Spintronic CW THz Generation Using an Optimized Fe/Pt Metallic Bilayer

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Metallic spintronic heterostructures, which consist of ferromagnetic (FM) and non-ferromagnetic (NM) thin films, are now an emerging ideal class of broadband terahertz (THz) sources. They exhibit a distinct THz generation mechanism that results from the efficient conversion of optically driven spin currents from an in-plane magnetized FM layer into charge currents in an adjacent NM layer [1-4]. By using an optimized spintronic bilayer structure (2-nm Fe and 3-nm Pt grown on 500-µm MgO), it has been demonstrated that metallic spintronic THz emitters are convenient sources of pulsed THz radiation at different wavelengths and average optical excitation power levels [3, 4]. For this work, spintronic generation of continuous THz waves (cw THz) was investigated by utilizing the same optimized Fe/Pt bilayer as the THz emitter in a cw THz generation-and-detection setup. The source of pump and probe beams is a chaos laser, which is basically a multimode semiconductor laser stabilized by optical feedback. Fig. 1 shows the THz emission spectra of the metallic bilayer when pumped by a 5-mW 780-nm beam from the cw chaos laser source. The spintronic THz emission features a continuous frequency comb ranging up to at least 1.8 THz and with discrete resonant peaks occurring at regular intervals of ~90 GHz or about twice the laser longitudinal mode frequency (~45 GHz). Although the high frequency end of the cw spintronic THz emission spectra may still be limited by the bandwidth of the spiral PCA detector that was used in the experiments, our results remarkably exhibit experimental proof of spintronic cw THz generation using metallic spintronic heterostructures, which are more convenient and have broader THz bandwidth compared to PCA emitters.

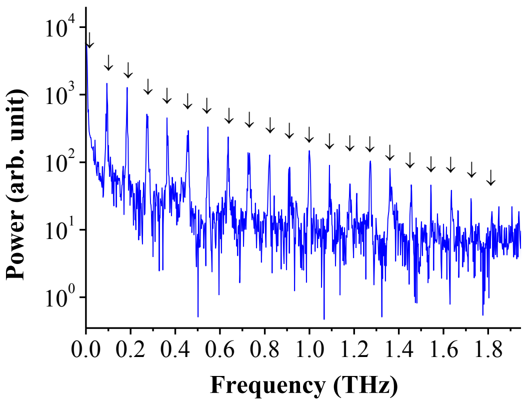

Fig. 1. The cw THz emission spectra from an optimized Fe/Pt spintronic THz emitter.

References:

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