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**Local and broadband photovoltaic response of aligned carbon nanotube films** SEBASTIEN NANOT, DARIUS MORRIS, LISA A. HENDRICKS, JUNICHIRO KONO, ECE and Physics and Astronomy Department, Rice University, CARY PINT, ROBERT H. HAUGE, Smalley Institute, Rice University, FRANCOIS LEONARD, Sandia National Laboratories, Livermore — Although individual semiconducting single-walled carbon nanotubes (SWCNT) have exhibited clear photovoltaic responses, it remains unclear whether macroscopic films of carbon nanotubes can also behave this way. While some groups have explained finite photovoltages as Schottky barrier effects, other groups have proposed photo-thermoelectric effects in suspended films. Here, we have studied highly aligned SWCNT films that work well as photovoltaics. SWCNTs grown by CVD were transferred onto a SiO2 substrate. There was a broad diameter distribution in the films to obtain a large wavelength range of interband absorption. The films were top-contacted with various metals. We made a systematic scanning photocurrent study of such samples at 660 and 1350 nm. A strong local photovoltage appeared at electrode-SWCNT interfaces. Detailed comparison with theoretical calculations of the dependence of photo-response on the nanotube orientation, metal electrode type, and temperature unambiguously revealed the photovoltaic nature of the observed photovoltage. We assign these effects to the doping of both metallic and semiconducting SWCNTs under the electrodes, in a similar fashion to graphene, its lineshape being determined by the diffusion of photoexcited carriers. Finally, to obtain a finite net signal under global illumination, we utilized different electrode combinations and studied their photoresponses from the visible up to mid-infrared and terahertz.

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