

Mechanism of Magnetic Anisotropy and Its Temperature Dependence:**Alternative Recording and Permanent Magnet Materials****Oleg Mryasov**Department of Physics and Astronomy, University of Alabama,
MINT Center, University of Alabama

Magnetic recording technology and permanent magnet applications demand alternative magnetic materials with improved magnetic anisotropy energy (MAE) and its temperature dependence. Rapidly decreasing grain size of data storage media requires large anisotropy within the corrosion resistive material set with suitable temperature dependence. Permanent magnet for electric vehicle (EV) and wind turbine applications are facing severe challenges due to limited availability, pricing and environmental hazard of mining rare-earth materials (RE).

In this presentation I focus on mechanisms of MAE and its temperature dependence for two classes of materials (i) M-X where M=(Fe, Co), X= (Pt, Pd) and (ii) Mn-Y where Y=(Al, Bi). To gain necessary understanding of MAE and its temperature dependence we employ multi-scale modeling approach which combines a microscopic model of the magnetic interactions and statistical modeling/theory techniques [1,2]. The microscopic model of the magnetic interactions is tested against measurements of the temperature dependent magnetic properties for nano-particulate and granular FePt thin films [3] including MnBi with anomalous dependencies [4]. I conclude with summary of examples for calculations of complete set of material parameters (T_c, A, M_s, K) needed to guide search/development of alternative materials for discussed applications.

References:

- [1]. O. N. Mryasov , U. Nowak, K. Guslienko, R.W. Chantrell EuroPhysics Letters, 69(5), 805 (2005).
- [2]. O.N. Mryasov, Journal of Magnetism and Magnetic Materials, v. 272-276, p.800, (2004). O.N. Mryasov et al., JPCM 3, 7683-7690 (1991); O.N. Mryasov, et al., PRB 45, 12330 (1992).
- [3]. S. Okamoto et al. Phys. Rev. B, 66, 024413 (2002); J. U. Thiele et al., J. Appl. Phys. 91, 6595 (2002).
- [4]. X.Guo et al., Phys. Rev. B. 46, 1478 (1992).

Bio: Dr. Oleg N. Mryasov is an Associate Professor of Physics. He received his doctoral degree in Solid State Physics from Russian Academy of Sciences in 1993 and performed postdoctoral research from 1993 to 1999 at Northwestern University, IL. Dr. Mryasov joined the University of Alabama faculty in 2009. His research focuses on the microscopic theory of fundamental magnetic interactions (magnetic anisotropy, exchange coupling) in metals, intermetallics and metal insulator hetero-structures, spin dependent transport in artificially layered nanostructures including high-spin-polarization materials (Heusler alloys) and magnetic tunneling junctions based on ordinary and multi-functional oxides. Dr. Mryasov research interests include fundamentals of large magnetic anisotropy materials, multi-scale models of static and dynamic properties of nano-magnets, theory of extended lattice defects, fundamentals of multi-functional materials such as transparent-conductors, magnetic semiconductors, ferroelectric materials and theory of extended lattice defects.

Dr. Mryasov has authored and coauthored more than 70 scholarly papers, one book chapter and 4 US patents.

Hosted by: Prof. Eric E. Fullerton

Please observe the "No Food or Drink in the Auditorium" policy.