Uniaxial Synthetic Antiferromagnetic Films
Z. Zhao\textsuperscript{a}, P. Mani\textsuperscript{a}, W.-T. Lee\textsuperscript{b}, Chengtao Yu\textsuperscript{c} and G. J. Mankey\textsuperscript{a}
\textsuperscript{a}MINT Center and Department of Physics and Astronomy, The University of Alabama
\textsuperscript{b}Spallation Neutron Source, Oak Ridge National Laboratory
\textsuperscript{c}Department of Physics, Miami University

This project was funded by NSF-DMR 0213985.

Abstract

Synthetic antiferromagnetic structures have been studied extensively due to their application in recording media, read head and magnetic random access memory. In addition, anisotropy is an important parameter for controlling magnetization in magnetic devices and determining the upper limit of susceptibility in magnetic thin films. In this project, Uniaxial anisotropy was induced by a obliquely sputtered Ta underlayer in Uniaxial Synthetic Antiferromagnetic (USA) structures.

Ir and Ru were selected as spacer materials since Ru and Ir have the strongest coupling force. These results show that Ru has a stronger coupling force through a broader thickness range than Ir.

Angular dependence anisotropy distribution measured by FMR.

USA Sample Preparation Diagram

1. USA structures have been successfully made.
2. Strong uniaxial anisotropy and antiferromagnetic coupling were observed in USA structures.
3. Structure origin of the anisotropy was revealed by AFM image of Ta underlayer.
4. Critical field shows a dependence on top Co layer thickness.

Conclusion

(a) Comparison of experimental remanence with a calculation which only considers bilinear coupling. The difference is due to biquadratic coupling.

(b) Dependence of easy axis critical fields Hc1 and Hc2 on top layer Co thickness. The dotted line is a fit to a minimize energy model.

For more information and reprints contact: Zhiya Zhao, MINT Center.
E-mail: zhao002@bama.ua.edu