Abstract Submitted for the MAR06 Meeting of The American Physical Society

The Periodic Table of Damping in Doped Permalloy Thin Films JAMES RANTSCHLER, NIST, DEEPTHI PULUGURTHA, GWU, LAWRENCE MATTHEW CONNORS, Rice Univ., ANDREW CHEN, AUDI CASTILLO, ALEXANDER SHAPIRO, WILLIAM EGELHOFF, JR., ROBERT MCMICHAEL, BRIAN MARANVILLE, NIST — In a survey of thin film Permalloy doped with transition metals, we have constructed a periodic table of damping. We have cosputtered 25 nm Permalloy films with twenty-one different dopants (Ti, V, Cr, Mn, Co, Cu, Zr, Nb, Mo, Ru, Rh, Pd, Ag, Hf, Ta, W, Re, Os, Ir, Pt, and Au) with at least ten cocnetrations. We measured damping with ferromagnetic resonance spectroscopy (FMR) and concentration with energy dispersive x-ray spectroscopy. Outof-plane rotation FMR experiments were used to separate the extrinsic linewidth contributions produced by inhomogeneities in the sample from the intrinsic damping of the material. In all samples, doping increased damping, but the effect varied considerably. Trends in the periodic table include larger damping for the heavier elements and larger damping when the d shells are half-full. When using the dimensionless damping parameter of the Landau-Lifshitz-Gilbert equation to describe magnetization dynamics, undoped Permalloy is generally found to have a damping parameter of 0.008. In this study doping increased the damping parameter in all cases; the weakest effects were as little as 0.0001 per atomic percent of copper or silver, while the largest effect was measured to be 0.006 per atomic percent of osmium.

> James Rantschler National Institute of Standards and Technology

Date submitted: 23 Nov 2005

Electronic form version 1.4