Opto-Electronic Advances

Supplementary information

2020, Vol. 3, No. 12

DOI: 10.29026/oea.2020.200023

Helicity-dependent THz emission induced by ultrafast spin photocurrent in nodal-line semimetal candidate Mg_3Bi_2

Mingyu Tong[1†], Yuze Hu[1†], Xiangnan Xie[3], Xiegang Zhu[5], Zhenyu Wang[2,4*], Xiang'ai Cheng[1] and Tian Jiang[1*]

[1]College of Advanced Interdisciplinary Studies, National University of Defense Technology, Changsha, 410073, China; [2]National Innovation Institute of Defense Technology, Academy of Military Sciences PLA China, Beijing 100010, China; [3]State Key Laboratory of High Performance Computing, College of Computer, National University of Defense Technology, Changsha 410073, China; [4]Beijing Academy of Quantum Information Sciences, Beijing 100193, China; [5]Science and Technology on Surface Physics and Chemistry Laboratory, Jiangyou 621908, China.
*Correspondence: Z Y Wang, E-mail: oscarwang2008@sina.com;T Jiang, E-mail: tjiang@nudt.edu.cn

This file includes:

Supplementary information for this paper is available at https://doi.org/10.29026/oea.2020.200023

Section 1: Sample preparation

The Mg_3Bi_2 thin fims were grown on sapphire substrates by using molecular beam epitaxy (MBE) in ultrahigh vacuum (UHV) chambers equipped with reflection high-energy electron diffraction (RHEED) system. The sapphire substrate was heated to 800℃ for 2 hours to remove contaminants. High-purity Mg and Bi were evaporated by standard Knudsen cells. The base pressure for the MBE system was less than 1×10^{-10} mBar and the growing pressure for the Mg_3Bi_2 thin films was maintained at less than 3×10^{-9} mBar. The Mg and Bi effusion cell temperatures were selected so that the fluxing ratio Mg/Bi was more than 5. The substrate temperature was maintained at 280–380℃ throughout the growth. The thickness of the Mg_3Bi_2 films in this work is ~90 nm. Finally, Se was deposited on Mg_3Bi_2 surface to prevent the film from oxidation and pollution.

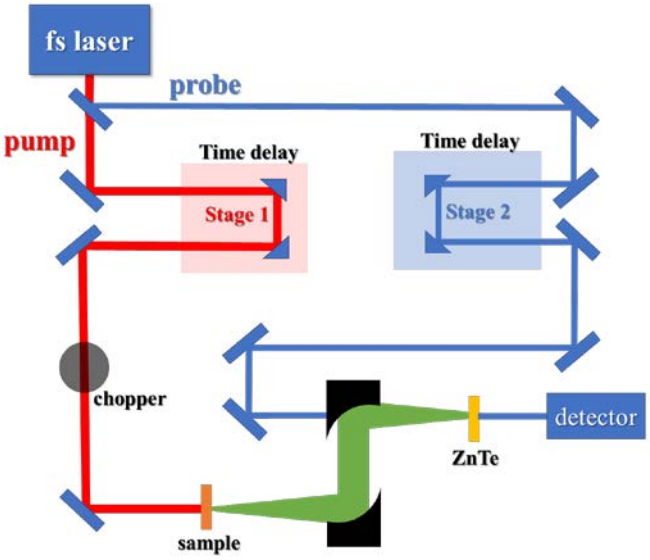

Fig. S1 | Schematic of the THz emission spectroscopy system.

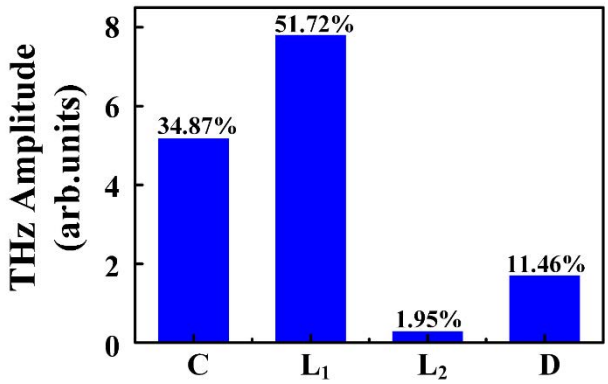

Fig. S2 | The coefficients *C*, L_1, L_2 and *D* are extracted from the fit in Fig. 3(d). The solid line is a fit to Eq. (2).

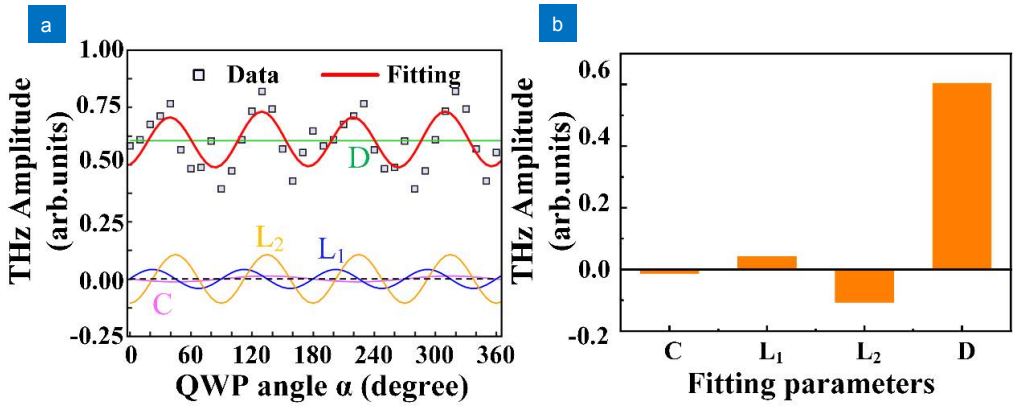

Fig. S3 | (a) The α-dependent terahertz emission in E_y direction. **(b)** The coefficients extracted from the fit in Fig. S3a.