4-15-1997

# In-situ ellipsometric control of magnetic multilayer deposition (abstract)

Xiang Gao
*University of Nebraska-Lincoln*

Scott Heckens
*University of Nebraska-Lincoln*

John A. Woollam
*University of Nebraska-Lincoln*, jwoollam1@unl.edu

# *In-situ* ellipsometric control of magnetic multilayer deposition (abstract)

Xiang Gao,[a] Scott Heckens, and John A. Woollam
*Center for Microelectronic and Optical Materials Research, and Department of Electrical Engineering, University of Nebraska, Lincoln, Nebraska 68588-0511*

Correct determination of layer thicknesses on a subnanometer scale is crucial for studies of giant magnetoresistance, magneto-optical (MO) Kerr rotation, magnetic interlayer coupling, and other magnetic properties of metallic multilayers. Some structures such as [Co/Ni] and [Co/Pt] with fewer than 20 repeats are difficult to be analyzed by x-ray diffraction (XRD) due to too little material. In this work, *in-situ* spectroscopic ellipsometry (*in-situ* SE) is used to precisely determine the optical constants undisturbed by oxidation, and the growth rates of different metal films deposited in a sputtering chamber. *In-situ* SE determines both the constant and continuously changing growth rates during deposition of individual layers. SE data were also taken during multilayer thin-film growth, from which we determine the individual layer thicknesses in the superlattice to a fraction of an angstrom. The *in-situ* SE data and ellipsometric analysis of [Co/Au] and [Co/Ni] multilayers on thick gold-coated silicon, and [Co/Pt] multilayers with a Pt underlayer are presented. Less than a few percent difference was found by comparing the XRD thickness results to the *in-situ* SE thickness results. *In-situ* SE permits studies of oxidation kinetics, important because oxidation strongly influences both the magnetic and MO results. Specifically, spectroscopic MO Kerr rotation, ellipticity, and figure of merit of [Co/Ni] and [Co/Pt] multilayers with different repeat structures, with and without capping layers are reported covering the spectral range from ultraviolet to near infrared.  [S0021-8979(97)82608-4]

---

Research supported by NSF Grant Nos. OSR-9255225 and DMR-9222976.
[a]Electronic mail: xgao@engrs.unl.edu