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Understanding wetting and drying of nanoporous media through optical and dilatometry experiments

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While imbibition kinetics are well-understood in nanoporous materials [1], their drying dynamics are still under investigation [2]. In this study, we present time-dependent macroscopic dilatometry experiments on the deformation of nanoporous monoliths upon spontaneous, capillarity-driven infiltration of water as well as drying. During both processes, we find characteristic dynamical regimes that can be quantitatively described in terms of Laplace pressure effects and changes in the surface stress at the inner pore walls [3]. In the particular case of transparent nanoporous Vycor glass, additional imaging experiments are conducted, allowing direct optical access to the filling front. The observed wetting-drying dynamics are consistent with our analysis of the strain regimes. Our study demonstrates that it is possible to monitor the interplay of imbibition and drying dynamics by simple dilatometry measurements, provided proper humidity control.

References:

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