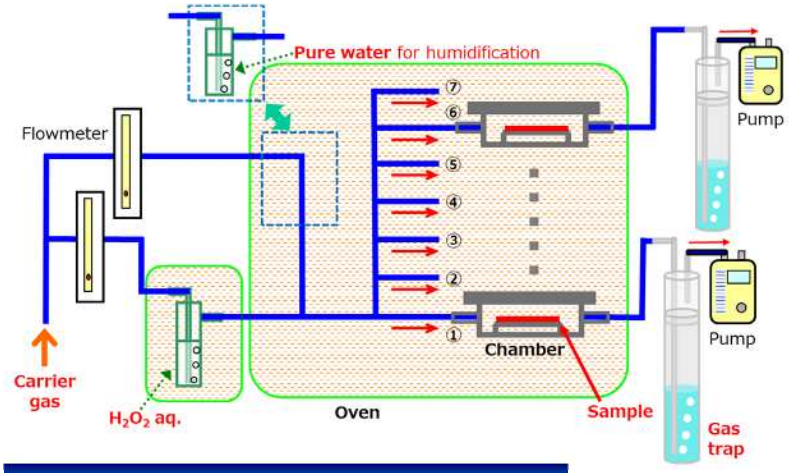
Dry Fenton test of electrolyte membranes (Hydrogen peroxide gas exposure test)

Dry Fenton test (H_2O_2 gas exposure test) is an acceleration test that can simulate the operating state of PEFC. Toray Research Center can arrange various conditions for dry Fenton test[1], and provide "one-stop service" until chemical and/or structural evaluation of degraded membranes.

Dry Fenton (H_2O_2 gas exposure) test



Settable conditions in dry Fenton test

Items	Conditions
Carrier gas	N_2, Air
H_2O_2 aq. temperature	R.T.～80℃
Sample surrounding temperature	80～100℃
Sample surrounding humidity*	10～80%RH
Gas flow rate	50～200 mL/min
Exposure time	Up to several hundred hours

*)Humidity is accompanied with temperature and gas flow rate.

Techniques for degradation analyses

Target	Analytical method		Information available
Membrane before/after the test	Weighing		Changes in membrane weight
	GPC, Solid-state NMR		Changes in molecular weight distribution, Changes in equivalent weight
	SEM		Changes in membrane thickness
Membrane after the test	Pure water extraction	IC	Remaining ionic species
		Combustion IC	Remaining decomposed side chains
		TOC	Remaining organic components
Generated gas	Gas trapping in impingers	IC	Decomposed ionic species
		Combustion IC	Total S, F generated throughout the test
		LC/MS	Decomposed low molecular weight species
		TOC	Decomposed organic components

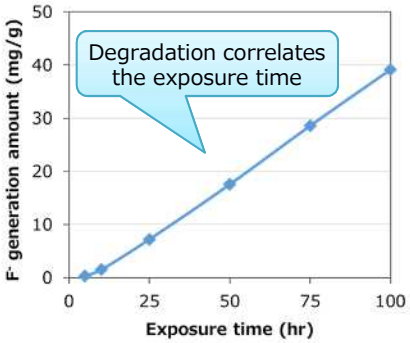
1) S. Hommura, K. Kawahara, T. Shimohira, *Polymer Preprints, Japan*, **54**, 2 (2005).

◆ Limitation on evaluable samples

Items	Conditions
Sample type	Membrane, MEA
Sample size	Up to 8 cm□
Exposure side	One side, both sides
Number of sample	Up to 6

Durability of samples can be evaluated without influence on the catalyst layer.

Generation amount of F^-



Sample : Nafion®NRE-212
Sample surrounding : 100℃, 20%RH
Gas flow rate : 100 mL/min

Chamber No.	F^- generated for 100 hours (mg/g)
②	37
③	47
④	37
⑤	38
⑥	36
Average	39

Subequal degradations of samples were confirmed in any chambers.

The H_2O_2 exposure test under various conditions is available for the electrolyte membrane and/or MEA.

Various analyses of unprocessed and/or H_2O_2-exposed membranes may clarify the degradation mechanism.

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