Robust Spin Current Generation using Ferroelectric Bi_2WO_6 at Room Temperature

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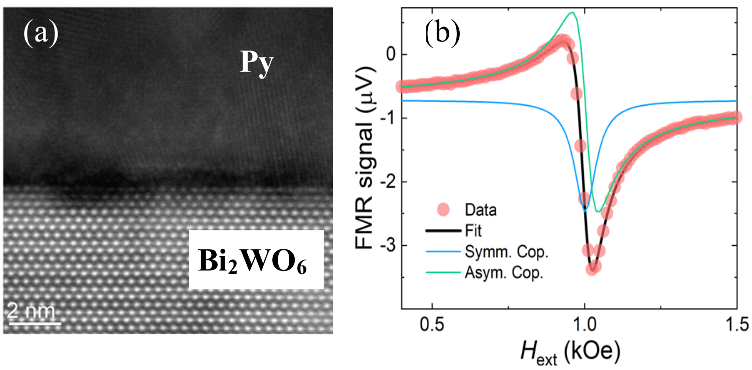
Generation of spin current from charge current via spin-orbit interaction has emerged as one of the central themes of spintronics research. The spin current enables magnetization switching and manipulation of domain wall and magnetic Skyrmions that hold potential for futuristic spin-based memory and logic technologies [1]. Traditionally, charge-spin current conversion employs the spin-Hall effect in a nonmagnetic heavy metal [2]. Alternative approaches include the use of topological insulators with spin-momentum locked surface states and two-dimensional electron gas (2DEG) systems hosting Rashba spin-orbit interaction-driven spin-split band structure. Recently it is demonstrated that oxidizing heavy metal like W or Pt enhances the charge-spin conversion efficiency.

Motivated by these considerations, we explored Aurivillius ferroelectric compound Bi_2WO_6 containing heavy elements for charge-spin conversion. Using the pulsed laser deposition technique, we grew Py/Bi_2WO_6 heterostructures with a reasonably high-quality interface [3]. Spin-torque ferromagnetic resonance (ST-FMR) measurements at room temperature reveal a clear signature of damping-like torque signifying the charge-spin conversion at the interface between the ferromagnetic Py and Bi_2WO_6. By tracing the change in the line-width of the ST-FMR spectrum as a function of an applied dc charge current, we further quantified the interfacial charge-spin conversion efficiency. In this presentation, we will detail the ST-FMR characterization and discuss the possible origin and implications of charge-spin conversion using the ferromagnetic/ferroelectric interface.



(a)HAADF STEM image of Py/Bi_2WO_6 heterostructure. (b) Representative ST-FMR spectrum.

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