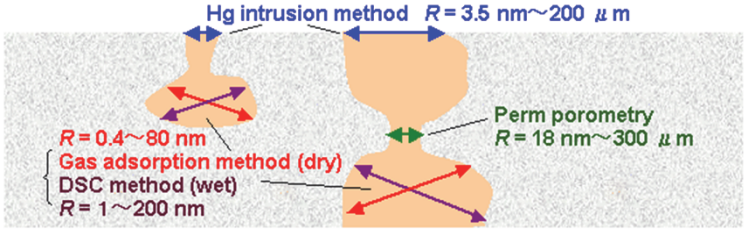
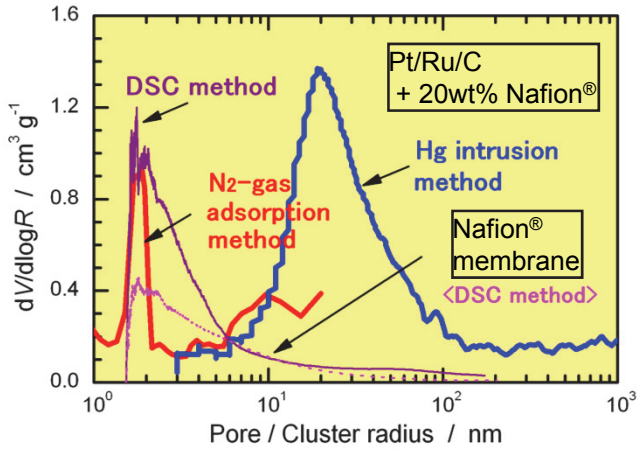
Pore Size Distributions of PEFC Materials

Understanding the cluster and pore sizes of the electrolyte membrane, catalyst layer and gas diffusion layer is one of the important issues in PEFC research and development. We introduce the results of various pore evaluation on each material. The features of each method and the measurable pore radius are summarized in the figure below. Mercury intrusion method is useful to measure the inlet diameter of through holes and half through holes, whereas permporometry is effective to determine neck (thinnest) diameter of through holes. Gas adsorption method and DSC method are available to obtain the information about overall pore diameter of through holes and half through holes. Gas adsorption method is applied to dry samples, while DSC method is applied to wet samples.

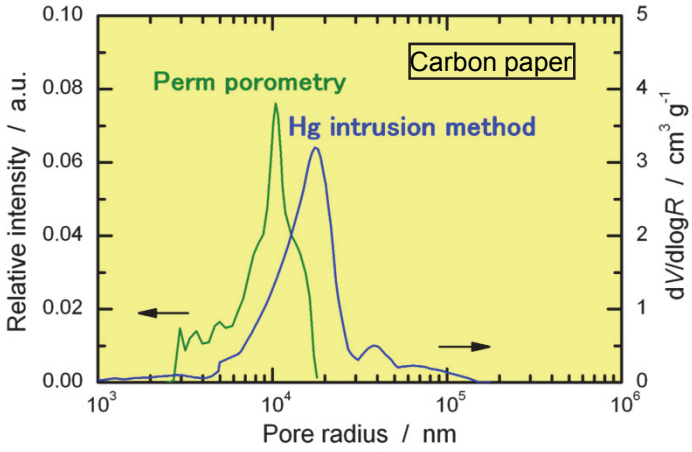


①Pore size distributions of catalyst powder



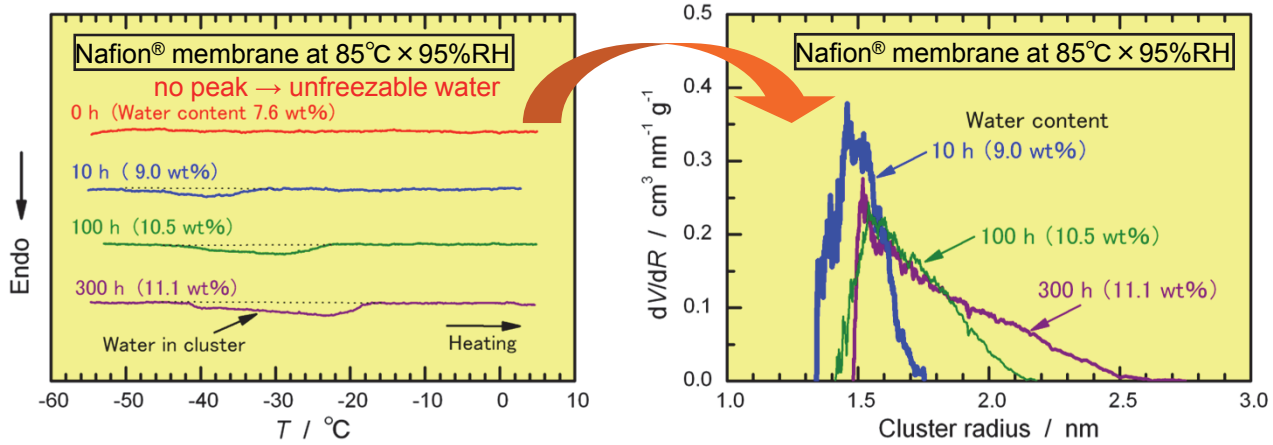
Gas adsorption method is suitable for the small pore analysis, whereas the mercury intrusion method is effective for large one. DSC method is needed to be applied to the wet membrane because the clusters of electrolyte membrane are destroyed by drying out.

②Pore size distributions of carbon paper



The pore size measured by permporometry shows smaller than that by Mercury intrusion method because the information detected by each method is not same. The neck diameter that controls gas permeability can be determined by permporometry. The amount of open pores in CP can be estimated by Mercury intrusion method.

③DSC curves and cluster size distributions of electrolyte membrane



The water permeation behavior of the electrolyte membrane, which was conditioned at 85 ℃×95%RH, was examined by DSC method. As the humidity control time was long, the water content in the membrane became high and the melting peak that reflects the ice trapped in the cluster shifts to high temperature side. Cluster size analyzed from DSC results show broad size distribution with increase of conditioning time.