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Spin transfer torque devices utilizing the spin Hall effect of tungsten CHI-FENG PAI, LUQIAO LIU, YUN LI, HSIN-WEI TSENG, DANIEL C. RALPH, ROBERT A. BUHRMAN, Cornell University — It is recently been shown that the spin Hall effect (SHE) in β -Ta generates a transverse spin current that is sufficient for efficiently reversing the moment of adjacent thin film nanomagnets through the spin torque (ST) mechanism. Here we report the existence of an even larger SHE in β -W thin films. Using spin torque induced ferromagnetic resonance (ST-FMR) with a β -W/CoFeB bilayer microstrip we have determined the magnitude of the spin Hall angle θ to be 0.30 ± 0.02 , which is twice as large as the previously reported value for β -Ta (~ 0.15). From switching data obtained with 3-terminal devices consisting of a β -W channel and an adjacent CoFeB/MgO/CoFeB magnetic tunnel junction, we have independently determined $|\theta| = 0.33 \pm 0.06$. We will also report on the variation of the spin Hall switching efficiency with W layers of different resistivities and hence of variable (α and β) phase composition. Finally we have studied the SHE exhibited by several other 4d and 5d transition metals using the techniques mentioned above and we will report on those results.

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