Multifunctional Structural Nanotube Polymer Nanocomposites for Aerospace Applications

Cheol Park

National Institute of Aerospace
Hampton, VA, USA
(email pcheol@nianet.org)

ABSTRACT

Multifunctional structural materials can offer a novel design paradigm for future aerospace vehicles and structures. Recent studies of nanotube-polymer nanocomposites indicate that these materials have the potential to provide the combination of structural integrity and sensing or actuation capability. Very small loadings of single wall carbon nanotubes (SWCNT) in a polyimide matrix result in a sensor material in response to strain, stress, pressure, and temperature. These materials also exhibit significant actuation in response to applied electric fields. This presentation will highlight how to tailor the physical properties of the multifunctional nanocomposites and discuss their potential for multifunctional structural aerospace applications [1–6].

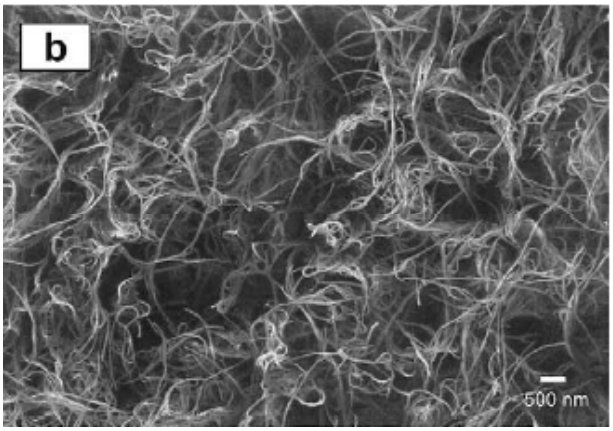

Figure 1. Polytransparent HRSEM micrograph of 2%SWCNT/polypeptide nanocomposite surface: excellent dispersion of SWCNT [3].

Table 1. Tensile properties of pristine polyimide and SWCNT/polyimide nanocomposite films [5].

	Tensile modulus (GPa)	Tensile strength (MPa)	Break at elongation (%)
Polyimide	2.74 ± 0.8	133 ± 4	7.7
2% SWCNT	3.36 ± 2.8	139 ± 2	7.8
5% SWCNT	3.96 ± 0.7	123 ± 6	7.0

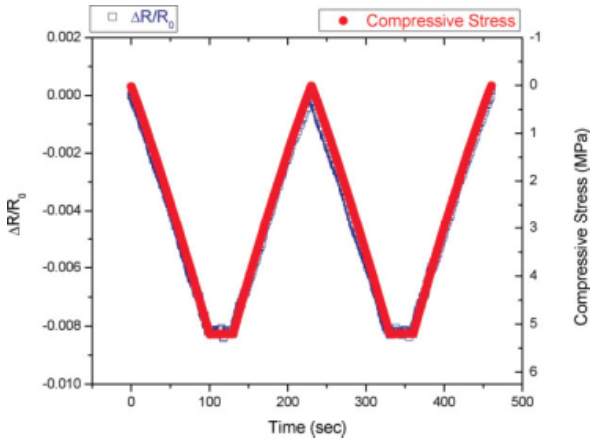

Figure 2. Resistance change under the compressive stress for 0.05%SWCNT/polyimide nanocomposite film (through-thickness mode) [2].

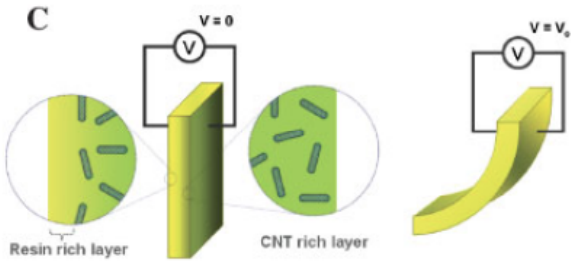

Figure 3. Schematic of a cross-section of the intrinsic unimorph of SWNT/LaRC-EAP composite film without and with an electric field [63].

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