Tailoring chemical reactivity to sol-gel derived porous glasses

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The technology of sol-gel derived porous glasses allows the incorporation of organic and bioorganic molecules within ceramic materials. While traditionally this has been impossible, because of the very high temperatures employed in glasses, now the ability exists to alter the properties of inorganic oxide glassy materials and to create a very wide range of previously unknown functional materials by the sol-gel doping methodology. Indeed, many applications have been developed by this methodology in numerous laboratories, which cover many modern needs for optics, reactivity and other materials performance functionalities. In this lecture will highlight some recent developments in our laboratories which focus on the usefulness of these materials for tailoring desired chemical reactivity. Examples include the following topics: I. It has been demonstrated that by co-entrapping the dopant with suitable surfactant, one can get from a single dopant a whole library of chemical reactivities. Elaborate syntheses of molecules, which reveal the same range of reactivities, are thus saved. II. It has been demonstrated that the entrapment of reagents in these sol-gel porous glasses enables one to carry out simultaneously reactions which otherwise must be carried out as consecutive steps. In particular, this methodology enables one to put, in one-pot, reagents which are usually destructive to each other, such as acids and bases, and yet keep them active. III. We showed that these porous materials can act as sponges for medical applications and for toxic wastes. IV. By doping these glasses with enzymes, materials with novel bioactive performances are obtained. And finally, V. A wide variety of useful catalytic reactions employing entrapped organometallic complexes will be presented, emphasizing the unique features that sol-gel catalysts have over other methods of immobilization.

For references and additional information, see http://chem.ch.huji.ac.il/~david/index.html
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