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Terahertz emission and detection using Fe-doped InGaAs and low-temperature-grown-GaAs photoconductive switches

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1. Introduction and Background

Photoconductive (PC) switches are one of the most commonly used room temperature sources of broadband terahertz frequency radiation, with low-temperature-grown (LT) GaAs being extensively used for operation at ~800nm excitation wavelengths. However, with advances in materials technology, Fe-doped InGaAs PC switches have recently been used to generate frequencies over a >2 THz bandwidth using both ~800 nm and ~1550 nm excitation wavelengths.[1, 2]

We report the design and fabrication of PC switches for coherent generation and detection of terahertz-frequency radiation in LT-GaAs, and Fe-doped InGaAs materials with different iron doping levels. PC switches incorporating broadband antennas have been fabricated and characterised using pulsed excitation at wavelengths from 800 nm to 1550 µm. PC switches incorporating log-spiral antennas with interdigitated electrodes have also been characterised for THz emission using both pulsed and continuous-wave excitation.

2. Results

Fe-doped InGaAs wafers with a range of doping concentrations were grown using metal organic chemical vapour deposition (MOCVD). Bow-tie antennas were fabricated and successfully tested for THz emission and detection at wavelengths from 800 nm to 1550 nm (Fig. 1).

We have also demonstrated pulsed terahertz frequency generation using both LT-GaAs and Fe:InGaAs devices incorporating log-spiral antennas and a range of interdigitated electrode designs.

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1. C. D. Wood et al., Appl. Phys. Lett. 96, 194104 (2010).
2. O. Hatem, et al., Appl. Phys. Lett. 98, 121107 (2011).

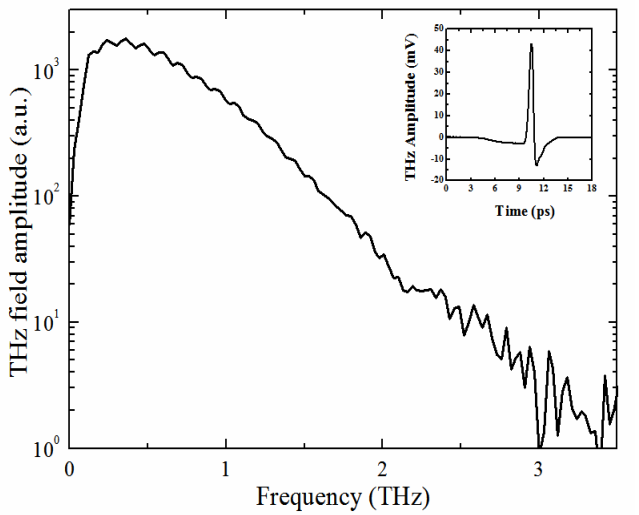

Fig. 1 Frequency spectrum and (inset) time-domain signal of the radiation detected from Fe-doped InGaAs PC switches at 1550 nm (50 mW) excitation wavelength.