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Uni- and Ambipolar Light Emission From Inhomogeneous Carbon Nanotube FET's JAMES TSANG, MARCUS FREITAG, JIA CHEN, PHAEDON AVOURIS, IBM T. J. Watson Research Center — Heterogeneities in the environment of CNTFETs can produce stationary, unipolar, electroluminescence, in addition to the normal ambipolar emission. We compare the unipolar emission with the ambipolar emission in the same device to characterize the unipolar emission process and show how the heterogeneities modify the electronic properties of the CNT. If a CNTFET is partially covered by a PMMA overlayer, changes in the IV characteristics are observed which correlate with discontinuities in the motion of the ambipolar emission at the PMMA boundary, and the generation of unipolar emission at the boundary. These PMMA induced changes show there is a step in the potential along the CNT at the boundary. Similarly, localized effects in both the ambi- and unipolar emission are observed in CNTFETs containing closed loops. The unipolar emission requires the junction between the portions of the single carbon nanotube that form the base of a loop must support the voltage drop needed to generate the light. Direct comparison of the ambipolar and unipolar emission in the same device demonstrates the efficiency of the unipolar processes.

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