Contribution ID: **109** Type: **Oral Presentation**

Fluid transfers in nanopores through dynamic NMR relaxometry

Monday, 22 May 2023 11:20 (15 minutes)

NMR relaxation time measurement is a well-known, non-destructive method to probe all states of protonic liquid such as water, in porous media, at different pore scales. In contrast with MRI which can get local information but is blind with respect to most liquid in nanomaterials, standard NMR relaxation measurements can provide information on the liquid content over six decades of relaxation times typically corresponding to pore scales from the millimeter to the nanometer. Here, we propose a simple though powerful technique which provides various direct, quantitative information on the liquid distribution inside nanoporous porous structures and its variations over time due to fluid transports and/or phase changes. It relies on the analysis of the details of the NMR (nuclear magnetic resonance) relaxation of the proton spins of the liquid molecules and its evolution during some process such as imbibition, drying, phase change, etc, of the sample. We present a few applications of this technique to nanoporous materials such as a silica glass [2], cellulose fibers [3], or nanoporous glass beads [1]. We show that this approach allows to observe and quantify a variety of possible dynamic phenomena such as: a progressive homogeneous or inhomogeneous emptying of pores, and isotropic or differential shrinkage of the pores, the possible existence of liquid films along the pore walls, transfers between bound and free water.

Participation

In-Person

References

[1] B. Maillet, R. Sidi-Boulenouar, P. Coussot, "Dynamic NMR relaxometry"as a simple tool for measuring liquid transfers and characterizing surface and structure evolution in porous media, in press, Langmuir (2022)
[2] B. Maillet, G. Dittrich, P. Huber, P. Coussot, Diffusion-like drying of a nanoporous solid as revealed by Magnetic Resonance Imaging, Physical Review Applied, 18, 054027 (2022)
[3] X. Ma, B. Maillet, L. Brochard, O. Pitois, R. Sidi-Boulenouar, P. Coussot, Vapor-sorption coupled diffusion in clothes revealed by MRI, Physical Review Applied, 17, 024048 (2021)

MDPI Energies Student Poster Award

No, do not submit my presenation for the student posters award.

Country

France

Acceptance of the Terms & Conditions

Click here to agree

Energy Transition Focused Abstracts

Primary author: Mr MAILLET, Benjamin (Navier laboratory)

Co-authors: COUSSOT, Philippe (Univ. Paris-Est); Mrs SIDI-BOULENOUAR, Rahima (Navier laboratory)

Presenter: Mr MAILLET, Benjamin (Navier laboratory)

Session Classification: MS13

Track Classification: (MS13) Fluids in Nanoporous Media