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Temperature-Dependent Maximum Density of 1D Excitons in Carbon Nanotubes THOMAS SEARLES, IAN WALSH, TAKAYUKI NOSAKA, WILLIAM RICE, JUNICHIRO KONO, Dept. of Electrical and Computer Engineering, Rice University — Previous studies have shown that an upper limit exists on the density of 1D excitons in single-walled carbon nanotubes (SWNTs) due to very efficient exciton-exciton annihilation (EEA). A recent theoretical study based on a dark-bright two-band exciton model predicts that there is a temperature at which the achievable exciton density will be maximized, surpassing the room-temperature upper limit. Therefore, we performed temperature-dependent (300 K to 11 K) photoluminescence (PL) on HiPco SWNTs embedded in an i-carrageenan matrix under high resonant excitation. To achieve high densities, we used pump fluences up to $\sim 10^{14}$ photons/cm^2, utilizing intense fs pulses from a wavelength-tunable optical parametric amplifier. We found that for each temperature the PL intensity saturates as a function of pump fluence and the saturation intensity increases from 300 K to a moderate temperature around 100-150 K. Below that critical temperature, the PL intensity decreases with decreasing temperature. Within the framework of diffusion-limited EEA, we successfully estimated the upper limit of the density of 1D excitons in SWNTs as a function of temperature and chirality

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