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Optical detection of spin Hall effect in metals[1] OLAF VAN T ERVE, AUBREY HANBICKI, KATHY MCCREARY, CONNIE LI, BERRY JONKER, Naval Research Lab — 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.[2] With this system, one can readily determine the angular dependence of the induced polarization on the bias current direction, the orientation of the spin Hall induced polarization, and the sign of the spin Hall angle. When a bias current is applied, the spin Hall effect causes electrons of opposite spin to be scattered in orthogonal 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, and follow the structural phase transition from β-W to α-W as the film is annealed through the dependence of the spin Hall angle on crystal structure. We also use this technique to detect spin diffusion from β-W into Al thin films.

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[2]O. M. J. van't Erve, A. T. Hanbicki, K. M. McCreary, C. H. Li, and B. T. Jonker, Optical detection of spin Hall effect in metals, *APL* **104** 172402 (2014)

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