Magnetism and microstructure: Challenges and opportunities for electron microscopy

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Frontiers in Chemical Imaging
Seminar Series

Presented by

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Abstract

There has been a renaissance in magnetism and magnetic materials research on the nanometer length scale, driven by discovery of new phenomena, advanced characterization and fabrication capabilities, their demonstrated impact in information storage as well as opportunities in spintronics, energy-conversion and biomedical technologies. Size-dependent scaling laws, exchange, proximity and interface effects, and studies of spin transport are increasingly of fundamental and technological interest. Over the past two decades, my research group has pioneered work in magnetic materials, broadly, in three areas. In *biomedical nanomagnetics* we have been developing multifunction platforms for therapy, diagnostics and imaging based on functionalized, biocompatible, theranostic magnetic nanoprobes. Central to this work are innovations in chemical synthesis of nanoparticles, their size-dependent magnetic properties and specifically tailoring their relaxation dynamics, both Néel and Brownian, to specific applied frequencies. We have also extensively studied *ultrathin magnetic heterostructures* that show a richness in magnetic behavior driven, in part, by exchange, interface, proximity, size and dimensionality effects. Specifically, we work on exchange-bias and exchange-spring behavior in epitaxial thin films and patterned elements. Finally, we have worked on understanding the origin of ferromagnetism in doped transition-metal oxides and identified a new class of such materials, *dilute magnetic dielectrics*. In light of the recent developments at PNNL, following a summary of our work in this wide range of magnetic materials and plans for the future, this talk will explore some of the key unresolved questions, of both fundamental and technological interest, that may provide opportunities for future collaborative research in chemical imaging and electron microscopy.

Bio

Prof. Krishnan was educated at IIT, Kanpur (B.Tech.,1978), SUNY, Stony Brook (MS,1980) and UC, Berkeley (Ph.D., 1984). After graduation, he held various scientific and teaching positions at LBNL and UCB, before joining the University of Washington, in 2001, as the Campbell Chair Professor of Materials Science. Prof. Krishnan's current research focus is broadly in two major, inter-related themes: (i) *Bioengineering* at the intersection of Magnetism, Materials and Medicine focusing on diagnostics, imaging and therapy, with appropriate translational research and commercialization activities. (ii) *Materials Science* with emphasis on nanoscale magnetic and transport (both charge and spin) phenomena in reduced dimensions, including their inter-coupling and structure-property correlations at relevant length scales, to develop new paradigms for materials and devices in the context of novel information (storage, processing and logic) and energy technologies.

Prof. Krishnan is highly recognized for research, teaching, mentoring and entrepreneurship. His three most recent awards are the IEEE Fink Prize (2012), Fulbright Specialist Award (2010) and the IEEE Magnetics Society Distinguished Lecturership (2009). He has also received the UW College of Engineering Outstanding Educator Award (2004), and has just completed the first draft of a comprehensive book, entitled "*Fundamentals and Applications of Magnetic Materials*" (Oxford University Press, to be published, 2013). He has received the Guggenheim (2004) and Rockefeller (2009) fellowships and is a Fellow of the AAAS, the APS and the IoP (London). Recently in 2010, along with two graduate students, he has founded a biomedical company, LodeSpin Labs.

Wednesday

August 8, 2012

9:00 am

EMSL Auditorium

More Info:
https://faculty.washington.edu/kannanmk/

Host: Nigel Browning – 375-7569
POC: Lacy Elsner – 371-6483