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13:00, Friday, May 17, 2019
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Tuning magnetic anisotropy in nanostructures for biomedical and electromagnetic applications

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Outline

Magnetic nanoparticles have been building blocks in applications ranging from high density recording to spintronics and nanomedicine [1]. Magnetic anisotropies in nanoparticles arising from surfaces, shapes and interfaces in hybrid structures are important in determining the functional response in various applications. In this talk I will first introduce the basic aspects of anisotropy and discuss resonant RF transverse susceptibility, that we have used extensively, as a powerful method to probe the effective anisotropy in magnetic materials. Tuning anisotropy has a direct impact on the performance of functional magnetic nanoparticles in biomedical applications such as contrast enhancement in MRI and magnetic hyperthermia cancer therapy. I will focus on the role of tuning surface and interfacial anisotropy with a goal to enhance specific absorption rate (SAR) or heating efficiency. Strategies going beyond simple spherical structures such as exchange coupled core-shell nanoparticles, nanowire, nanotube geometries can be exploited to increase heating efficiency in magnetic hyperthermia [2,3]. In addition to biomedical applications, composites of anisotropic nanoparticles dispersed in polymers pave the way to a range of electrically and magnetically tunable materials for RF and microwave device applications [4]. This lecture will combine insights into fundamental physics of magnetic nanostructures along with recent research advances in their application in nanomedicine and electromagnetic devices.

References:

[1] E.A. Périgo et al., "Fundamentals and advances in magnetic hyperthermia", *Appl. Phys. Rev.* vol. 2, 041302 (2015)
[2] Z. Nemati et al., "Core-shell iron/iron oxide nanoparticles: Are they promising for magnetic hyperthermia?", *RSC Advances* vol. 6, 38697 (2016)
[3] H. Khurshid et al., "Tuning exchange bias in Fe/γ-Fe_2O_3 core-shell nanoparticles: Impacts of interface and surface spins", *Appl. Phys. Lett.* vol. 104, 072407 (2014)
[4] K. Stojak et al., "Polymer nanocomposites exhibiting magnetically tunable microwave properties", *Nanotechnology* vol. 22, 135602 (2011)

Biography

Hari Srikanth is a Professor of Physics at the University of South Florida in Tampa, FL. He received his Ph.D. in experimental condensed matter physics from the Indian Institute of Science. After postdoctoral research for several years, Hari joined USF in 2000 and established the Functional Materials Laboratory. His research spans a wide range of topics including magnetic nanoparticles, magnetic refrigerant materials, spin calorics and complex oxides. He has around 250 journal publications and given numerous invited talks. Hari is a *Fellow of the American Physical Society* and a *Senior Member of IEEE*. He is also an Associate Editor for *Journal of Applied Physics*. Hari has been closely involved with the MMM and INTERMAG conferences for more than 15 years serving as Publication Editor, Publication Chair and on program committees.