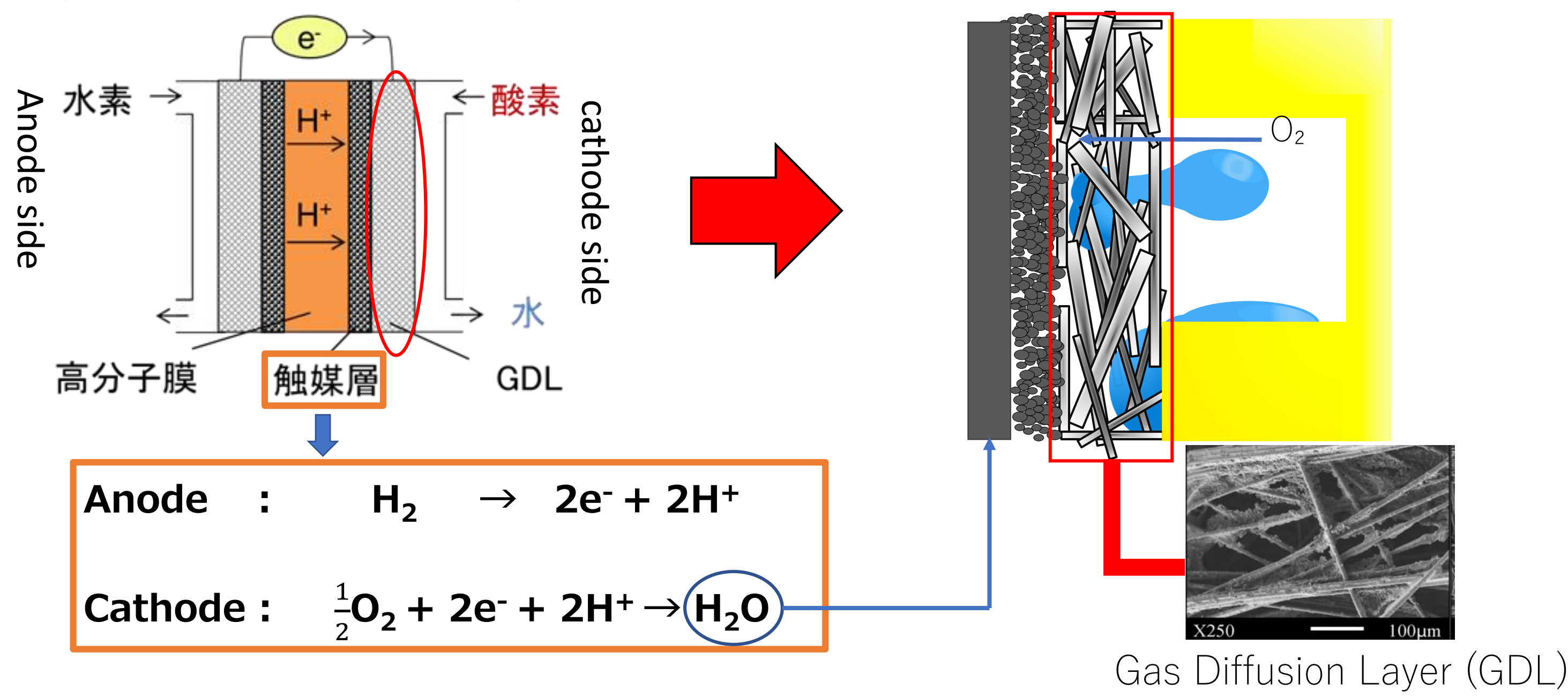


Analysis of Wettability Effect on Liquid Water Behavior in PEFC Gas Diffusion Layer

○ Satoki Arisawa (北大院) Can Enes Muhammet (北大) Yutaka Tabe (北大) Takemi Chikahisa (北大)

1. Objective

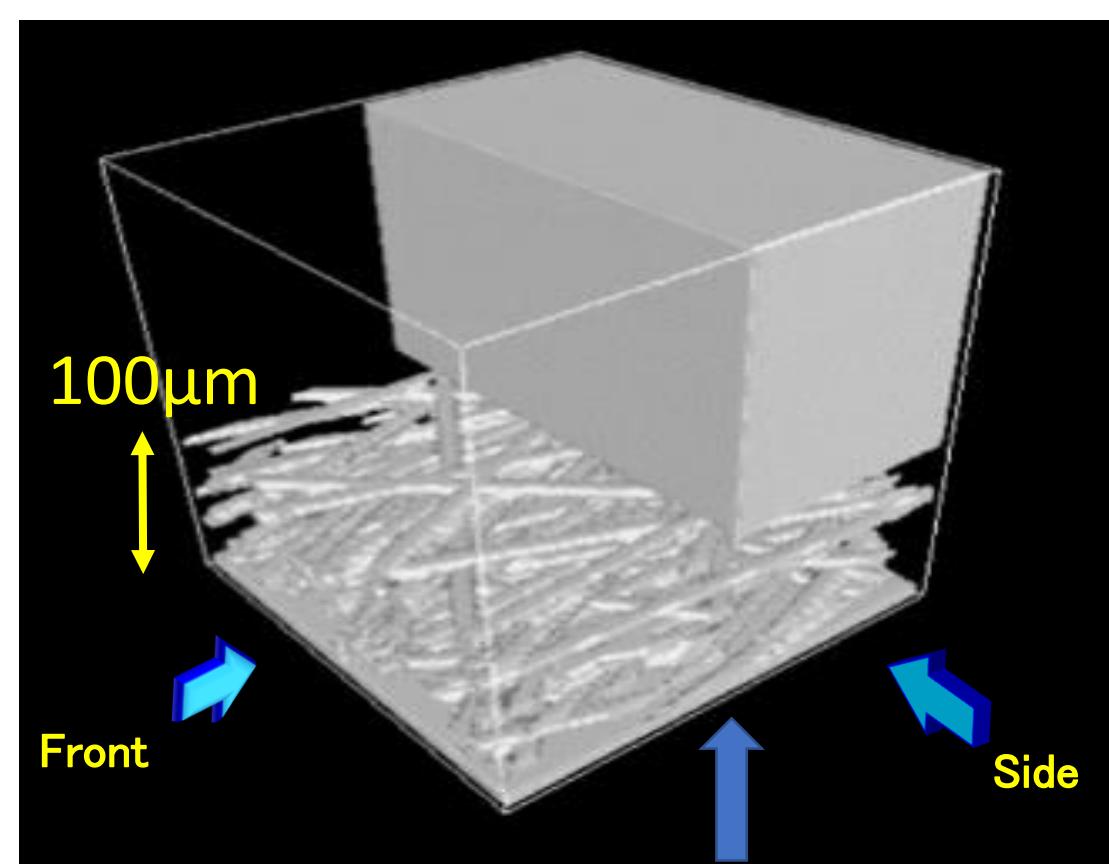
Polymer Electrolyte Fuel Cell (PEFC)



Objective : accumulated water in GDL suppress to transport O_2

Aim and Methods

Lattice Boltzmann Method



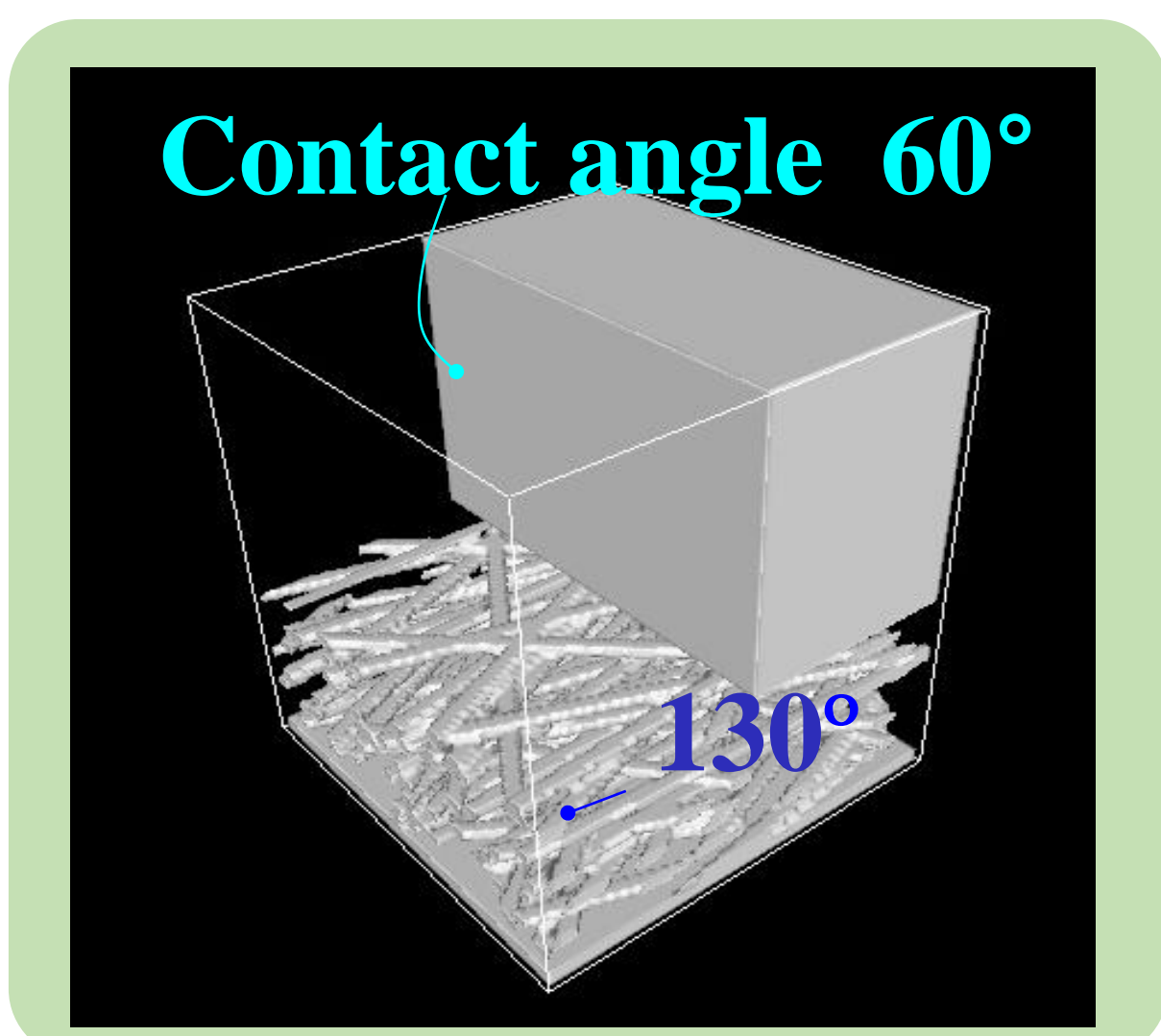
Water injection

Scale model experiment

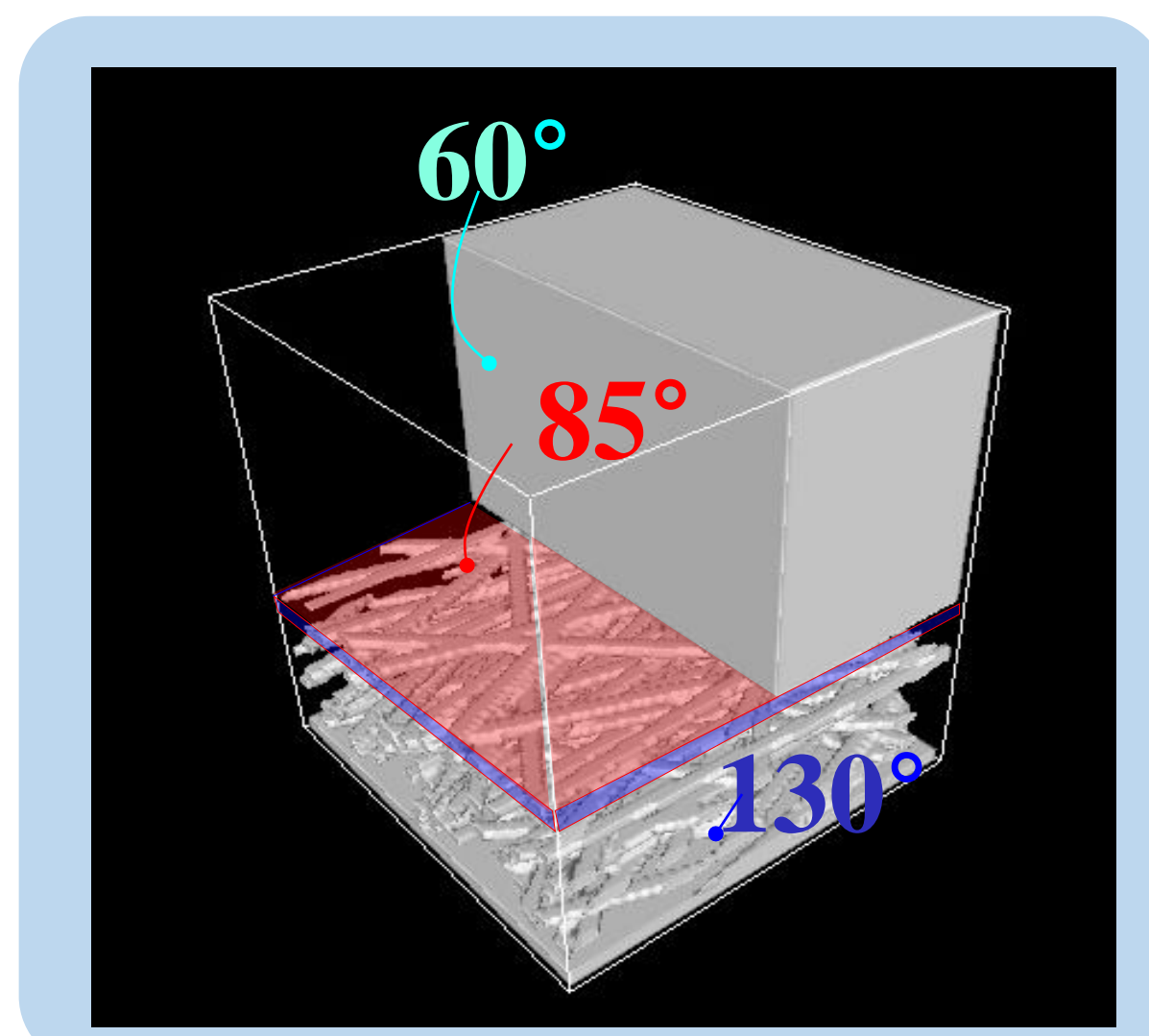


※The model was made by 3D printer

Reproduction similar flow



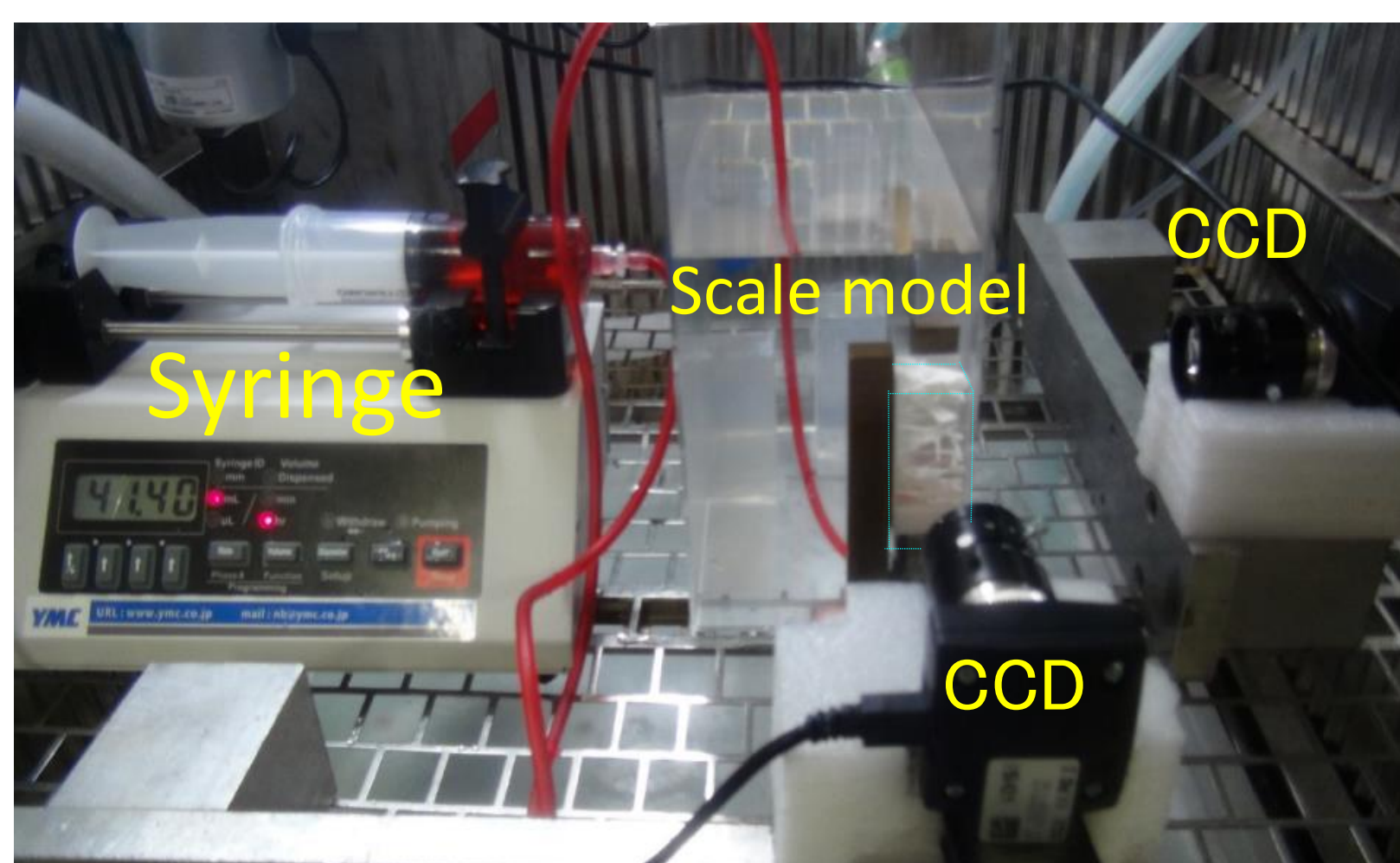
Observe water behaviors with surface wettability changes



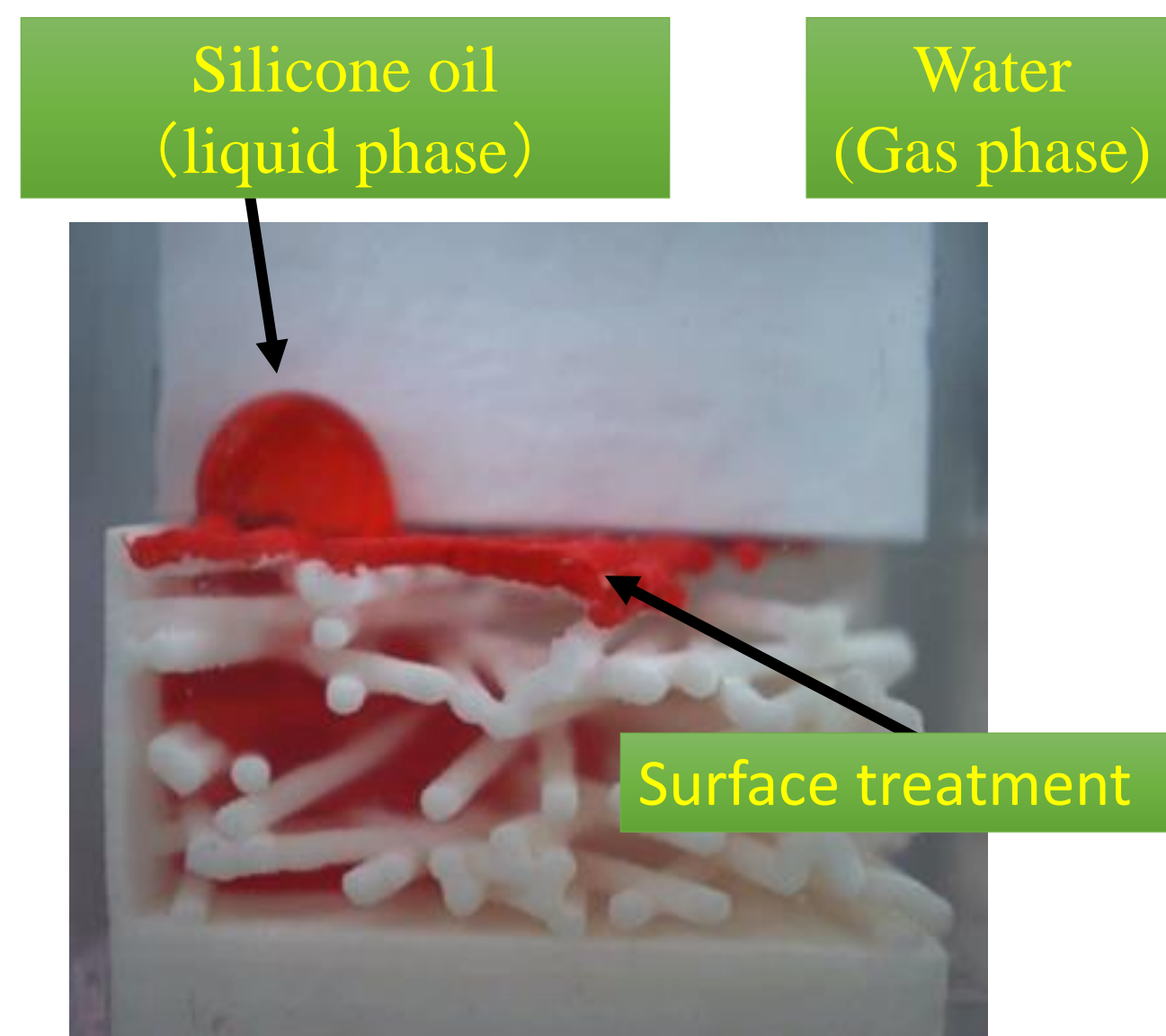
Efficient drainage of accumulated water under ribs contributes to performance

2. Experimental setup

Scale model experiment



Similar conditions



$$Ca = \frac{\mu_L U}{\sigma} \dots \frac{\text{Sticky}}{\text{Surface force}}$$

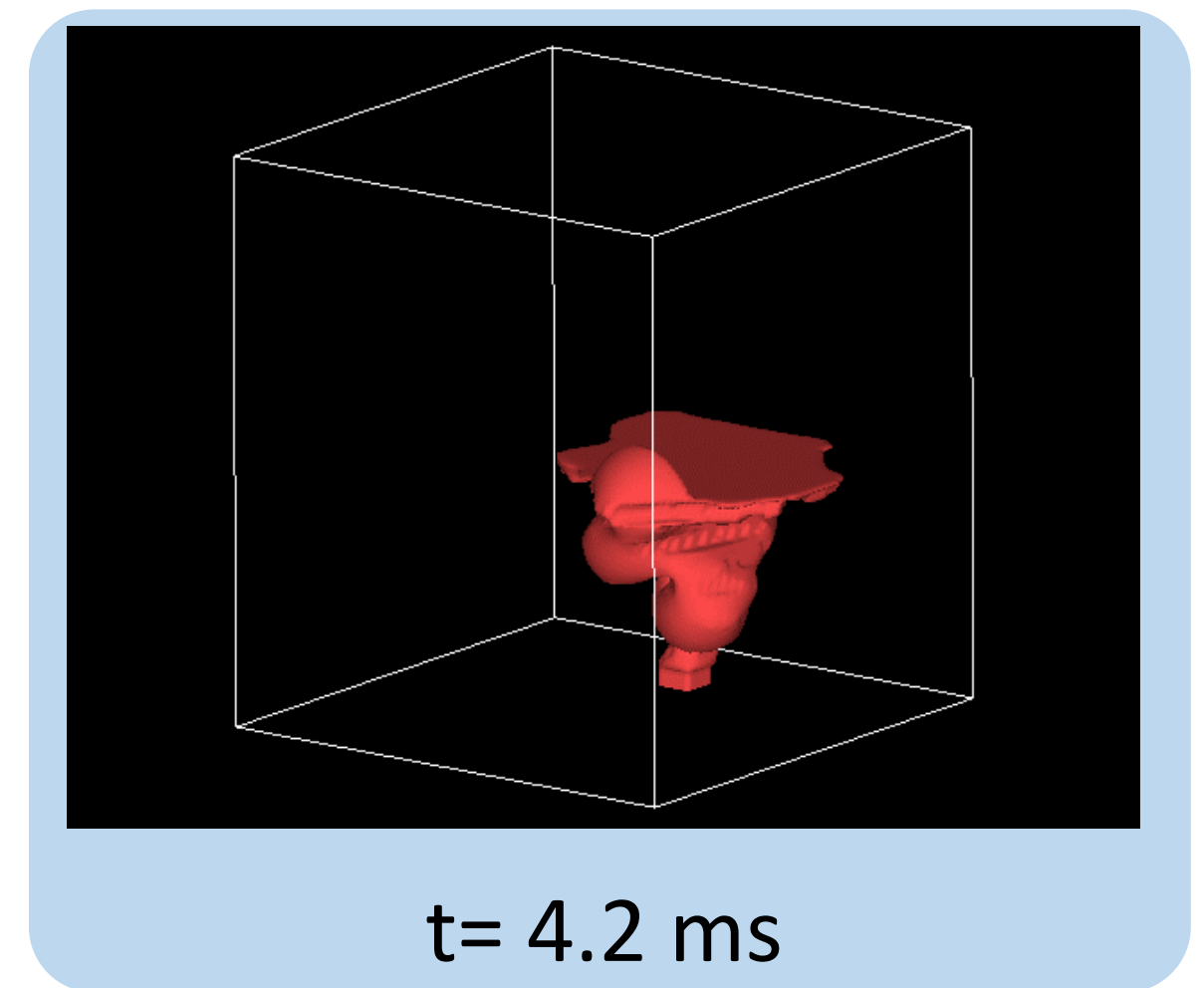
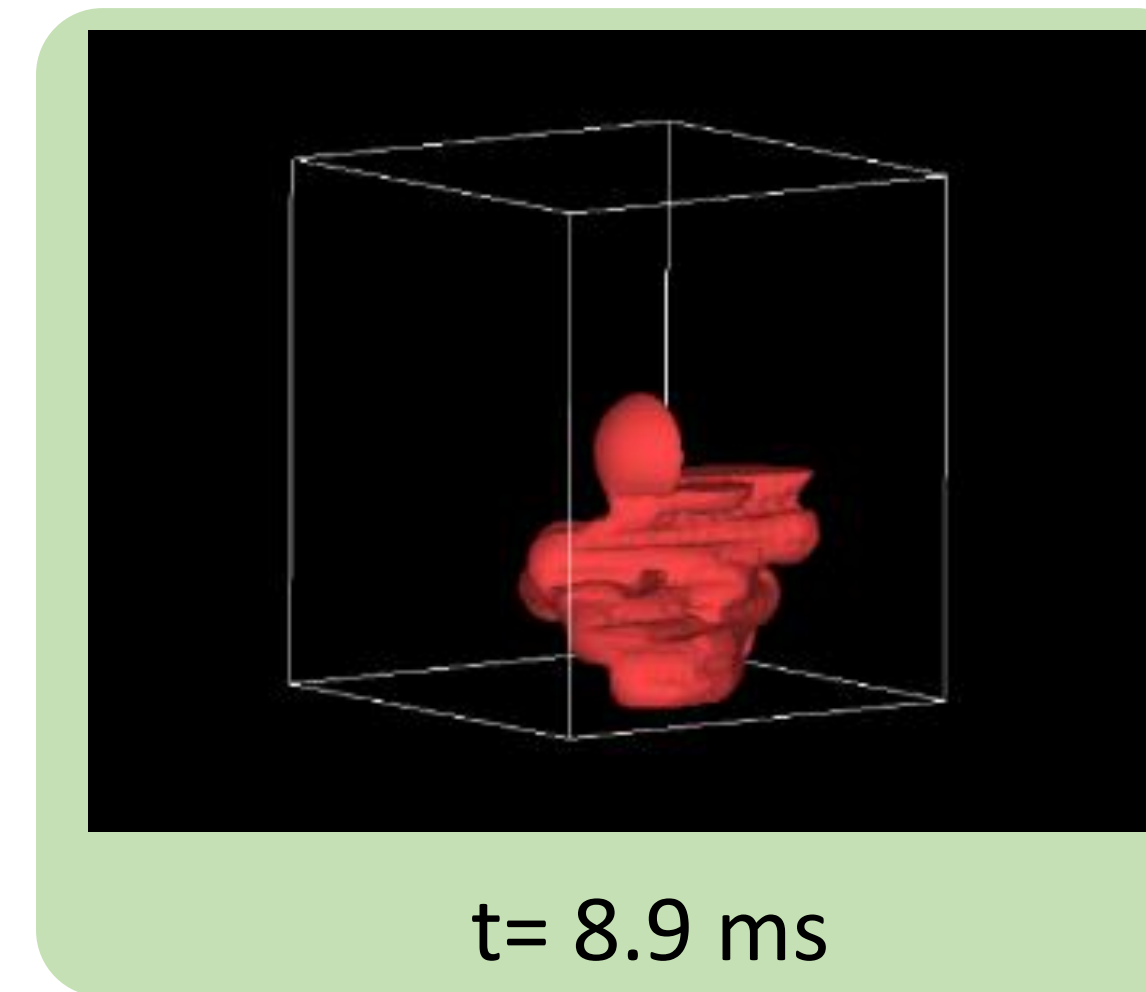
$$M = \frac{\mu_L}{\mu_G} \dots \frac{\text{Viscosity (liquid)}}{\text{Viscosity (Gas)}}$$

the condition which can ignore gravity force with as below

- Equal Ca ($Ca = 3 \times 10^{-3}$)
- Equal viscosity ratio ($Ms = 16.7$)

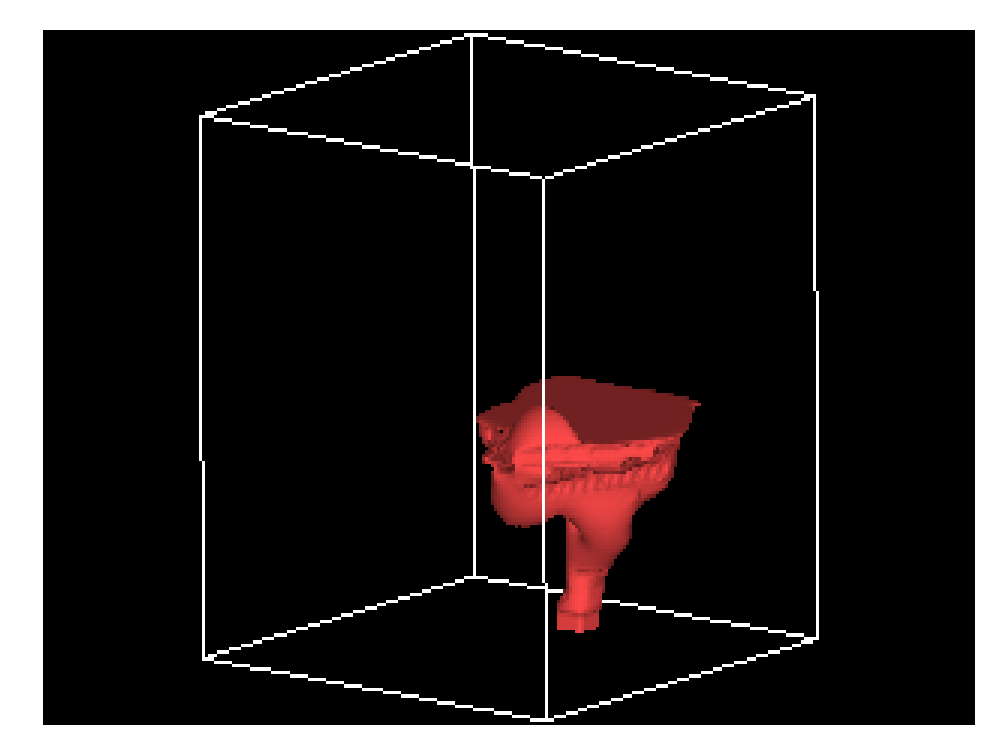
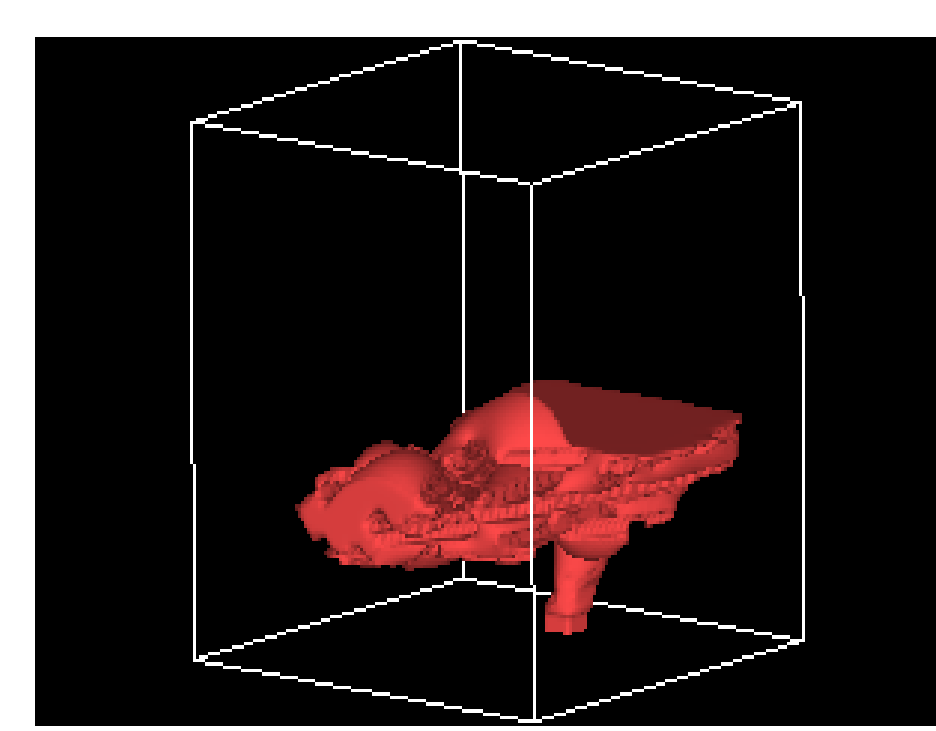
3. Result and discussion

LBM simulation results



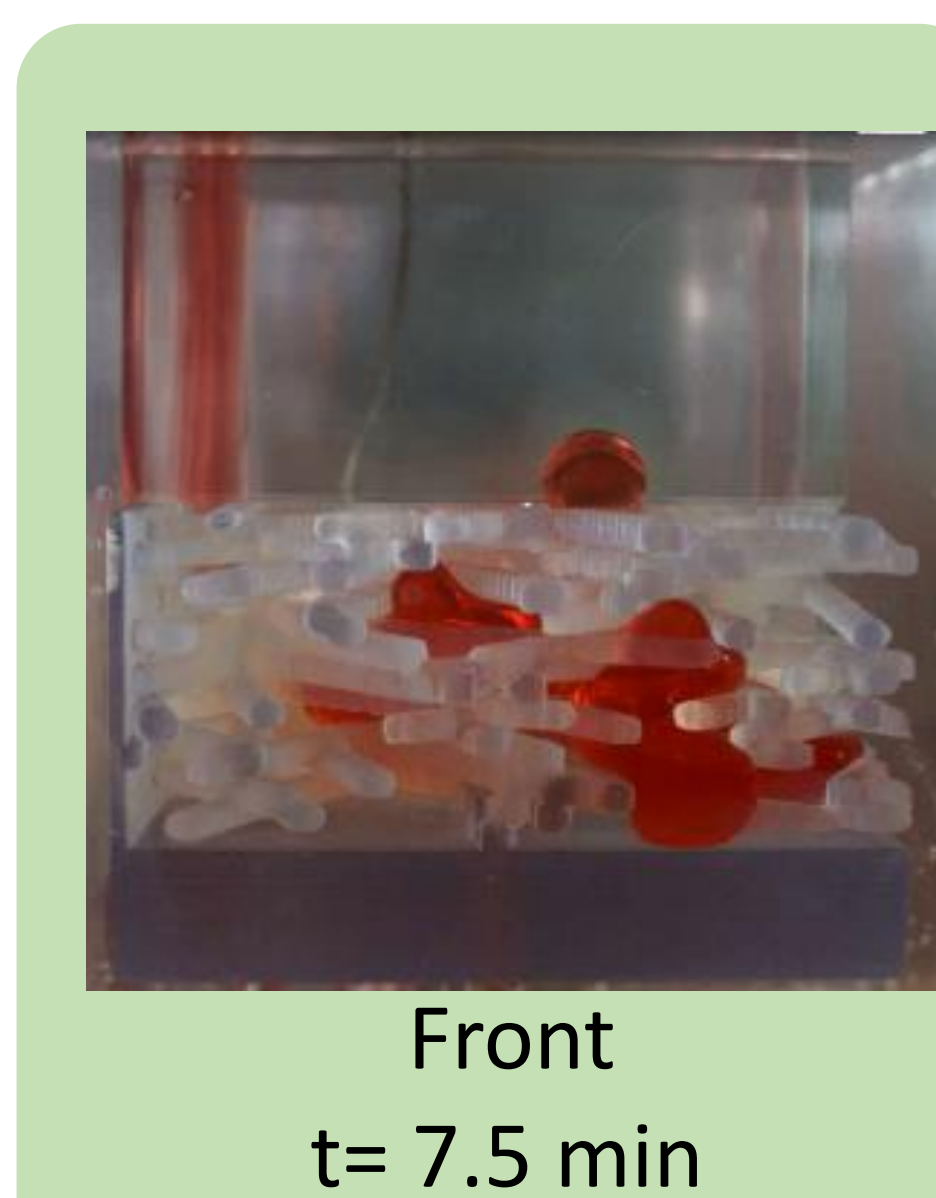
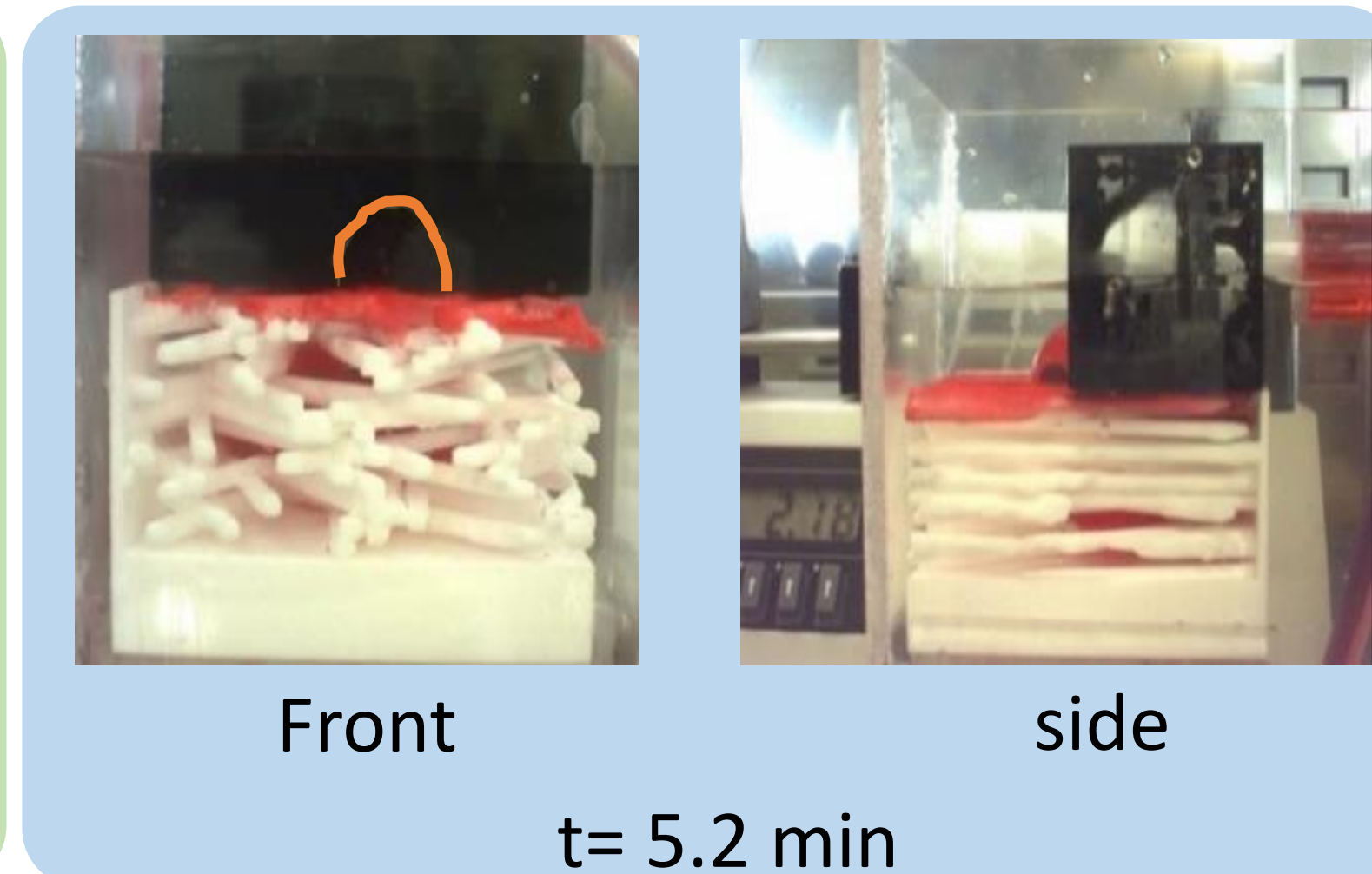
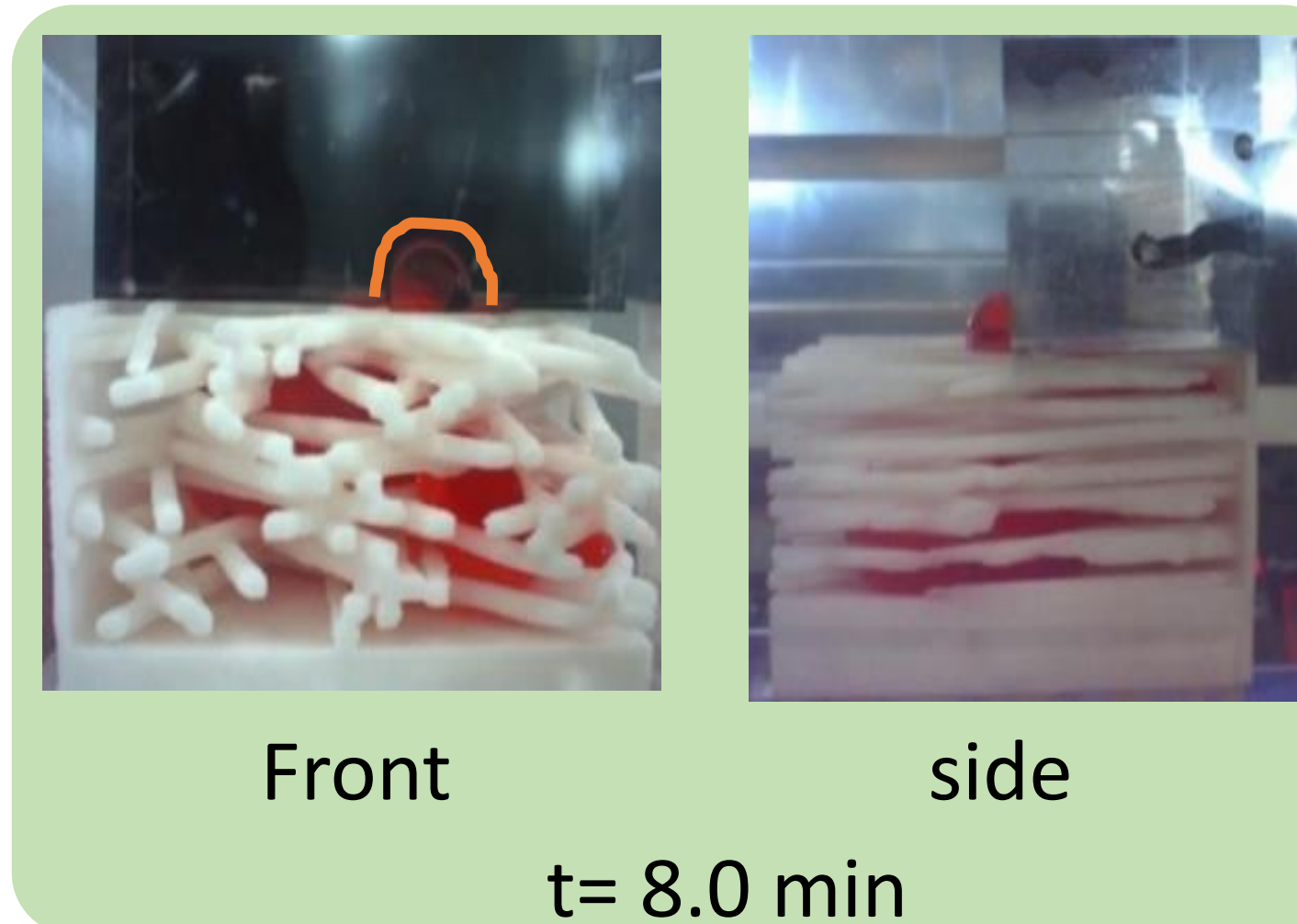
With surface treatment, water doesn't stack in the GDL

Water emitted rapidly

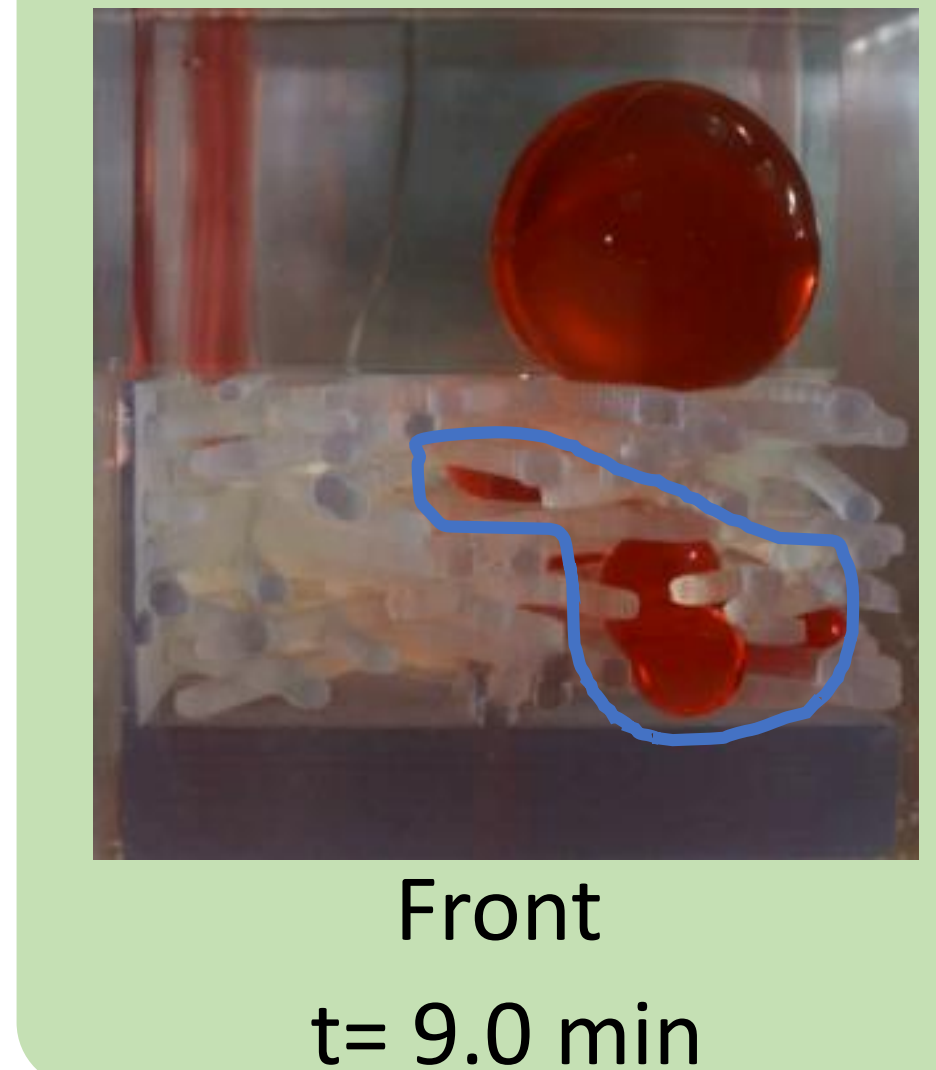


Surface treatment has optimal processing thickness

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 O_2 transport.
- As scale model experiment also shows, accumulated water decrease in the GDL with surface treatment. And the results indicated suck out effect.