Phase Behavior and Dynamics of Fluids in Mesoporous Glasses: Understanding Hysteresis

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Fluids confined in disordered mesoporous glasses are studied by Monte Carlo simulations of a lattice model. Macroscopic phase separation is suppressed to low temperatures as the strength of the fluid-solid attraction increases, and the system shows unusually slow relaxation dynamics, consistent with the random-field Ising picture. The relaxation time of the system associated with typical adsorption experiments is estimated by rescaling the relaxation time of the Glauber dynamics simulations with the characteristic time of diffusive relaxation. The calculations provide a basis for understanding the reproducibility of hysteresis loops encountered in adsorption/desorption experiments and further support the recent applications of mean-field theory to the calculation of hysteresis in these systems.