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Transport and evaporation of aqueous co-solvent solutions in thin porous media

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We have studied the imbibition and drying of water/co-solvent mixtures in paper and glass microfiber filters. The experiments reveal a rich interplay of solution imbibition, solvent evaporation and solvent-mediated pore-fiber transport. After deposition, liquids occupy the micron-scale inter-fiber pores of a paper sheet. In thermodynamic equilibrium, polar liquids such as water and co-solvents reside in the nm-scale intra-fiber pores of the cellulose fibers. The timescales for attaining equilibrium prove to depend sensitively on the water content, such that co-solvents can be temporarily trapped in a non-equilibrium configuration. The combination of two experimental methods allows the determination of both the overall co-solvent content and an estimation of what fractions reside in the pores and in the fibers of a paper sheet. The results are relevant to understanding the behavior of solutions in paper and provide insight into the dynamics of aqueous inkjet printing inks.

Participation

In-Person

References

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