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The spin-Hall effect and spin-orbit torques in epitaxial Co_2FeAl/platinum bilayers[1] T. A. PETERSON, C. LIU, University of Minnesota, T. MCFADDEN, C. J. PALMSTRØM, University of California Santa Barbara, P. A. CROWELL, University of Minnesota — We have performed magnetoresistance measurements on epitaxially grown Co_2FeAl/platinum (CFA/Pt) ultrathin ferromagnet/heavy metal bilayers to study the spin-Hall effect in Pt and the accompanying spin-orbit torque (SOT) exerted on the magnetic CFA layer. Specifically, we measure the spin-Hall magnetoresistance in the Pt layer by changing the orientation of the CFA magnetization with respect to the spin current orientation created in the Pt, and we determine the SOT efficiency using a second-harmonic detection technique. Because the latter of the two measurements is proportional to the spin-Hall ratio θ_{SHE} while the former is proportional to θ_{SHE}^2, we are able to extract the bare Pt spin-Hall ratio with no assumptions about the CFA/Pt interface spin mixing conductance. Furthermore, by varying the Pt thickness we show that the results are consistent with resistivity-independent spin-Hall conductivity. Finally, the two measurements in combination allow us to infer a spin-mixing conductance at the CFA/Pt interface of $2 \pm 1 \times 10^{15}\ \Omega^{-1}\ m^{-2}$. The combination of spin-Hall magnetoresistance and SOT measurements allows for a determination of the spin-mixing conductance using only low-frequency transport techniques.

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