Contribution ID: **209** Type: **Oral Presentation**

Imaging fluid transfers in pores and pore changes through dynamic NMR relaxometry

Tuesday, 31 May 2022 11:45 (15 minutes)

Magnetic Resonance Imaging (MRI) is well known to be a powerful non-destructive means to get local information on the spatial distribution of water in porous media. However, it does not easily provide quantitative information on the pore size distribution, the pore filling, and the evolution of these characteristics in time, i.e. the dynamics of the structure and the process. Here we show that this type of information can be obtained in a straightforward way through an original approach, namely "dynamic NMR relaxometry".
Data from a standard NMR (Nuclear Magnetic Resonance) sequence are analyzed with the help of a Contin treatment (basically a Laplace transform), which provides the distribution of relaxation times in the samples, i.e. the probability density function to have each relaxation time value. This information is critical as the NMR relaxation time is related to the pore size and liquid filling of the pore, all aspects which may be quantified through the Brownstein and Tarr model. The originality of our approach is to quantitatively analyze the evolution in time (dynamics) of this distribution during transfers in porous media such as drying, imbibition, diffusion, swelling, etc. We then get a straightforward quantification of a variety of possible phenomena such as:
- progressive homogeneous or inhomogeneous emptying of pores
- isotropic or differential shrinkage of the pores
- possible development of liquid films along the pore walls
- transfers between bound and free water

In association with independent MRI measurements such data allow to get a complete view of the transfers and changes of porous media. We show examples from our recent works on wood [1-2], cement, cellulose [3], model compressible biporous materials [4], composite systems, etc.

Acceptance of the Terms & Conditions

Click here to agree

MDPI Energies Student Poster Award

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

Country

France

References

[1] H. Penvern, M. Zhou, B. Maillet, D. Courtier-Murias, M. Scheel, J. Perrin, T. Weitkamp, S. Bardet, S. Caré, P. Coussot, How bound water regulates wood drying, Phys. Rev. Applied, 14, 054051 (2020)

[2] D.M. Nguyen, S. Caré, D. Courtier-Murias, M. Zhou, P. Coussot, Mechanisms of softwood imbibition inferred from Magnetic Resonance Imaging, Holzforschung, 75, 225-236 (2021)
[3] X. Ma, B. Maillet, L. Brochard, O. Pitois, R. Sidi-Boulenouar, P. Coussot, Vapor-sorption coupled diffusion in cellulose fiber pile (fabric) revealed by MRI, submitted (2021)
[4] T. Lerouge, B. Maillet, D. Courtier-Murias, D. Grande, B. Le Droumaguet, O. Pitois, P. Coussot, Drying of a compressible biporous material, Phys. Rev. Applied, 13, 044061 (2020)

Time Block Preference

Time Block B (14:00-17:00 CET)

Participation

In person

Primary author: MAILLET, Benjamin (Laboratoire Navier)

Co-authors: Dr SIDI-BOULENOUAR, Rahima (UGE); COUSSOT, Philippe (Univ. Paris-Est)

Presenter: MAILLET, Benjamin (Laboratoire Navier)

Session Classification: MS10

Track Classification: (MS10) Advances in imaging porous media: techniques, software and case studies