Abstract for paper presented at
5th International Conference on the Physics of X-Ray Multilayers
Chamonix, France, 5-9 March 2000
LBNL-46288 Abs.

Soft x-ray characterization of structural and magnetic heterogeneity in thin films and multilayers

Eric E. Fullerton,[1] Gabriel Zeltzer,[1] Kentaro Takano,[1] Dieter Weller,[1]
J. B. Kortright,[2] Sang-Koog Kim[2]
[1]IBM Almaden Research Center, 650 Harry Road,
San Jose, CA 95120 USA
[2]Materials Science Division, Lawrence Berkeley National Laboratory,
Berkeley, CA 94720 USA

The element-specificity of resonant magneto-optical effects near core levels in the x-ray range offers numerous opportunities to study the structure and magnetism in thin films and multilayers. By combining reflectivity and small-angle scattering (SAS), variations in both the structural and magnetic properties of heterogeneous films can be determined. At the 1-2 nm wavelengths of interest, SAS is readily measured from lateral inhomogenieties with dimensions comparable to or greater than these wavelengths. In this talk we report recent SAS results obtained from magnetic thin films and multilayers of interest for magnetic storage. The SAS experiments were performed at the Advanced Light Source and provide a quantitative approach to obtain statistically averaged structural parameters such as average grain size and grain-size distributions. By tuning near resonances of selected elements, the scattering contrast can be enhanced and element specific information (both structural and magnetic) determined. These approaches are applied to explore the chemical segregation in CoPtCrB recording media and FePt and TbFeCo films. In appropriate geometries, resonant SAS also arises from magnetic domains. Examples of magnetic scattering from perpendicular $CoPt_3$ films and Co/Pt multilayers will be presented and correlated to atomic and magnetic force microscopy images.

Work at LBNL was supported by the U.S. Department of Energy, Office of Basic Energy Sciences, Materials Sciences Division, Contract No. DE-AC03-76SF00098.