MEA technology and power performance of Core-shell catalyst

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Introduction

The development subjects of the new materials developed in the NEDO project and the industrial community will be found out by comparing its physical properties, the cell performance or the durability. Especially, the accumulation of data by the common evaluation methods of the different kind material based on a similar concept can greatly contribute to the hypothesis setting and the verification of the problem that each concept has. It will accelerate the new material development. About twice the performance of the core-shell catalyst is obtained by measuring the ORR by RDE, when compared to a standard catalyst TEC10E50E. Core-shell catalyst is seen as an excellent technology for low platinized cathode catalyst of PEFC. However, Core-shell catalyst MEA of the standard manufacturing method cannot be obtained excellent ORR in the power generation performance compared to standard catalyst MEA. To clarify the causes of low ORR of core-shell catalyst MEA .And report measures and test results.

Experimental

MEA was prepared by the small amount catalyst manufacturing method. The ink of standard catalyst was mixed with beads method (disruptor homogenizer used) using the electrolyte solution, solvent and 70mg of TEC10E50E catalyst. Using a standard catalyst ink, MEA (A) with the active area of 1cm × 1cm was prepared with a hot press transfer method of electrolyte film (Nafion ® NR212). MEA(B) was prepared with the same manufacturing method using core-shell catalysts (Pt-Pd / C). MEA (C) was subjected to alkali cleaning and acid cleaning after the production of the catalyst ink Na type electrolyte solution using the core-shell catalyst.

Results

1) I-V characteristics and Polarization separation

Fig. 1 shows the I-V characteristics obtained by the power generation conducted in order to examine the performance of the MEA. As shown in the figure, the cell voltage of MEA(B) with core-shell catalyst is lower than that of the standard catalyst MEA(A). It was found that the activation overvoltage and diffusion overvoltage is high according to the polarization separation. A high cell voltage is obtained for MEA(C) in which Pd is not adsorbed to the ionomer of the catalyst layer.

2) ORR activity

Tabel.1 shows the ORR activity of three MEAs. The ORR of MEA(B) is 0.4 times of that of MEA(A). The ORR of MEA(C) is 2.0 times of that of MEA(A) .This results are similar to the ORR activity measured in RDE. Based on such results, it is guessed that Pd adsorbed on the ionomer causes to reduce ORR activity due to inhibiting proton conduction.

This study is one that was carried out commissioned NEDO.
(Core-shell catalyst is one that has received the offer from Doshisha University Professor Inaba.)

Reference

1) K.Sasaki et.al., Angew.Chem.Int.Ed., 49.8602 (2010)

Fig1 Comparison of IV curves with standard and core-shell catalyst .

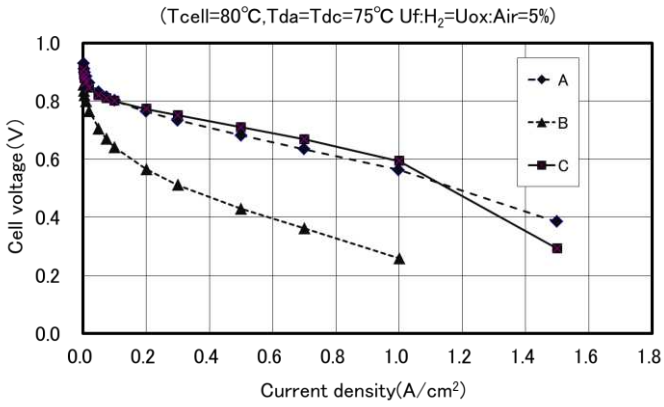

Table 1 Comparison of ORR

MEA	ORR(A/g)
A	70.5
B	26.8
C	144.0