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Bicontinuous Microemulsion in Porous Matrices

Monday, 22 May 2023 11:05 (15 minutes)

Wicking is the spontaneous imbibition due to the negative capillary pressure created at the liquid-air interface 1. The wicking of simple fluids, such as water and organic solvents is well understood for a long time [2]. This well defined situation becomes more complicated in the case of complex fluids with an internal structure on the nanoscale. Then, competitive wetting and confinement effects play an important role and influence both, the behavior of the complex fluid inside the porous matrix and the inner structuring of the fluid. The latter can result in changes in phase behavior and other fundamental properties. To explore these effects we use bicontinuous microemulsions in the ternary phase system (water/octane/C\textsubscript{10}E\textsubscript{4}) as model complex fluid and controlled-pore glasses as confining matrices (CPG). Understanding the influence of geometrical restrictions yields both, fundamental insights and importance for applications, e.g. decontamination and enhanced oil recovery.
For a deeper understanding of these effects, of the spontaneous imbibition of a bicontinuous microemulsion and its components into the CPGs is investigated. In our study, we explore the wicking with the Washburn approach. In this approach the wicking of a test liquid is monitored gravimetrically, as shown on the right side in figure 1. Effects of the traversed matrices are studied by using various CPGs with pore diameters between 75 –1000 Å and porosities from 55% to 80 %. The naturally hydrophilic surfaces of the CPGs were hydrophobically modified to analyze the impact of the surface polarity. The bicontinuous microemulsion shows a more universal wicking behavior than the tested pure liquids.
Imaging techniques (cryo-SEM) and small angle scattering (SANS, SAXS) are used to investigate the microemulsion phase structure inside the porous matrices. In this talk, the results of these combined experiments will be presented and discussed.

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Participation

In-Person

References

1 R. Masoodi, K. M. Pillai, Wicking in porous materials. Traditional and modern modeling approaches, CRC Press, Boca Raton, Fla., 2013.
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Energy Transition Focused Abstracts

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