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Explaining the Purification of Single-Walled Carbon Nanotubes by 248 nanometer UV Light ABRAM VAN DER GEEST, Colorado School of Mines, KATHERINE HURST, JOHN LEHMAN, NIST - Boulder, MARK LUSK, Coloado School of Mines — It has been experimentally observed that amorphous carbon is removed from as-prepared, bulk, single-walled carbon nanotubes by illumination with 248 nm (5 eV) UV light. The process via which this occurs, though, has not yet been rigorously identified. We use a combination of experiments and modeling to explain how localized surface plasmon pairs can be induced at the surfaces of nanotubes. The 248 nm light is near the resonant frequency of one of these plasmon pairs for small diameter nanotubes, and this causes a large electric field enhancement in the vicinity of the tubes. The enhanced field increases the rate at which sp-2 bonds in the amorphous carbon are excited into a state from which the carbon is more easily oxidized. Electromagnetic catalysis by embedded nanoparticles describe these processes. Classical electromagnetics, in conjunction with density functional theory, is used to quantify the field enhancement and the relationship between laser wavelength and nanotube radius which will result in cleaning. Cleaning is defined as the removal of a-C from SWCNT by optical processes. The absorption spectra in the region of 5 eV, for amorphous carbon, is also described by using density functional theory to study the effects of deformation on related molecules such as ethylene and benzene.

Abram Van Der Geest
Colorado School of Mines

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