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Large Spin Hall Angle in Vanadium Film TAO WANG, Department of Physics and Astronomy, University of Delaware, Newark, DE 19716 USA, XIN FAN, Department of Physics and Astronomy, University of Denver, Denver, CO 80208 USA, WENRUI WANG, Department of Physics, University of Illinois, Urbana, IL 61801 USA, YUNSONG XIE, MUHAMMAD A. WARSI, JUN WU, YUNPENG CHEN, Department of Physics and Astronomy, University of Delaware, Newark, DE 19716 USA, VIRGINIA O. LORENZ, Department of Physics, University of Illinois, Urbana, IL 61801 USA, JOHN Q. XIAO, Department of Physics and Astronomy, University of Delaware, Newark, DE 19716 USA — We report the large spin Hall angle observed in Vanadium film with small grain size and distorted lattice parameter. The spin Hall angle is quantified by measuring current-induced spin-orbit torque in V/CoFeB bilayer using optical spin torque magnetometer based on polar magneto-optical Kerr effect (MOKE). The spin Hall angle as large as θ_{SH} =-0.071 has been observed in V/CoFeB bilayer Structural analysis, using X-ray diffraction (XRD), transmission electron microscopy (TEM) and selected area electron diffraction (SAED), confirms films grown at room temperature have very small grain size and enlarged lattice parameter. The Vanadium films with distorted crystal structure also have high resistivity (>200 $\mu\Omega\bullet$cm) and long spin diffusion length (˜16.3 nm) measured via spin pumping experiment. This finding of spin Hall effect enhancement in more disordered structure will provide insights for understanding and exploiting materials with strong spin orbit interaction, especially in light 3d transition metals which promise long spin diffusion length.

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