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Influence of Defects and Doping on Optical Phonon Dynamics in Carbon Nanotubes DANER ABDULA, KHOI NGUYEN, KWANGU KANG, SCOTT FONG, TANER OZEL, DAVID CAHILL, MOONSUB SHIM, University of Illinois Champaign- Urbana — The relaxation of electronic excitations induced by high bias or photoexcitation occurs primarily through optical phonon emission. Optical phonon relaxation may be affected by metallic/semiconducting character of carbon nanotubes, defect concentration, as well as doping. Changes in carbon nanotube G-band optical phonon population and pure dephasing lifetimes with doping and defects are described. Time-resolved incoherent anti-Stokes Raman spectroscopy is used to directly measure phonon decay lifetime, T_1, while total dephasing rate is inferred from static Raman linewidths. Defect concentration is varied by sample annealing and covalent functionalization showing increasing disorder reduces T_1 as well as overall dephasing time, T_2, with an even greater dependence. Samples with different metallic and semiconducting contribution have similar lifetimes, $T_1 \sim 1.2 \pm 0.1$ ps in the no defect limit. Doping is shown to increase G-band linewidth, and therefore overall dephasing rate, for semiconducting nanotubes while leaving T_1 unaffected.

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