

CONFERENCIA

Tuning Magnetic Anisotropy in Nanostructures for Biomedical and Electromagnetic Applications

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Magnetic nanoparticles have been building blocks in applications ranging from high density recording to spintronics and nanomedicine. 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 radio-frequency (RF) transverse susceptibility, which we have used extensively, as a powerful method to probe the effective anisotropy in magnetic materials. The tuning of anisotropy has a direct impact on the performance of functional magnetic nanoparticles in biomedical applications such as contrast enhancement in magnetic resonance imaging and magnetic hyperthermia for cancer therapy. I will focus on the role of tuning surface and interfacial anisotropy with a goal to enhance specific absorption rate or heating efficiency. Strategies going beyond simple spherical structures to include exchange coupled core-shell nanoparticles, nanowires, and nanotubes, can be exploited to increase heating efficiency in magnetic hyperthermia. 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. This lecture will combine insights into fundamental physics of magnetic nanostructures along with recent research advances in their application to nanomedicine and electromagnetic devices.



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