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Modeling the Interface of a Heavy Metal/Ferromagnetic Bilayer Using the Boltzmann and Drift-Diffusion Equations VIVEK AMIN, Center for Nanoscale Science and Technology, National Institute of Standards and Technology, Gaithersburg, Maryland 20899, USA, KYOUNG-WHAN KIM, Basic Science Research Institute, Pohang University of Science and Technology, Pohang 790-784, Korea, KYUNG-JIN LEE, Department of Materials Science and Engineering, Korea University, Seoul 136-701, Korea, HYUN-WOO LEE, PCTP and Department of Physics, Pohang University of Science and Technology, Pohang 790-784, Korea, M.D. STILES, Center for Nanoscale Science and Technology, National Institute of Standards and Technology, Gaithersburg, Maryland 20899, USA — Accurate models for spin torques due to electrical currents in heavy metal/ferromagnetic bilayers allow for the meaningful extraction of parameters from measurements and optimization of devices. Descriptions of coherent spin transport across magnetic interfaces used to date typically take the form of resistor-like components that neglect the spin-orbit interaction. Using the Boltzmann equation, we develop new boundary conditions for the drift-diffusion equations to include both interfacial spin-orbit coupling and the exchange interaction due to the magnetization. These boundary conditions capture interfacial spin-flip scattering, coupling between longitudinal and transverse spin components, and significant modifications to the interfacial torques on the magnetization. They address the spin-orbit interaction at the interfaces of heavy metal/ferromagnetic bilayers, and allow for the calculation of interfacial spin-orbit torques within the drift-diffusion approach.

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