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# Pore-scale modelling and analysis of multiphase flow in gas diffusion layers

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Wettability design is of crucial importance for optimization of multiphase flow behaviour in gas diffusion layers (GDLs) in fuels cells. The accumulation of electrochemically-generated water in the GDL will impact fuel cell performance. Hence, it is necessary to understand multiphase displacement to design optimal pore structures and wettability to allow the rapid flow of gases and water in GDLs over a wide saturation range. In this work, high-resolution three-dimensional X-ray imaging combined with a pore network model was used to investigate the breakthrough capillary pressure and water saturation in gas diffusion layers manufactured with a different degree of polytetrafluoroethylene coating: 5, 20, 40, and 60%, making them more hydrophobic. We first demonstrate that the pore network extraction method provides representative networks for the fibrous porous media examined. Then, using a pore-network flow model we simulate water flooding in initially gas-filled fibrous media, and analyse the effect of wettability on breakthrough capillary pressure and water saturation. Overall, this work demonstrates that the wettability and flow direction have a significant impact on breakthrough capillary pressure and water saturation during multiphase flow in GDLs and that with an appropriate pore-scale characterization of wettability, a pore network model can match experimental results.

## Participation

In-Person

## References

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