THE PARTNERSHIP FOR INTERNATIONAL RESEARCH AND EDUCATION AT THE UNIVERSITY OF CALIFORNIA
ELECTRON CHEMISTRY AND CATALYSIS AT INTERFACES

pirecci
science crossing borders...

SEMINAR ANNOUNCEMENT

Potentials and Benefit of "Microscopic" Techniques of Diffusion Measurement in Nanoporous Materials

Jörg Kärger
Leipzig University, Faculty of Physics and Earth Sciences

Date: Wednesday, May 29, 2013
Place: Eng-II 1519
Time: 4:00PM

ABSTRACT

As an omnipresent phenomenon in nature, diffusion is among the rate-determining processes in many technological processes. This is in particular true for mass separation and catalytic conversion in nanoporous materials [1]. The talk illustrates the possibilities of exploring diffusion phenomena over microscopic dimensions in such media by direct experimental observation and provides some recent findings of such studies [2,3].

By monitoring the probability distribution of molecular displacements as a function of time, the pulsed field gradient technique of NMR (PFG NMR) records the rate of molecular re-distribution [4]. By varying the observation time, PFG NMR is thus able to trace even hierarchies of transport resistances as occurring, e.g., in catalyst particles in the form of compacted assemblages of zeolite crystallites [5]. Similarly, by tracing the diffusion paths of the guest molecules, PFG NMR provides direct evidence about the microdynamic phenomena giving rise to a shortcut in the diffusion resistance of a genuine micropore bulk phase owing to the presence of the mesopores in materials with hierarchical pore architecture [6].

Alternatively, and complementary to this information, the methods of micro-imaging, notably interference microscopy (IFM) and IR microscopy (IRM), are able to follow the evolution of intracrystalline concentration profiles during uptake and release [7,8], with IRM even separately for all molecular species involved [2,9]. This allows, in particular, an accurate quantification of the transport resistances on the surface of the individual crystallites [10]. Simultaneously, measurements of this type allow to directly determine the probability that reactant molecules from the gas phase, upon colliding with the external surface, are able to penetrate through such ''surface barriers'' into the crystal bulk phase [8,11], as an equivalent of the sticking coefficient of molecules on metal surfaces.

Refreshments will be served before the seminar