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Investigation of Spin Pumping in Fe_3Si/GaAs and Fe_3Si/Bi_2Se_3 Bilayer Structure HUNG-YI HUNG, HSIAO-YU LIN, JUEINAI KWO, NTHU/Physics, TSUNG-HUNG CHIANG, NTHU/Mat. Sci. and Eng., JAUYN G. LIN, NTU/CCMS, SHANG FAN LEE, IOP/AS, BEI ZHEN SYU, MINGHWEI HONG, Institute of Applied Physics, NTU — Spin pumping, a dynamical spin-injection method to generate a pure spin current by magnetization precession, can be used to conduct the spin injection into a wide range of materials. Here we report the spin pumping experiment by utilizing epitaxial ferromagnetic Fe_3Si thin films interfaced with GaAs for spin injection into semiconductor, and interfaced with Bi_2Se_3 for exploitation of topological insulator (TI) edge or surface states at the TI/ferromagnet (FM) interfaces. An inverse spin Hall effect voltage as large as 49 μV, and 19 μV was detected in Fe_3Si/p-GaAs, and Fe_3Si/n-GaAs structures, respectively, under a microwave power of 100 mW. Our analysis showed that the spin injection efficiency is affected by the Schottky barrier height of Fe_3Si/(n- or p-) GaAs interface, and so is the spin mixing conductance. As for the TI/FM structure, an out of plane spin transfer torque is generated due to current driven spin accumulations. Spin pumping in Fe_3Si/Bi_2Se_3 structure using Pt electrodes has been carried out to elucidate spins diffusion process from Fe_3Si via Bi_2Se_3 into Pt, and will be reported.

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