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Diffusive and Rotational Dynamics of Condensed n-H_2 Confined in MCM-41[1] PAUL SOKOL, MATTHEW BRYAN, Indiana University, TIMOTHY PRISK, Oak Ridge National Laboratory — We report neutron scattering studies of the condensed phases of normal-hydrogen confined within MCM-41. This is a high surface area, mesoporous silica glass with a narrow pore size distribution. The neutron scattering data suggests a picture of condensed normal-hydrogen within small mesopores in which the adsorbed hydrogen may be conceptually divided into an interfacial layer and the inner core volume. Preferential adsorption of ortho-hydrogen makes the interfacial layer rich in ortho-hydrogen, while the inner core volume consists of a depleted mixture of ortho- and para- hydrogen. In the liquid state, the hydrogen molecules making up the interfacial layer are immobile and tightly bound to adsorption sites, unable to diffuse on picosecond time scales. Molecules within the inner core volume undergo liquid-like jump diffusion, but with residence times much longer than the bulk fluid. In the solid state, only the hydrogen molecules occupying the inner core volume show the free quantum rotor behavior characteristic of the bulk crystal. The ortho-hydrogen molecules bound to the pore walls experience an orientational hindering potential which perturbs their rotational energy levels. Comparison with Vycor suggests the pore walls of MCM-41 are smoother on the atomic-scale.

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