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Second-order Harmonic Generation in CNT arrays for THz Wave Emission

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ABSTRACT

Two laser beams with frequencies ω_1 and ω_2, wave vectors k_1 and k_2 are transmitted through a network of CNTs placed on a dielectric substrate. When these laser pulses come into contact with nanotubes, a confined plasma is created. Electrons acquire oscillatory velocities as a result. The electrons experience ponderomotive pressure, which results in oscillations in the charge density at $2\omega_1$ and $\omega_1 - \omega_2$. The laser applies a ponderomotive force to the free electrons in carbon nanotubes at the frequency $2\omega_1 - \omega_2$, which is in the terahertz (THz) zone, resulting in a nonlinear current density. Every nanotube emits THz radiation by acting as an oscillating electric dipole. We determine the THz efficiency controlling formula and its reliance on the CNT spacing, size, amplitude, and angle of laser incidence. At the incident angle $\theta \approx 23.5^{\circ}$, we acquire the greatest peak of THz power. Carbon nanotube terahertz power is directly proportional to their length and radius, meaning that an increase in any of these two factors will result in an increase in terahertz power. THz efficiency rises as the distance between the nanotubes decreases.

Keywords: Carbon nanotube; Terahertz generation; Second harmonic generation

How to Cite

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