Carbon Nanotube Arrays for Infrared Sources and Detectors

John Lehman [C, S]
NIST, Quantum Electronics and Photonics Division, Boulder, CO, U.S.A.
lehman@boulder.nist.gov

Vertically aligned carbon nanotube arrays (VANTAs) are known to have the lowest reflectance of any material in the visible and far infrared (50 μm and longer). This behavior, along with their remarkable thermal properties, presents an opportunity to create new sources and detectors for visible and infrared radiation. There remains a challenge, however, to achieve desirable properties on practical devices because of the adverse conditions presented by water-assisted chemical vapor deposition (e.g., 750 C in a reducing environment). We present modeling and measurement results on a variety of platforms, including pyroelectric detectors and thermoelectric devices. In addition, we present some discussion of the gap between theoretical expectations and experimental results, comparing single-wall carbon nanotube mats and multiwall carbon nanotube arrays. This work supports our goal to establish new standards for laser radiometry (for communications, manufacturing and defense) and to assist the work of others with priorities related to earth observation and renewable energy.