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Ultrafast demagnetization, spin-dependent Seebeck effect, and thermal spin transfer torque in Pt/TbFe/Cu and Pt/TbFe/Cu/Fe thin films[1] JOHANNES KIMLING, University of Illinois, BIRGIT HEBLER, University of Augsburg, JUDITH KIMLING, University of Illinois, MANFRED ALBRECHT, University of Augsburg, DAVID G. CAHILL, University of Illinois — We investigate diffusive spin currents in Pt(20nm)/TbFe(10nm)/Cu(100nm) and Pt(20 nm)/TbFe(10nm)/ Cu(100nm)/Fe(3nm) stacks using time-resolved magneto-optic Kerr effect (TRMOKE) and time-domain thermoreflectance measurements. Our experiments are based on two hypothesis: (1) fast changes of magnetization due to laser excitation are transferred into spin accumulation, e.g., via electron-magnon scattering; the generated spin accumulation drives a diffusive spin current into adjacent normal metal layers; (2) electronic thermal transport through the ferromagnetic layer injects a spin current into adjacent normal metal layers, based on the spin-dependent Seebeck effect. [1] We excite the Pt layer with ps-laser pulses. Resulting diffusive spin currents generate nonequilibrium magnetization in the Cu layer (sample I) and induce a precession of the magnetization of the Fe layer via spin transfer torque (sample II). Both responses are probed using TRMOKE. Prior experiments used $[Co(0.2nm)/Pt(0.4nm)]_{x5}/Co(0.2nm)$ instead of TbFe. [1] The ferrimagnetic TbFe layer with introduces two major modifications: (1) slow demagnetization behavior, and (2) large thermal resistance. Hence, thermal spin transfer torques can be observed on significantly longer time scales. [1] G.-M. Choi, C.-H. Moon, B.-C. Min, K.-J. Lee, and D. G. Cahill, Nature Physics 11, 576 (2015).

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