

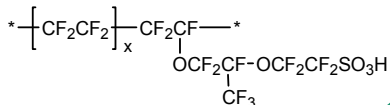
Analysis of water in fluorine polymer electrolyte with different side chain

The cell performance of PEFC depends on the water content in the polymer electrolyte membrane. Solid State F-NMR can assign detail chemical structure of ion exchange membrane, and analysis of water in the membrane can be conducted by FT-IR and DSC.

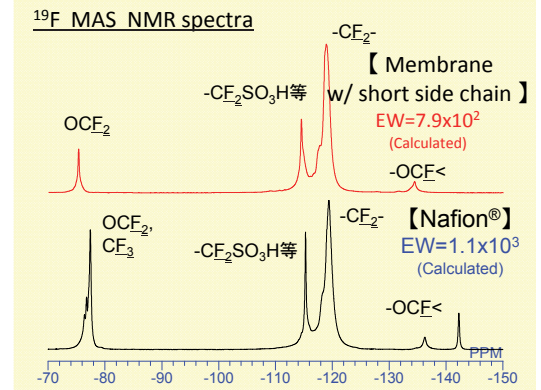
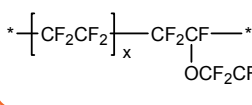
Chemical structural analysis by Solid State ^{19}F -NMR

- Assignment of chemical structure of ion exchange groups
- Estimation of EW (Equivalent Weight)

【Nafion® NRE212】

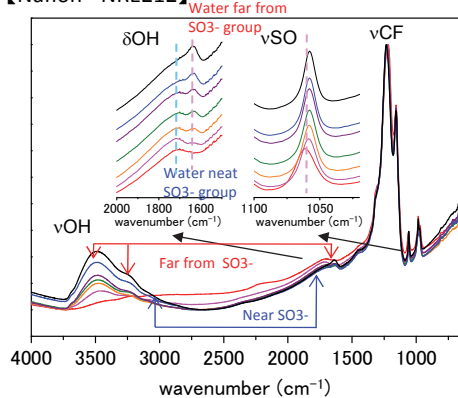


【Membrane w/ short side chain】

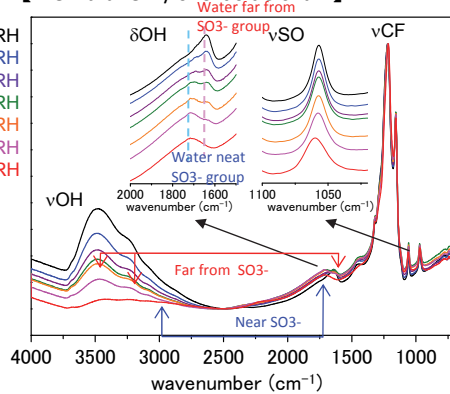


FT-IR measurement under different humidity

【Nafion® NRE212】



【Membrane w/ short side chain】



- Detect Free water, far from -SO₃⁻ group, and the water near -SO₃⁻ group*
- Free water increase under high humidity
- -SO₃⁻ structure exists under 3%RH
- Larger amount of water content in the membrane with short side chain

* R. Buzzoni et al., *J. Phys. Chem.* 1995, 99, 11937.

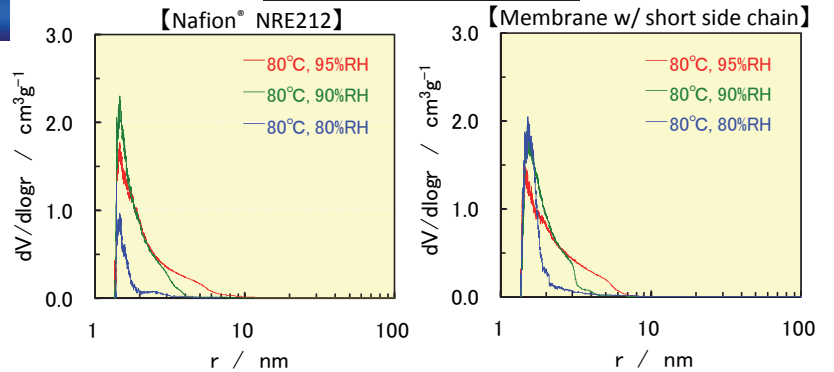
Water cluster radius distribution by DSC

Water cluster size distribution can be analyzed by DSC, the original analysis method of TRC, which can distinguish nonfreezing water, cluster water (freezable), and free water

- No distinguishable difference of water cluster size between samples, 1 to 5nm size clusters exist in the membrane
 - Only nonfreezing water exists upto 60%RH in the membrane with short side chain and the amount is larger than Nafion® NRE212
- ⇒ Membrane w/ short side chain can show good performance under low humidity operation, which might derive from the existence of larger amount of nonfreezing water.

※Water content of the membrane = nonfreezing water + cluster water

Water cluster radius distribution



Water content ratio

