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Origins of Damping in Ultra-Thin Ferromagnetic Films LEI LU, ZIHUI WANG, GRIFFIN MEAD, MINGZHONG WU, CHRISTIAN KAISER, QUNWEN LENG, DEPARTMENT OF PHYSICS, COLORADO STATE UNIVERSITY, FORT COLLINS, CO 80523, USA TEAM, WESTERN DIGITAL CORPORATION, MHO, 44100 OSGOOD ROAD, FREMONT, CA, USA COLLABORATION
— Identification of physical damping processes in magnetic materials is critical to the understanding and control of magnetization dynamics in these materials. This presentation reports on the identification and quantization of damping processes in a 7 nm-thick Ni-Co-Fe alloy film with a nonmagnetic metallic cap layer. The work was done through the use of ferromagnetic resonance (FMR) measurements and numerical analysis. The FMR measurements utilized shorted waveguides and waveguide cavities and were carried out for a wide range of polar angles from -25 $^\circ$ to 95 $^\circ$ and a wide frequency range from 8 GHz to 18 GHz. The results indicate that the FMR linewidth consists of a large contribution from Gilbert-type damping, a small contribution from grain-to-grain two magnon scattering, and a very small component from inhomogeneity line broadening. The obtained Gilbert damping constant is slightly larger than the intrinsic damping constant generally accepted for transition metals. The intrinsic damping is mainly associated with magnon-electron scattering processes. The small addition to the intrinsic damping is believed to be a result of the spin pumping effect.

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