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Carbon nanotube fiber based flexible, lightweight and broadband photodetector AHMED ZUBAIR, ECE Department, Rice University, NAOKI FUJIMURA, Department of Physical Electronics, Tokyo Institute of Technology, DMITRI E. TSENTALOVICH, COLIN C. YOUNG, ChBE Department, Rice University, XIAOWEI HE, XUAN WANG, WEILU GAO, ECE Department, Rice University, YUKIO KAWANO, Department of Physical Electronics, Tokyo Institute of Technology, MATTEO PASQUALI, ChBE Department, Rice University, JUNICHIRO KONO, ECE Department, Rice University — Ultrabroadband absorption properties of carbon nanotubes (CNTs) make them attractive materials for solar cell and photodetector applications. In particular, CNT fibers, which have the unique properties of flexibility and high mechanical strength combined with excellent electrical and optical properties, hold the promise as flexible, broadband photodetectors with inherent polarization sensitivity. Here, we explore the optoelectronic properties of high-performance multifunctional fibers of CNTs towards the development of lightweight, flexible, and broadband photodetectors. We present a photothermoelectric-effect-based flexible CNT-fiber photodetector fabricated using a novel technique. The spatial variation of doping in CNT fibers creates a Seebeck coefficient gradient, leading to a photothermoelectric signal. The current-voltage characteristics of the fiber photodetector produced polarization-sensitive short-circuit currents and open-circuit voltages in response to light in a wide wavelength range, from the visible to the far-infrared. In the terahertz frequency range, the device showed responsivities as high as 2.1 mA/W.

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