Internship offered in M2
2018

Responsibles

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Group: **Couches nanométriques : formation, interfaces, défauts**

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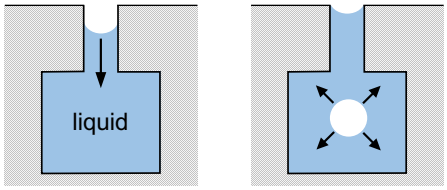
Internship topic: *CAVITATION OF CONFINED FLUIDS IN NANOPORES*

For years, models have proposed that the evaporation of a fluid confined in a porous material requires the creation of a vapor path from the periphery to the inside of pores, via the propagation of the liquid-vapor interface. For instance, in a solid made of cavities connected to the gas reservoir via necks, the emptying of cavities can occur only when necks become unstable.

Recent experiments in nano-porous solids questioned the validity of these models and suggest an alternative scenario: our adsorption experiments showed for the first time that the evaporation of fluid proceeds through cavitation, *i.e.*, a thermally activated nucleation of gas bubbles in the cavities.



When outer gas pressure is deacreased, liquid in the cavity evaporates via receding meniscus in the neck (left) or bubble nucleation (right).

The goal of this internship is to study the cavitation scenario and to understand the nucleation mechanism in nanopores. To this aim, model materials will be designed with controlled geometries. Both simple van der Waals liquid (nitrogen…) and room temperature liquids such as water or alkanes will be used in order to vary the fluid-wall interaction. In a second step, the large tunability of model materials will allow us to seek for superstability due to mass conservation.

Cavitation in metastable fluids confined to linear mesopores, Grosman and Ortega, Langmuir 27, 2364 (2011).

On the formation of the nanobubbles.., Mitropoulos et. al. Nature, 5 :10943 (2015).

Techniques involved : the internship is mainly experimental and called on to varied techniques: fabrication of porous silicon and alumina samples, measurements of adsorption/desorption isotherms, through volumetric measurements and innovative interferometric techniques. This work being part of a collaborative project with Institut Néel (Grenoble) and ICMN (Orléans).

Knowledge and skills : background in statistical and condensed matter physics.

Type of internship: experimental and theoretical

Paid internship: according to legal legislation

This internship can be continued for a PhD funded by French National Research Agency (ANR)