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Wetting and Drying Dynamics in Hierarchically Porous Silicon: An In-Situ X-Ray Microscopy Study

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Hierarchical porosities consist of small, often nano-scaled pores as well as large, macroscopic pores to simultaneously achieve large inner surfaces in combination with optimized mass transport. The investigation of the capillary dynamics within optically opaque hierarchically porous membranes necessitates sophisticated microscopy techniques. First hints to unveil the dynamics are obtained from theoretical thoughts and lab-scale experiments, e.g. mass-uptake as a function of time or the mechanical response depending upon wetting and drying in dilatometry. However, these techniques do not spatially resolve on the rising liquid front, which we achieved with transmission X-ray microscopy at DESY's beamline P05. The samples are scanned in radiography (2D) and tomography (3D) to resolve both the static structure and the capillary dynamics. The findings from those experiments can help to tailor hierarchical porous materials for their designated application and to tune the dynamics in wetting and drying depending on the needs.

Participation

In-Person

References

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