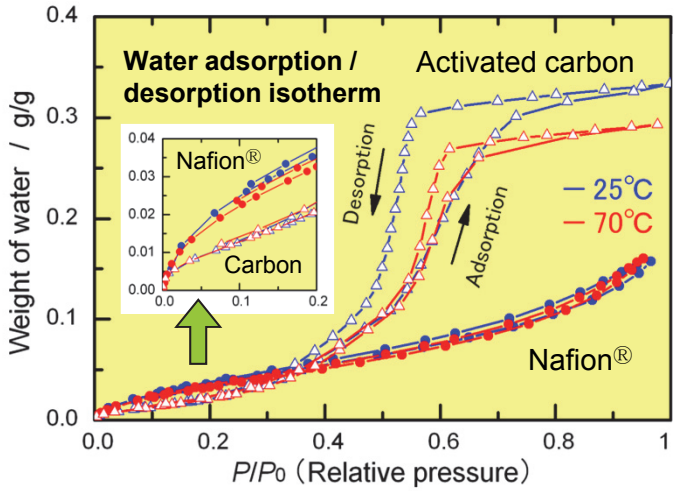
PEFC
Structural Evaluation of Catalyst Layer

Understanding the microstructure and surface properties of the constituent materials of the PEFC catalyst layer (carbon, noble metal particles, electrolyte, PTFE *etc.*) is necessary for further improvement of the PEFC performance.

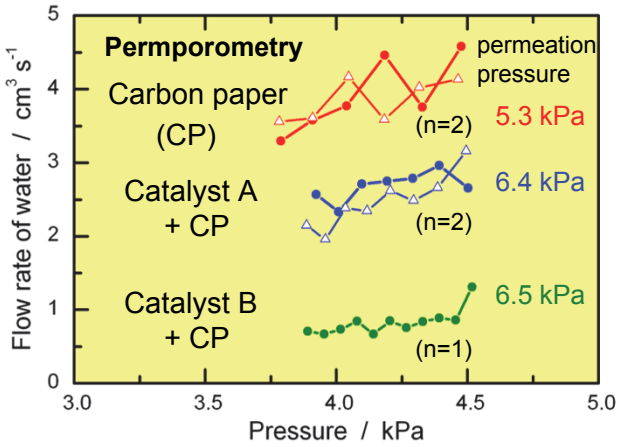
Here, we introduce the examples of the results of ①water vapor adsorption isotherm of carbon and electrolyte, ②water repellency and wettability of catalyst layer measured by permporometry, ③pore size distribution of catalyst layer measured by mercury intrusion method.

①Water vapor adsorption isotherm



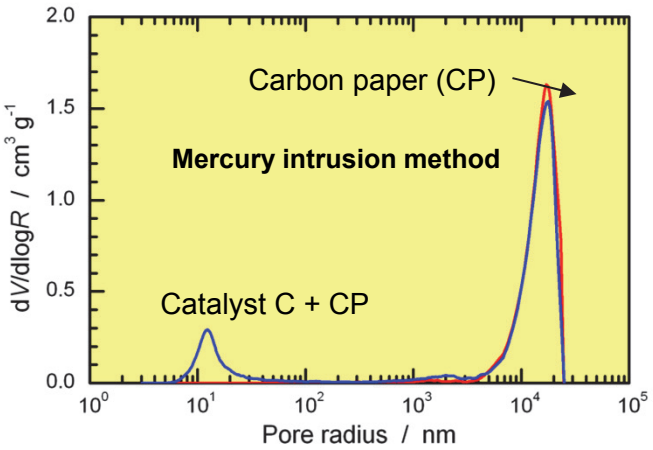
Nafion® has a large amount of water vapor adsorption at low relative pressure (see enlarged view). It is considered that a large amount of water is adsorbed to the hydrophilic sulfone group. The amount of adsorption of activated carbon rapidly increases at high relative pressure, which is presumed to be due to the infiltration of water into nanopores.

②Water permeability,Water permeation pressure

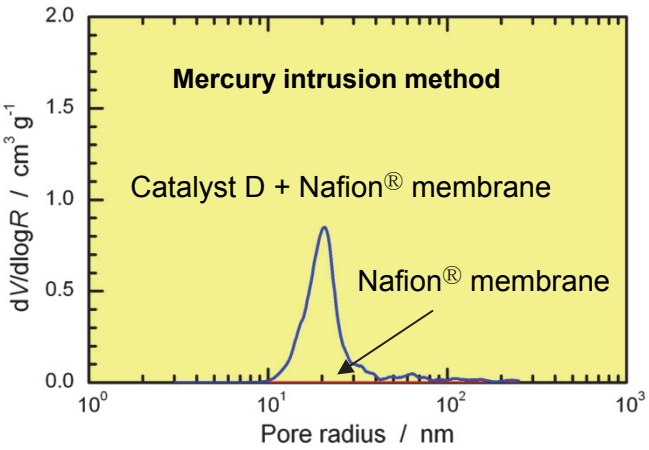


Carbon paper shows the highest permeability and the lowest permeation pressure. On the other hand, water permeability of the catalyst A is higher than B, although water permeation pressure of two catalyst layers (A,B) is almost same. Further investigation including contact angle etc., is needed to reveal the reason for the difference between them.

③Pore size distribution analysis by mercury intrusion method



The pore size distribution curve of the catalyst layer (the particle space of carbon) and that of CP doesn't overlap, we can determine the pore size of the catalyst. However, since the pore size of the microporous layer and the catalyst layer overlap, it is necessary to be careful in interpreting the results.



The pores (clusters) in the electrolyte membrane are not detected by mercury intrusion method, we can determine the pore size of catalyst as painted on membrane. If the thickness of the catalyst layer can be measured by SEM, it is also possible to calculate the porosity of the catalyst layer.