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High Bias Characteristics of Individual, Suspended Carbon Nanotube p-n Junction Photodiodes SHUN-WEN CHANG, University of Southern California, KEVIN BERGEMANN, University of Michigan, ROHAN DHALL, University of Southern California, JERAMY ZIMMERMAN, STEPHEN FORREST, University of Michigan, STEPHEN CRONIN, University of Southern California —
We have recently investigated p-n junction diodes formed by electrostatic doping of individual, suspended, single-walled carbon nanotubes (CNTs) using two gate electrodes positioned beneath a free standing nanotube that bridges source and drain electrodes. The electrostatic field imposed by the two gates polarizes the nanotube along its length, thereby allowing independent control of the "doping" in the nanotube without introducing impurities or defect states. These pn-devices exhibit rectifying diode behavior and finite photoresponse under illumination. Several interesting phenomena are observed at high bias that arise from Schottky contacts formed between the nanotube and its metal contact electrodes and electron tunneling between the n- and p-doped regions. A model is developed explaining this behavior showing evidence for plasmon-induced band gap shrinkage with electrostatic doping.

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