

## **Dynamics of plastic and liquid cyclohexane in bulk and in porous glasses studied by NMR methods**

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### **Abstract**

Cyclohexane was investigated both in bulk and in porous glasses with pore diameters between 4 and 208 nm in the temperature range  $136 \text{ K} \leq T \leq 300 \text{ K}$ . The methods involved were field-cycling NMR relaxometry, field-gradient NMR diffusometry, transverse-relaxation spectroscopy, and differential scanning calorimetry (DSC). The field-cycling data for the bulk material can best be described assuming translational modulation of intermolecular dipole-dipole coupling. This interpretation is confirmed by experiments with different degrees of deuteration, and is in accordance with diffusion coefficients determined with the aid of field-gradient diffusometry. The confinement in pores produces substantial changes in the phase behaviour and in molecular dynamics. For pore diameters of 30 nm and above, a non-frozen two monolayers thick film on the surface retains a diffusivity about one order of magnitude lower than in the bulk liquid, but two orders of magnitude larger than in the bulk plastic phase. Experiments indicate an exchange mechanism between this layer and the crystallite inside the pore. In glass with a pore diameter of 4 nm, all applied methods corroborate DSC results of the virtual absence of a phase transition and reveal a continuously decreasing translational mobility down to temperatures more than 100 K below the bulk liquid/cubic phase transition temperature. © Springer-Verlag 1997.

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