Minicolloque n° MMB15 **x Oral** **☐ Poster**

Dynamics of heterogeneous wetting in periodic hybrid nanopores

Cyril Picard[a*], Valentin Gérard[a], Xavier Cattoën[b] and Elisabeth Charlaix[a]

a. Univ. Grenoble Alpes, CNRS, LIPhy, 38000 Grenoble, France
b. CNRS, Grenoble INP, Institut Néel, University Grenoble Alpes, 38000 Grenoble, France

* email : cyril.picard@univ-grenoble-alpes.fr

Hydrophobic nanoporous materials behave as anti-sponges when immersed within aqueous solutions. The liquid, that can be forced to enter the nanopores at high pressure, is spontaneously expelled out of the pores when the pressure is released. These systems make a direct bridge between phenomena at the molecular scale and bulk quantities such as pressure. They can be used to investigate water in hydrophobic confinement, a topic of major importance for industrial applications, such as boiling, heat or mass transfers at interfaces, but also for the general understanding of hydrophobic interactions mediated by water in biological matter and biomolecular responses under osmotic stress.

In this presentation we will focus on experimental and theoretical results concerning the dynamical forced filling and spontaneous drying of hydrophobic cylindrical mesopores 2 nm in diameter. Pores are structured with organic/inorganic moieties responsible for a periodicity of the surface energy along their axis. We find that the forced intrusion of water in these hydrophobic pores presents a slow dynamics: the intrusion pressure decreases as the logarithm of the intrusion time. We find that this slow dynamics is well described quantitatively by a classical model of activated wetting at the nanoscale, giving access to the structural length scales and surface energies of the mesoporous material [1]. The spontaneous extrusion, on the other hand seems to be triggered by the heterogeneous nucleation of nanobubbles in the pore, with a strong contribution of line tension which can be determined from the measurement of the extrusion pressure. The value of the so obtained negative line tension is consistent with values extracted from numerical simulations by means of a novel approach based on direct force measurement on a slab of liquid confined between two flat walls [2].

[1] C. Picard et al, J. Chem. Phys. **154**, 164710 (2021)
[2] R. Bey et al, J. Chem. Phys. **152**, 094707 (2020)

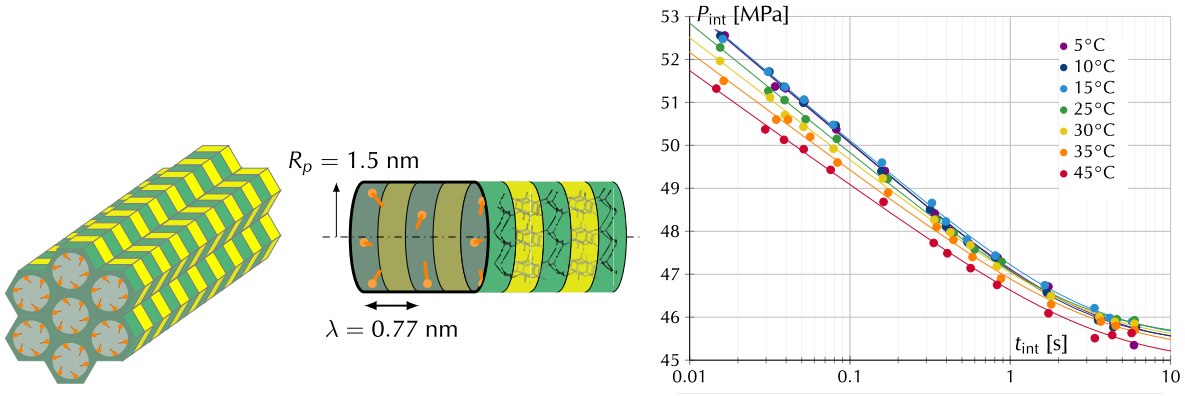

Figure 1 : Structured hydrophobic nanoporous material (left) and dynamical filling pressure of water in this material (right) according to filling time.