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Determination of Intrinsic Damping in a MWNT using the Harmonic Detection of Resonance Method DOYL DICKEL, GAYATRI KESKAR, MALCOLM SKOVE, APPARAO RAO, Clemson University, DEPARTMENT OF PHYSICS AND ASTRONOMY, CLEMSON UNIVERSITY, CLEMSON, SC 29634 COLLABORATION, CENTER FOR OPTICAL MATERIALS SCIENCE AND ENGINEERING TECHNOLOGIES, CLEMSON UNIVERSITY COLLABORATION — Harmonic Detection of Resonance (HDR) method has been shown to be an effective method of electrically determining the resonant frequency of cantilevered structures at both the micro- and nanometer scale. Previously, HDR has been used effectively to study nonlinear behavior in highly anharmonic systems, as a gas sensor, and to determine the resonant frequency of nanoscale structures such as a Multi-wall Carbon Nanotube (MWNT). In addition, HDR method has been used for determining material properties such as the Young's Modulus. Here, we provide a simple model describing the theory underlying the HDR method and a demonstration of its use to determine the resonant behavior of a MWNT. Finally, we report the effects of varying pressures on both the resonant frequency and quality factor of the MWNT. We also estimate the intrinsic damping inherent in the MWNT from these effects and show its correlation with defect density. The MWNT examined was found to have a resonant frequency for its primary mode of oscillation of 2.79 MHz with a quality factor of 10.15 at a pressure less than 1 Pa.

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