Spin-Orbital Torque Switching of Ferromagnetic Layer with PMA Via SmB_6 Thin Films

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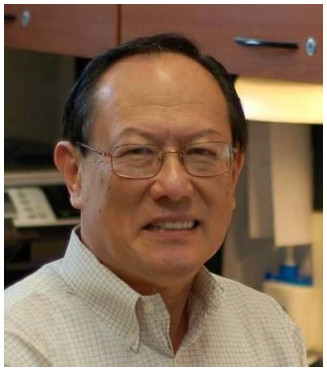
Spintronics advances by exploiting novel materials with new effects, such as materials with strong spin-orbit coupling (SOC) for current switching of ferromagnetic layer via spin-orbital torque (SOT). Topological insulators (TI) are a new class of novel materials with conducting spin-chiral surface state, from which strong SOT is anticipated. SmB_6 has been recently proposed as a TI with truly insulating interior, as suggested from thickness-independent low-temperature resistance plateau observed in bulk specimens. We have synthesized (001) SmB_6/Si epitaxial thin films, 50 nm to 500 nm thick. However, the resistance of SmB_6 thin films is distinctively thickness dependent and does not support the notion of surface conducting and interior insulating. However, the SmB_6 thin films can generate a strong SOT to switch the magnetization of an adjacent CoFeB layer with a thin W buffer layer with perpendicular magnetic anisotropy (PMA). The critical current density for switching reduces for increasing SmB_6 thickness, indicating that SmB_6 as the major source of SOT. The effective SOT generated from SmB_6 is comparable to that of β-W, the material with arguably the strongest SOT.



BIO: Dr. Chien is the Jacob L. Hain Professor of Physics, at Johns Hopkins University, where he has been a professor since 1983. During 1997-2013 he also served as the director of the NSF-funded Materials Research Science and Engineering Center (MRSEC). Dr. Chien earned the Ph.D. in Physics from Carnegie-Mellon University, in 1972. He is a Fellow of the American Physical Society (APS), and a fellow of the American Association for the Advancement of Sciences (AAAS). He received the 2004 APS David Adler Award, was the first recipient of the Asian Union of Magnetics Societies Award in 2012 and was awarded the IUPAP Magnetism Award and Néel Medal in 2015. He has 400 publications, which have been cited over 16,000 times, and he has an H-factor of 64.