliminary results indicate that amorphous diamond thin films can be used as protective matrices for multifunctional SWNT composites.

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