Current-Induced Magnetization Switching in a Ferrimagnetic Layer

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Primary CNF Tools Used: 5x stepper, AJA sputter deposition, DISCO dicing saw

Abstract:

Ferrimagnets with strong perpendicular magnetic anisotropy are interesting for their exotic spin-orbitronic effects and technological potential in high-performance magnetic storage and computing. Here we demonstrate efficient switching of ferrimagnetic layers by in-plane charge current. This result indicates the presence of a strong current-induced spin orbit torque.

Summary of Research:

Using ultraviolet photolithography (5X stepper with resist S1813) and ion milling, we patterned sputter-deposited ferrimagnetic FeTb single layers into Hall bar devices ($5\times60\ \mu m^2$) at the Cornell NanoScale Science &Technology Facility. We then fabricated electrical contacts of Hall bars by ultraviolet photolithography (5X stepper with resist S1813), AJA sputter deposition of 5 nm Ti and 150 nm Pt, and lift-off in acetone. Finally, we diced the samples into chips using the dicing saw with a silicon only blade.

As we show in Figure 1, the FeTb single layers can be switched sharply at a low current density of 8×10^6 A/cm^2. During the measurement, we applied a bias magnetic field of -3 kOe along the current direction. This finding indicates that the in-plane current induces a strong spin orbit torque in the ferrimagnetic layers.

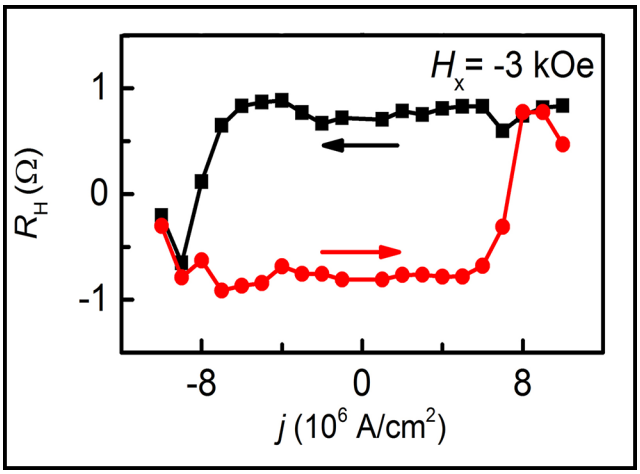

Figure 1: Anomalous Hall resistance of a ferrimagnetic FeTb thin film plotted as a function of the in-plane current density. An in-plane bias field of -3 kOe was applied along the current direction.