

Degradation analysis for polymer electrolyte membrane by H₂O₂ vapor exposure test

To simulate the driving environment of polymer electrolyte fuel cells (PEFCs), accelerated degradation test system¹⁾ was composed. The degradation mechanism of perfluorosulfonated membrane was investigated by analyzing gases generated from the membrane exposed to H₂O₂ vapor and structural analysis of degraded membrane.

1) Honmura, et al., *Polymer Preprints, Japan* vol.54, No.2 (2005)

1. Test method

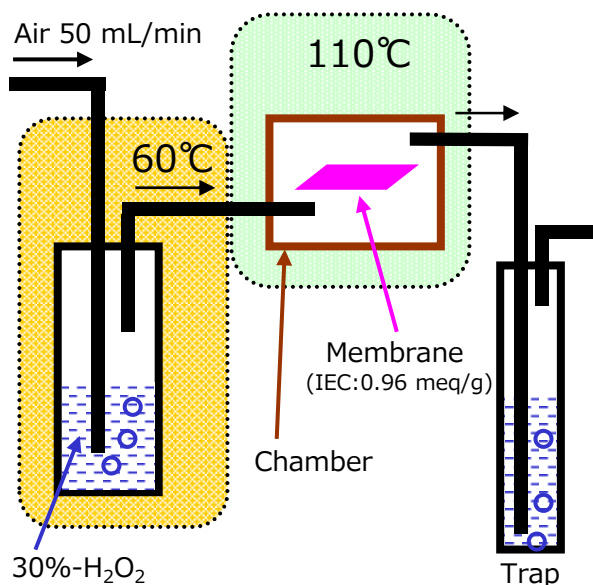


Figure 1. Scheme of the H₂O₂ vapor exposure test

2. Result of analysis (1)

	Exposure time (hr)	48	96
Membrane	Weight reduction (%)	0.8	2.8
	Ion exchange capacity (meq/g)	0.94	0.94
Trapping solution	F ⁻ (μg/g)	3970	8690
	CF ₃ COO ⁻ (μg/g)	872	1870
	SO ₄ ²⁻ (μg/g)	3	7
	TOC (μg/g)	570	757
	H ₂ O ₂ (mg/L)	1.1	

- ◆ Ion exchange capacity : Rb replacement / atomic absorption spectrometry
- ◆ Ions : Ion chromatography
- ◆ TOC : Combustion oxidation / infrared absorption spectrometry
- ◆ H₂O₂ : Absorption spectrometry

With the degradation of membrane, F⁻ and CF₃COO⁻ were detected.

3. Result of analysis (2)

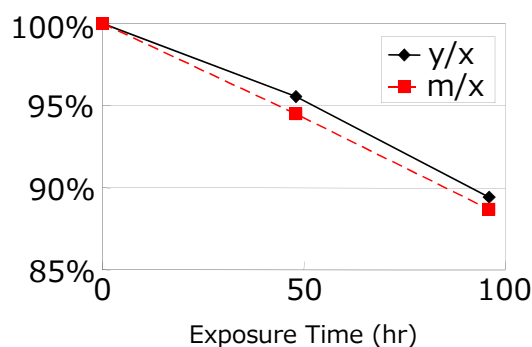
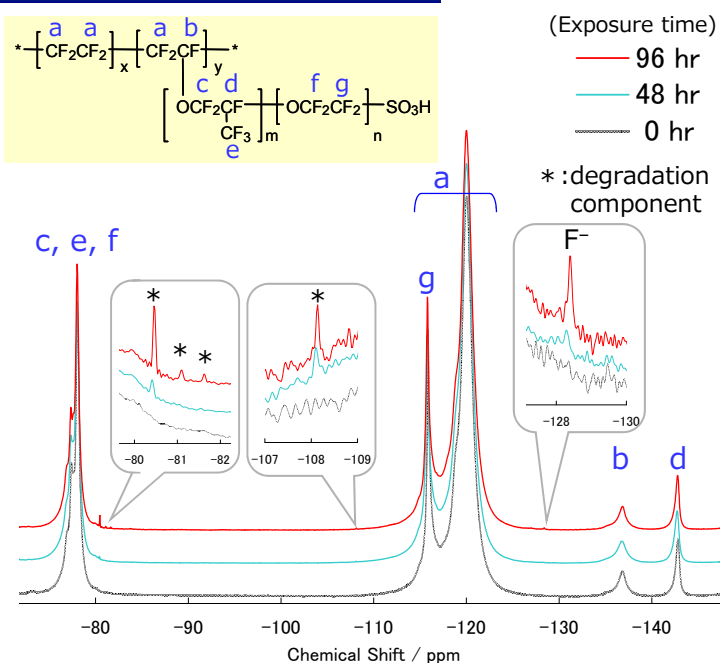


Figure 3. Side/main chain ratio

Solid state ¹⁹F NMR revealed molecular structure of polymer electrolyte membrane in before and after exposed to H₂O₂. With increasing exposure time, side chain component decreased and degradation of membrane had seemed to make progress.

Figure 2. Solid state ¹⁹F NMR spectrum of ionomer