

# Evaluation of Pt/C catalysts made by various carbon materials with different nanostructures for PEFC

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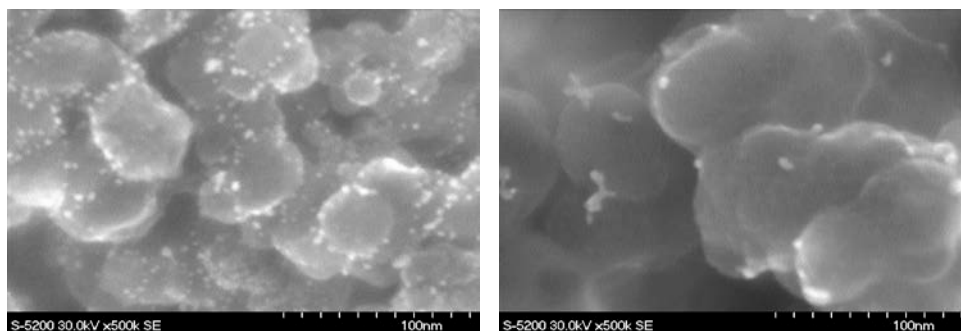
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Polymer electrolyte fuel cells (PEFCs) have attracted great attention as good candidates to provide electricity for portable and automobile applications. However, durability is still one major obstacle for PEFC commercialization. Objective of our research is to investigate effects of the nanostructure of carbon supports on the electrochemical activity and durability of catalysts in the application of PEFCs.

In this report, various kinds of Pt/C catalysts fabricated by carbon support materials with different nanostructures, such as carbon black (CB), ketjen black (KB) and graphitized ketjen black (GKB), were prepared. ORR measurements and durability tests were performed for each kind of catalysts. The change in the nanostructure before and after the durability test was also investigated for each catalyst.

In our experiment, ORR and durability measurements were evaluated by using the three electrode half-cell setup. Methods of making electrodes and protocols for ORR and durability experiments were followed by the method recommended by FCCJ<sup>[1]</sup> in 2011.

From the results of ORR measurements, the activity of Pt/GKB were a little less than those of the others. Based on the results of durability tests, by comparing their electrochemical surface areas of catalyst (ECA), Pt/GKB had the superior durability than those of Pt/CB and Pt/KB, especially under the experiment condition of 60°C. Also, conditions of platinum particles before and after the durability test were examined by SEM/TEM. SEM images of Pt/CB before and after the test are shown in Fig.1. Agglomeration of Pt particles and detachment of Pt particles from the carbon support after the durability test can be seen from the images. However, the growth of Pt particles of Pt/GKB were restrained. Thus, the influence of different nanostructures of carbon supports on the durability were clearly demonstrated. Also, the degree of graphitization seems to be a key, and we are attempting to graphitize different carbon supports for further evaluation.



(a) Before test

(b) After test (60°C)

Fig.1 SEM images of Pt/CB before and after durability test

Reference:

[1] Fuel Cell Commercialization Conference of Japan (FCCJ), Proposals of the development targets, research and development challenges and evaluation methods concerning PEFCs (Revised edition released in 2011)