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Electrical Breakdown of Carbon Nanotubes in Ultrahigh Vacuum
AMY L. PERLMAN, ALEXANDER D. SCHWAB, WALTER F. SMITH, Haverford College, JAMES HONE, Columbia University, NATHAN C. KEIM, University of Chicago — It has been shown[1] that the current-induced breakdown of multiwall carbon nanotubes occurs at a higher voltage in high vacuum than in air, and that the size of the resulting gap is smaller. It is believed that the breakdown is due to joule heating and oxidation. Therefore, we expect that the maximum voltage and current would be higher in an oxygen-free environment, and that these conditions would allow study of the fundamental limits of current density in nanotubes. Further, it is reasonable to expect that the resulting gap would be smaller, and perhaps more suitable for making electrical contacts to other target molecules.[2] We present measurements on single wall nanotubes taken in a vacuum better than 1 x 10^{-10} Torr, so that less than one oxygen molecule impinges on a nanotube over a several hour experiment. [1]P.G. Collins *et al*, Phys. Rev. Lett. **86**, 3128 (2001). [2] K. Tsukagoshi, I. Yagi, and Y. Aoyagi, Appl. Phys. Lett. **85**, 1021 (2004).

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