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Fluid Phase Equilibria in Geometrically Disordered Mesoporous Materials

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Mesoporous solids exhibit structural disorder which strongly influences confined fluid properties. This renders quantification of structural disorder and its correlation with physical properties of confined matter a necessary step towards their optimization in practical applications. In this work, we present advances made in the understanding of correlations between the phase state and geometric disorder in nanoporous solids. We overview the recently developed statistical theory for phase transitions in a minimalistic model of disordered pore networks represented by the linear chains of pores with statistical disorder. Furthermore, we show that correlating its predictions with various experimental observations, the model gives notable insight into collective phenomena in phase-transition processes in disordered materials and is capable of explaining self-consistently the majority of the experimental results obtained for gas–liquid and solid–liquid equilibria in mesoporous solids. We also show how a newly-introduced interconnectivity parameter of the pore network can be assessed to describe the morphology of porous solids.

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