Analysis of Wettability Effect on Liquid Water Behavior in PEFC Gas Diffusion Layer

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1. Objective

Polymer Electrolyte Fuel Cell (PEFC)

Objective: accumulated water in GDL suppress to transport O₂

Aim and Methods

Lattice Boltzmann Method

Scale model experiment

Reproduction similar flow

Observe water behaviors with surface wettability changes

Efficient drainage of accumulated water under ribs contributes to performance

2. Experimental setup

Scale model experiment

Similar conditions

the condition which can ignore gravity force with as below
- Equal Ca (Ca= 3 × 10⁻³)
- Equal viscosity ratio (Ms= 16.7)

3. Result and discussion

LBM simulation results

With surface treatment, water doesn’t stack in the GDL
Water emitted rapidly

Half of GDL thickness
2 fiber thickness

Surface treatment has optimal processing thickness

Scale model experiment results

It can confirm the effect of surface treatment with various material and modeling method

Suck out effect

As blue lines shows accumulated water reduced

4. Conclusion

- As the LBM simulation shows, surface treatment urges elimination of water inner GDL. And that can expect to suppress inhibition of O₂ transport.
- As scale model experiment also shows, accumulated water decrease in the GDL with surface treatment. And the results indicated suck out effect.