University of Minnesota
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Department of Chemistry

Seminar

9:45 a.m. Tuesday, April 30 • 331 Smith Hall

Professor

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Multifunctional Mesoporous Silica Nanoparticles Controlled by Nanomachines for *In Vitro* and *In Vivo* Drug Delivery

Research interest focuses on understanding the properties of metal-containing molecules in excited electronic states. One important area of investigation is the determination of excited state geometries.
Website: http://www.chemistry.ucla.edu/directory/zink-jeffrey-i

Abstract

Mesoporous silica nanoparticles (particle diameter ~ 50 nm, pore diameter ~ 2 nm) are derivatized with molecules designed to induce multiple functionality. The most important functionality is the ability to trap molecules in the pores and release them in response to specific stimuli and/or on external command by using molecular machines. Other functions highlighted in this talk include incorporation of smaller metal nanocrystals (for magnetic heating, resonance imaging and/or manipulation), targeting molecules (towards specific cells), and fluorescence (for imaging).[1] Two types of molecular machines that are based on molecules that undergo large amplitude motion when attached to mesoporous silica are described: impellers and valves. Derivatized azobenzene molecules, attached to the interior pore walls function as impellers that can move other molecules through the pores. Nanoparticles containing toxic molecules in the mesopores are taken up by cancer cells, and optical stimulation of the impellers drives out the toxic molecules and kills the cells. Nanovalves consisting of rotaxanes and pseudorotaxanes, placed at pore entrances, can trap and release molecules from the pores in response to stimuli. Two methods of activation that have been demonstrated for *in vitro* studies will be discussed: pH changes and oscillating magnetic fields. Lysosomal acidification causes self-opening of the valves, and externally applied magnetic fields affords external control. Activation by both of these methods in living cancer cells will be discussed.

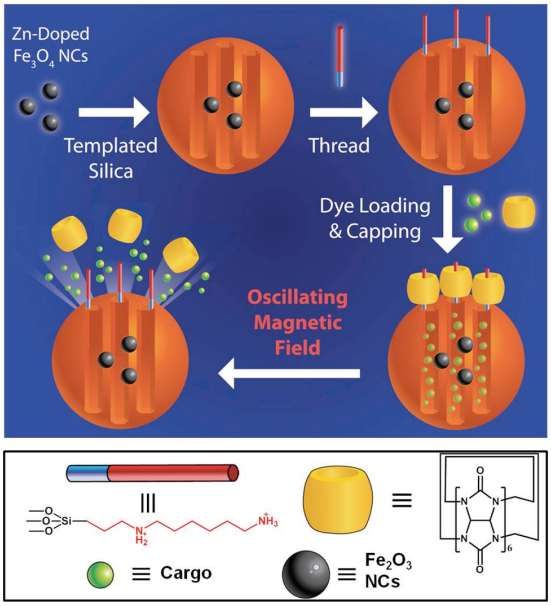

Figure: Schematic depiction of dye-loaded magnetic-core mesoporous silica nanoparticles functionalized with nanovalves that respond to internal heating caused by an oscillating magnetic field.

1. Z. Li, J.C. Barnes, A. Bosoy, J.F. Stoddart and J.I. Zink. "Mesoporous silica nanoparticles in biomedical applications," *Chem. Soc. Rev.*, 41, 2590-2605 (2012)

Host: Christy Haynes
Refreshments will be served prior to the seminar.