Recent Progress on Epitaxial Graphene Detectors Operating from the GHz to THz range

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Graphene is attractive for broad band detector applications because its interband absorption is nearly constant, □□ ≈ 2.3%. At very low frequencies (≲ 1 THz) the absorption dramatically increases, due to Drude absorption of free carriers. Adding to the appeal, graphene-based detectors based on hot-electron photothermoelectric effect can operate at room temperature and have fast responsivity (up to 75 GHz). Moreover, graphene used as a bolometer at lower temperatures has exceptional responsivity. Recent progress on detectors using epitaxial graphene will be described with preliminary results given for detecting amplitude modulated light for frequencies < 50 GHz, gated structures directly detecting radiation from 100 to 200 GHz, and cryogenic quantum dot bolometers operating in the low THz range. In addition, photothermoelectric detection utilizing plasmonic structures, tuned by ribbon width and carrier density, responsive to 1 to 10 THz photons will be presented. The positive impact of hydrogen intercalated epitaxial graphene on all these detector types will also be discussed.