MATERIALS RESEARCH SOCIETY
Advancing materials. Improving the quality of life.

Program - Symposium HH: Nanocomposites, Nanostructures, and Heterostructures of Correlated Oxide Systems

2012 MRS Spring Meeting & Exhibit

April 9 - April 13, 2012
Moscone West Convention Center | Marriott Marquis - San Francisco, California-

2012-04-09

Symposium HH

Show All Abstracts

Symposium Organizers

- Tamio Endo, Mie University Graduate School of Engineering
- Kazuhiro Endo, Kanazawa Institute of Technology
- Anand Bhattacharya, Argonne National Laboratory Materials Science Division and the Center for Nanoscale Materials
- Lane W. Martin, University of Illinois, Urbana-Champaign
- Nobuyuki Iwata, Nihon University College of Science and Technology

Support

- Japan Society of Applied Physics (JSAP)

- **Tutorial HH: Oxide Heterostructures and Nanostructures—Fabrication, Properties, Magnetic Coupling, and Applications**
- Monday AM
- April 9, 2012
- Moscone West, Level 2, Room 2011

2012-04-10

Symposium HH

Show All Abstracts

Symposium Organizers

- Tamio Endo, Mie University Graduate School of Engineering
- Anand Bhattacharya, Argonne National Laboratory Materials Science Division and the Center for Nanoscale Materials
- Lane W. Martin, University of Illinois, Urbana-Champaign
- Nobuyuki Iwata, Nihon University College of Science and Technology
- Hiroaki Nishikawa, Kinki University

Support

- Japan Society of Applied Physics
  Sigma-Aldrich

HH1: Nanostructures

- Chair: Tamio Endo
- Chair: Josep Nogues
- Tuesday AM, April 10, 2012
- Moscone West, Level 3, Room 3001

8:00 AM - *HH1.1

Magnetization Reversal in Nanostructures with Graded Perpendicular Anisotropy

Peter K Greene1, Dustin A Gilbert1, Brian J Kirby2, Julie A Borchers2, June W Lau2, Chih-Huang Lai3, Julia Osten4, Juergen Fassbender4, Joseph E Davies5, Michael R Fitzsimmons6, Kai Liu1.

1, Physics, University of California, Davis, California, USA; 2, , NIST, Gaithersburg, Maryland, USA; 3, Materials Science and Engineering, National Tsing Hua University, Hsinchu, Taiwan; 4, HZDR, Institute of Ion Beam Physics and Materials Research, Dresden, Germany; 5, , NVE Corp, Eden Prairie, Minnesota, USA; 6, , Los Alamos National Laboratory, Los Alamos, New Mexico, USA.

Hide Abstract

Magnetic nanostructures with graded anisotropy offer a solution to both thermal stability and writability challenges in advanced magnetic recording media. The interlayer exchange coupling lowers the overall coercivity, facilitating the writing process, while the magnetically hard layer provides pinning for the media and ensures its thermal stability. Magnetization reversal in such materials can be influenced by both the magnetic anisotropy gradient along the film depth and the lateral feature size. We have explored magnetization reversal in Co/Pd films and patterned structures. Perpendicular magnetic anisotropy is varied by changing the Co thicknesses or sputtering pressure during growth. Effects of deposition order and ion irradiation have been studied by x-ray diffraction, transmission electron microscopy, magnetometry, and first-order reversal curves. Structural integrity and amount of disorders are found to sensitively influence the magnetic properties. Reversal in highly ordered films is dominated by nucleation, propagation, and annihilation of domain walls while in disordered films magnetization reversal is largely by domain wall pinning and magnetization rotation. Depth-dependent magnetization profiles and magnetic anisotropy have been confirmed by polarized neutron reflectivity. Effects of lateral patterning have been investigated in patterned nanodots (down to 60nm diameter). An increase in coercivity and a modified switching field distribution are observed in patterned structures. This is due to the reduced lateral dimensions which limit the domain nucleation and propagation commonly found in unpatterned films. These results demonstrate attractive features of nanostructures with graded anisotropy towards future magnetic recording applications. This work has been supported by the US NSF (DMR-1008791 & ECCS-0925626).