

**BIO-HYBRID MATERIALS:  
DESIGNING SOL-GEL MATERIALS WITH BIOCHEMICAL PROPERTIES**

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The flexible solution chemistry of the sol-gel process has been used to synthesize bio-hybrid materials in which a wide variety of biomolecules are encapsulated in a transparent, inorganic matrix. It is now well established that the dopant biomolecules retain their characteristic reactivities and spectroscopic properties despite being immobilized in the pores of the inorganic matrix. These materials have been widely explored as sensors with the biomolecule serving as both the biorecognition and transduction elements while the transparency of the matrix enables spectroscopic monitoring of the reactions. This paper reviews some of our recent work where we are moving beyond the encapsulation of individual proteins and developing nanostructured systems and multi-functional materials. Examples to be discussed include architectures for biofuel cells and sol-gel derived materials that exhibit photo-induced proton pumping.