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N-type Doping of Single-walled Carbon Nanotubes: Fundamental Properties, Spectroscopic Signatures, and Transparent Conducting Electrodes KEVIN MISTRY, BRIAN LARSEN, JEREMY BERGESON, MATTHEW REESE, TERESA BARNES, JEFFREY BLACKBURN, National Renewable Energy Laboratory — Controllable p- and n-type doping of single-walled carbon nanotube (SWNT) films enables technologies such as FETs, LEDs, and solar cells. Because many p-type dopants for SWNTs are environmentally stable, they have been studied in greater detail and used in far more applications than their less stable n-type counterparts. As a result, further studies on n-type SWNTs are needed. We report on the effectiveness of small molecule and polymer amines as n-type dopants on thin film nanotube networks. We find significant doping-induced changes in NMR, XPS, and Raman spectra that can be used in future studies to characterize n-type SWNTs. Moreover, we find that the best amines can produce n-type transparent conducting films with nearly the same sheet resistance (at a given transparency) as p-doped HNO_3 treated films. These results serve both to increase the knowledge base in the community regarding the fundamental properties and spectroscopic signatures of n-type doped SWNTs and to expand the versatility of functional SWNT network electrodes that are typically resigned to p-type SWNTs.

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