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Optical detection of spin Hall effect in metals OLAF VAN T ERVE, AUBREY HANBICKI, CONNIE LI, BEREND JONKER, Naval Research Lab — Spin Hall effects in metals have been successfully measured using electrical methods such as nonlocal spin valve transport, ferromagnetic resonance or spin torque transfer experiments. These methods require complex processing techniques and measuring setups. Here we present room temperature measurements of the spin Hall effect in non-magnetic metals such as Pt and β-W using a standard bench top magneto-optic Kerr effect (MOKE) system. With this system, one can readily determine the angular dependence of the induced polarization on the bias current direction. When a bias current is applied, the spin Hall effect causes electrons of opposite spin to be scattered in opposite directions, resulting in a spin accumulation at the surface of the film. The MOKE signal tracks the applied square wave bias current with an amplitude and phase directly related to the spin Hall angle. Using this technique, we show that the spin-Hall angle of β-W is opposite in sign and significantly larger than that of Pt. In addition, we use this technique to detect spin diffusion from β-W into Al thin films, as well as spin diffusion from the topological surface states of Bi_2Se_3 into Al. We will also show direct modulation of the reflected light up to 100 kHz, using Bi doped Cu samples. This work was supported by internal programs at NRL.

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