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Spin-Hall and spin-pumping effect observed in W/FeCoB thin films YUN LI, CHI-FENG PAI, HSIN-WEI TSENG, LUIS LEAO, DAN RALPH, ROBERT BUHRMAN, Cornell University, Ithaca,NY,14853 — The spin-Hall effect (SHE) and its reciprocal, the inverse spin-Hall effect (ISHE), are of great importance in spintronics since they enable, respectively, the conversion of a longitudinal charge current to a transverse spin current and the reverse process. Here we will report on a ferromagnetic resonance (FMR) study of FeCoB/W thin film bi-layer structures that incorporate different W thicknesses and hence difference phases. A very large negative spin Hall angle has been observed in the β-W samples and confirmed by spin-torque switching studies. Alternatively FMR measurements with bilayers containing α-W suggests a strong positive SHE, but this interpretation of the experiment is not consistent with spin torque switching studies utilizing α-W. Since the α-W FMR results also show an enhanced magnetic damping we tentatively attribute these results to a significantly enhanced spin pumping effect in α-W, relative to β-W. Magnetization measurements indicate that the two different types of FeCoB/W bilayers have substantially different interfacial magnetic anisotropy coefficients. We will discuss these results, together with the differing temperature dependence of the FMR signal in the two cases, which help point the way to understanding the origin of the giant SHE in β-W and the strong ISHE in α-W.

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