Measurement of Proton Conductivity of Electrolyte Membrane for Fuel Cell

The proton conductivity of the electrolyte membrane is an important physical property for the performance of the membrane. We can provide proton conductivity in a wide range of temperatures and humidity.

● Characteristics required for electrolyte membranes

Transfer of hydrogen ions (proton conduction)
Gas (hydrogen and oxygen) isolation
Insulation between anode and cathode (electron isolation)

● Evaluation method related to proton conduction

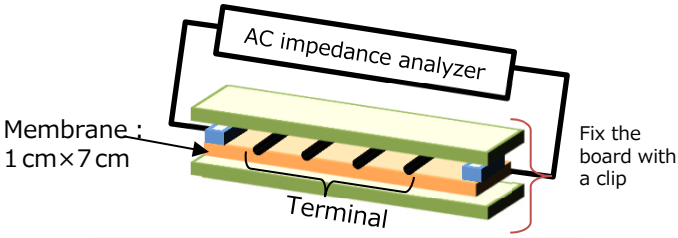
- Proton conductivity
  ⇒ AC impedance method
- Water cluster radius ⇒ DSC method
- Water diffusion coefficient
  ⇒ PFG-NMR method
- EW value ⇒ Ion exchange method, Solid-state NMR method

※EW (equivalent weight)

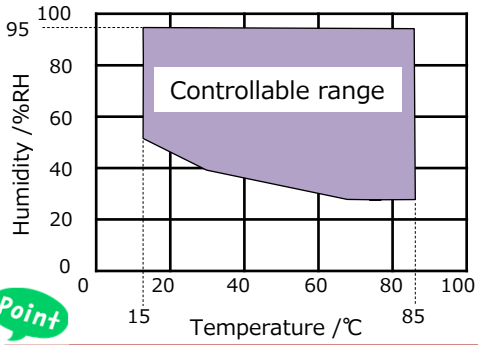
New

Direct evaluation by AC impedance measurement is effective

Outline of measurement method



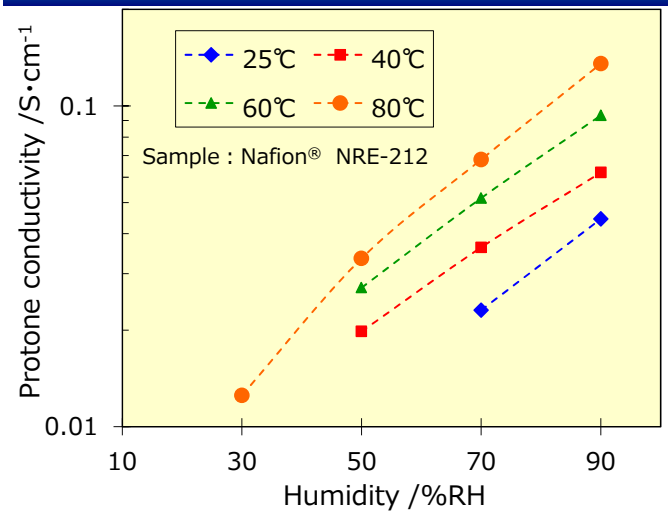
Method : 4-terminal method
Direction: Planar direction
Frequency : 10 kHz
Constant temperature and humidity



Point

Can be measured under a wide range of temperature and humidity conditions !

Measurement results at various conditions



Proton conductivity increases as temperature and humidity increase.

$$\text{Protone conductivity } \sigma\ (\mathrm{S\cdot cm^{-1}}) = \frac{1}{\Delta R\ (\Omega\cdot\mathrm{cm^{-1}}) \times S\ (\mathrm{cm^2})}$$

$$\text{Proton transport resistance } R\ (\Omega\cdot\mathrm{cm^2}) = \frac{1}{\sigma\ (\mathrm{S\cdot cm^{-1}}) \div t\ (\mathrm{cm})}$$

S : Cross-sectional area, t : Membrane thickness

Point

Calculate the proton conductivity and proton transport resistance using the above formula.

- By acquiring accurate physical property values, it contributes to material selection and improvement of simulation accuracy.
- It is possible to obtain an index of performance deterioration by a fuel cell operation test.

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