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Characterization of the Electrical Properties of Single Multi-Walled Carbon Nanotubes

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Extended Abstract:

As next-generation materials with complex properties are used in structures and numerous existing structures are nearing their predicted lifetimes, the need for structural health monitoring (SHM) becomes increasingly evident. Numerous methods for performing SHM have been developed, with the addition of electrically-based monitoring. These methods typically involve monitoring for changes of the electrical conductivity of a material, from which a decrease is generally correlated to damage. In some cases, the application of a conductive thin film is required to perform these electrically-based methods. In order to optimize the properties of these sensitive materials, engineers refer to material models for this practice. To properly model the electrical response of a CNT-PVDF thin film to changes in CNT content, applied strain, and other phenomena, we require an accurate understanding of the CNT network geometry, electrical properties of individual CNTs, and the electrical properties of the CNT junctions. This work focuses on obtaining the electrical properties of individual multi-walled CNTs (MWCNTs) using conductive atomic force microscopy (C-AFM) measurements. These measurements are conducted by depositing the MWCNTs on a silicon wafer, applying electrodes to one end of the MWCNTs, grounding the electrode, biasing a conductive AFM probe, and measuring the current as a function of length along each MWCNT. We present the resistance per length of a distribution of MWCNTs with respect to MWCNT diameter and a comparison to other values of MWCNTs in the literature.

Short Abstract:

This work focuses on obtaining the electrical properties of individual multi-walled CNTs (MWCNTs) using conductive atomic force microscopy (C-AFM) measurements. These measurements are conducted by depositing the MWCNTs on a silicon wafer, applying electrodes to one end of the MWCNTs, grounding the electrode, biasing a conductive AFM probe, and measuring the current as a function of length along each MWCNT. We present the resistance per length of a distribution of MWCNTs with respect to MWCNT diameter and a comparison to other values of MWCNTs in the literature.

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