Transport of complex mixtures in porous materials studied with NMR imaging

Citation for published version (APA):
Kuijpers, C. J., Huinink, H. P., Adan, O. C. G., & Tomozeiu, N. Transport of complex mixtures in porous materials studied with NMR imaging

Document status and date:
Published: 01/01/2014

Publisher Version:
Publisher’s PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher’s website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

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Current focus: capillary suction

With current health and safety regulations, the reduction of the volatile components in printer ink is an ongoing challenge. Water based inks are therefore increasingly used. These inks contain, amongst other things, water, co-solvent and pigment. The latter is very important since pigment is the component that results in the visible image. Its use however, is minimized to reduce costs and obtain a more eco-friendly ink.

Introduction

Due to the challenges with studying paper (i.e. swelling, broad pore size distribution, fibers), Al₂O₃ is used as a first model porous medium. The sorption of water and ink mixtures in an Al₂O₃ sample is measured as function of time (Figure 3). From the moisture profiles, the front position as a function of time is extracted. From the results we can conclude that:

- The front position can be scaled with liquid and material parameters to generate a generic curve which can be fitted with Washburn’s equation.
- Water-glycerol moves in the sample as a single front.
- There is a spread in the H₂O-glycerol in 200 nm samples, which needs further investigation.

Approach

The model needs to include four important processes (Figure 2): evaporation, sorption into the fibers, capillary suction in the pores and agglomeration of the particles. Therefore experiments and simulations are performed, and designed to complement each other. The experiments are conducted using Nuclear Magnetic Resonance imaging (NMRI), a non-destructive technique that visualizes the liquid components inside a porous sample in a space and time resolved manner.

Future work & Valorization steps

The next step in the project is to increase the number of components in the liquid in order to increase the resemblance with inkjet inks. Furthermore the imbibition of ink components in paper will be investigated using high resolution NMR.