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Surface self-diffusion of organic molecules adsorbed in porous silicon

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Abstract

The pulsed field gradient nuclear magnetic resonance method has been employed to probe self-diffusion of organic guest molecules adsorbed in porous silicon with a 3.6 nm pore size. The molecular self-diffusion coefficient and intrapore adsorption were simultaneously measured as a function of the external vapor pressure. The latter was varied in a broad range to provide pore loading from less than monolayer surface coverage to full pore saturation. The measured diffusivities are found to be well-correlated with the adsorption isotherms. At low molecular concentrations in the pores, corresponding to surface coverages of less than one monolayer, the self-diffusion coefficient strongly increases with increasing concentration. This observation is attributed to the occurrence of activated diffusion on a heterogeneous surface. Additional experiments in a broad temperature range and using binary mixtures confirm this hypothesis. © 2005 American Chemical Society.

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