



## Development of a Method for Clarifying the Perfluorosulfonated Membrane Degradation Mechanism in a Fuel Cell Environment

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A gas-phase H<sub>2</sub>O<sub>2</sub> exposure method in which a membrane was exposed to gaseous hydrogen peroxide to simulate the polymer electrolyte fuel cells (PEFC) environment was introduced to accelerate and assess membrane degradation. Gaseous hydrogen peroxide is able to degrade a membrane in the same manner as an actual fuel cell operation. This method is suitable for clarifying the membrane degradation mechanism because a membrane is degraded uniformly without contamination and mechanical degradation. The degradation mechanism of perfluorosulfonated membrane in a PEFC environment was investigated using the gas-phase H<sub>2</sub>O<sub>2</sub> exposure method. An increase in the number of carboxyl groups and a rapid drop of molecular weight in degraded membrane with time exposed to gaseous hydrogen peroxide was observed. We concluded that degradation of the perfluorosulfonated membrane was composed of the following two modes: (i) unzipping reaction at unstable polymer end groups and (ii) scission of main chains and forming new unstable polymer end groups at severed points. It is very likely that membranes can be degraded by hydrogen peroxide alone; ferrous ions are not necessary for membrane degradation.

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