Efficient THz Generation of Diabolo-Shaped Spintronic Fe/Pt Bilayer on MgO Substrate using 780-nm Pump Wavelength

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Terahertz (THz) generation of spintronic heterostructures is becoming popular due to broader THz bandwidth with tunable emission amplitude and polarization [1-2]. These heterostructures typically consist of stacks of ferromagnetic (FM) and nonmagnetic (NM) thin films which generate THz radiation either by the inverse spin-Hall [3] or the interface inverse Rashba-Edelstein effect [4]. Several studies [1-2, 4] were performed which include choosing the appropriate stacks and thicknesses of NM and FM materials and suitable substrates to enhance THz emission. In most of these studies, THz generation was obtained from unstructured spintronic layers which emit electromagnetic radiation in the far-field. In this paper, we performed THz-Time Domain Spectroscopy (TDS) measurements of a diabolo-shaped Fe(3nm)/Pt(2nm) spintronic bilayer on MgO substrate using an IMRA femtolite780 laser which delivers ~100fs optical pulses at a repetition rate of 75MHz. The emitted THz radiation was detected by an LT-GaAs dipole-type photoconductive antenna. The generated THz amplitude of the diabolo-shaped spintronic Fe/Pt layers was compared to that of an unstructured Fe(3nm)/Pt(2nm) bilayer. Results showed THz emission amplitude of the diabolo-shaped spintronic bilayer to be ~3x stronger than that of the unstructured one as shown in Figure 2. The improved THz emission amplitude of the shaped spintronic bilayer can be attributed to the near-field electromagnetic radiation coupled with the enhanced and confined magnetic optical field provided by the diabolo-shaped structure as discussed in [5].

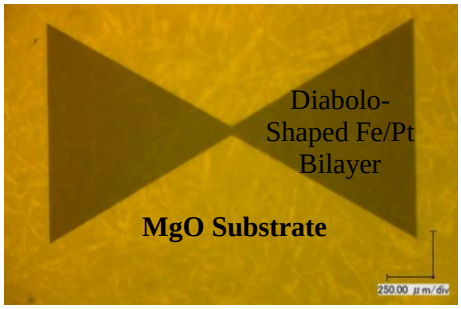

Fig 1. Optical image of the fabricated diabolo-shaped Fe/Pt spintronic bilayer.

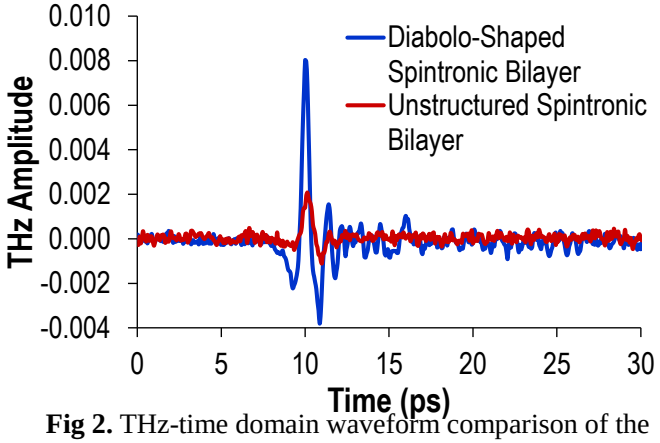

Fig 2. THz-time domain waveform comparison of the diabolo-shaped and the unstructured spintronic Fe/Pt bilayers.

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References:

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