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Condensation, Imbibition and Crystallization of Molecular Liquids in Nanoporous Solids

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Vapor-condensation and capillarity-driven, spontaneous imbibition allow one to fill nanoporous media in a controlled manner with molecular liquids. We present experimental studies on the dynamics of these filling processes for a variety of porous media (silicon, silica, and gold with pore diameters ranging from 2 to 100 nm). These experiments are aimed at an exploration of the rheology of nanoconfined liquids as a function of the complexity of their building blocks (hydrocarbons, liquid crystals, and water) (1,2,3). Temperature-dependent X-ray and neutron diffraction studies complement these non-equilibrium with equilibrium studies on the thermodynamics of the confined liquids, encompassing suppressed phase transitions (1), extremely supercooled (1,4) and textured crystalline states (4) as well as entirely new liquid crystalline phases (5).

- (1) P. Huber, *J. Phys.: Condensed Matter* 27, 103102 (2015).
- (2) S. Gruener, H.E. Hermes, B. Schillinger, S.U. Egelhaaf, P. Huber, *Coll. Surf. A* 496, 13 (2016).
- (3) Y. Xue, J. Markmann, H. Duan, J. Weißmueller, P. Huber, *Nat. Commun.* 5, 4237 (2014).
- (4) A. Henschel, P. Kumar, T. Hofmann, K. Knorr, and P. Huber, *Phys. Rev. E* 79, 032601 (2009).
- (5) M. Busch, A. V. Kityk, W. Piecek, T. Hofmann, D. Wallacher, S. Calus, P. Kula, M. Eich, and P. Huber, *Nanoscale* C7NR07273B (2017).

References

- (1) P. Huber, *J. Phys.: Condensed Matter* 27, 103102 (2015).
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Primary authors: SENTKER, Kathrin (Hamburg University of Technology); BUSCH, Mark (Hamburg University of Technology); Prof. HUBER, Patrick (Hamburg University of Technology)

Presenter: Prof. HUBER, Patrick (Hamburg University of Technology)

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