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### **Multifunctional Nanostructured Silica: Monoliths, Films and Particles.**

Mesostructured silica thin films and particles prepared by surfactant-templated sol-gel techniques are highly versatile substrates for the formation of functional materials. The ability to deliberately place molecules possessing desired activities in specific spatially separated regions of the nanostructure is an important feature of these materials. Such placement utilizes strategies that exploit the physical and chemical differences between the silica framework and the templated pores, and enables molecular machines to be synthesized.

Nanoparticles (particle diameter ~ 100 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 antimicrobial activity, magnetic resonance imaging and/or magnetic manipulation), targeting molecules (towards specific cells or microorganisms), and fluorescence (for imaging). “Theranostic” (therapy and diagnostic) applications of multifunctional nanoparticles involving anticancer drug delivery will be discussed.