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Enhanced spin orbit torques by oxygen incorporation in tungsten films TIMOTHY PHUNG, KAI-UWE DEMASIUS, WEIFENG ZHANG, BRIAN P. HUGHES, SEE-HUN YANG, ANDREW KELLOCK, WEI HAN, AAKASH PUSHP, STUART S. P. PARKIN, IBM Almaden Res Ctr — Spin orbit torques are generated by the conversion of charge to spin currents in non-magnetic materials. The origin of these torques is of considerable debate. One of the most interesting materials is metallic tungsten for which large spin orbit torques have been found in thin films that are stabilized in the A15 (β-phase) structure. Here we report, using spin transfer torque ferromagnetic resonance, large spin Hall angles of up to ˜–0.5 by incorporating oxygen into tungsten films. Whilst the incorporation of oxygen into the tungsten leads to significant changes in its microstructure and electrical resistivity, the large spin Hall angles measured are found to be remarkably insensitive to the oxygen doping level (12-44%). This invariance of the spin Hall angle with the bulk W(O) properties for higher oxygen concentrations suggests that the spin orbit torques in this system may actually be partly interfacial in origin, and induced by scattering of the electrons at the W(O) |CoFeB interface rather than from the interior of the W(O) film. Our results show an intriguing novel path towards enhanced spin orbit torques.

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