

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Faculty Publications from the Department of
Electrical and Computer Engineering

Electrical & Computer Engineering, Department of

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

Follow this and additional works at: <http://digitalcommons.unl.edu/electricalengineeringfacpub>



Part of the [Electrical and Computer Engineering Commons](#)

Gao, Xiang; Heckens, Scott; and Woollam, John A., "In-situ ellipsometric control of magnetic multilayer deposition (abstract)" (1997). *Faculty Publications from the Department of Electrical and Computer Engineering*. 63.
<http://digitalcommons.unl.edu/electricalengineeringfacpub/63>

This Article is brought to you for free and open access by the Electrical & Computer Engineering, Department of at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Faculty Publications from the Department of Electrical and Computer Engineering by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

***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. © 1997 American Institute of Physics. [S0021-8979(97)82608-4]

Research supported by NSF Grant Nos. OSR-9255225 and DMR-9222976.

^{a)}Electronic mail: xgao@engr.unl.edu

Exchange decoupling of grains in polycrystalline CoPt alloy films (abstract)

J. HeimeI and Th. Kleinefeld^{a)}

Universitaet Duisburg, FB 10/Angewandte Physik, D-47048 Duisburg, Germany

D. Weller

IBM Almaden Research Center, San Jose, California

Thin films of CoPt alloys in the thickness range of 5–50 nm were investigated using magnetic and nanostructural characterization methods. These compounds are suitable candidates for magnetic and magneto-optic recording applications due to their excellent perpendicular anisotropy and stability of very small magnetic domains in the nanometer regime. We have intensively studied the influence of thermal treatment on the magnetic behavior as well as on the nanostructure of the alloy films. The films were prepared under UHV conditions at elevated substrate temperature. X-ray measurements reveal a preferential fcc (111) texture with very small dispersion of the *c* axes. From scanning tunneling microscopy studies a typical grain size of the order of 10–20 nm was determined. The as-grown films exhibit only little surface roughness. MOKE measurements and domain visualization by means of Kerr microscopy reveal an almost perfect perpendicular magnetic orientation. © 1997 American Institute of Physics. [S0021-8979(97)82708-9]

^{a)}Electronic mail: theo@kleemann.uni-duisburg.de