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Flexible, Lightweight Terahertz Photodetector and Polarizer Based on Carbon Nanotube Fibers AHMED ZUBAIR, COLIN C. YOUNG, DMITRI E. TSENTALOVICH, MATTEO PASQUALI, JUNICHIRO KONO, Rice University, Houston, Texas, USA — Carbon nanotubes (CNTs) have some extraordinary properties such as ultrabroadband (ultraviolet to far-infrared) absorption, ultrahigh electrical and thermal conductivities, ultralight weights and ultrahigh mechanical strengths, which have attracted the interest of researchers in diverse fields. In particular, the photonic and optoelectronic properties of CNTs are ideally suited for terahertz (THz) technologies which have applications in astronomy, communications, and sensing. The THz detectors and polarizers that we currently use are mostly bulky operated at very low temperatures, and have complex structures. Here, we explore the optoelectronic properties of high-performance multifunctional fibers of CNTs towards the development of lightweight, flexible THz photodetectors and polarizers. We present a photothermoelectric-effectbased flexible CNT-fiber photodetector fabricated using a novel technique. The spatial variation of doping in CNT fibres creates a Seebeck coefficient gradient, leading to a photothermoelectric signal. This CNT-fiber photodetector shows polarization-sensitive detection in the THz regime. Under illumination by a 3.52THz beam, the I-V characteristic of the fiber photodetector produced a finite short-circuit current (I_{SC}) and open-circuit voltage (V_{OC}). The device showed responsivities up to 2.1 mA/W. We also fabricated a CNT-fiber-based polarizer, which exhibited ideal polarizer properties with $\sim 100\%$ degree of polarization and extinction ratios of better than 30 dB in the THz range.

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