Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Strain-Tunable Magnetocrystalline Anisotropy in Epitaxial $Y_3Fe_5O_{12}$ Thin Films HAILONG WANG, CHUNHUI DU, P. CHRIS HAMMEL, FENGYUAN YANG, The Ohio State University — Magnetocrystalline anisotropy plays an essential role in many applications and there is intense interest in understanding the role of magnetoelastic coupling in phonon-magnon interactions in thermal spintronics. It is important to understand magnetocrystalline anisotropy in the presence of lattice distortion induced by epitaxial strain and the underlying magnetization-lattice coupling. $Y_3Fe_5O_{12}$ (YIG) has been widely used in microwave applications and spin pumping. Most YIG epitaxial film fabrication has employed $Gd_3Ga_5O_{12}$ (GGG) substrates with nearly perfect lattice match. In order to probe the magnetocrystalline anisotropy and control magnetization by epitaxial strain in epitaxial YIG films, we grow YIG epitaxial thin films on (001)-oriented $Y_3Al_5O_{12}$ (YAG) substrate with -3.0% lattice mismatch. We demonstrate strain-tuning of magnetocrystalline anisotropy over a range of more than one thousand Gauss in epitaxial YIG films of excellent crystalline quality grown on YAG substrates. Ferromagnetic resonance (FMR) measurements reveal a linear dependence of both out-of-plane and in-plane uniaxial anisotropy on the strain-induced tetragonal distortion of $Y_3Fe_5O_{12}$. Importantly, we find the spin mixing conductance determined from inverse spin Hall effect and FMR linewidth broadening remains large in Pt/YIG/YAG heterostructures, quite comparable to the value found in Pt/YIG grown on lattice-matched GGG substrates.

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Date submitted: 15 Nov 2013 Electronic form version 1.4