Preparation of CO-tolerant Pt and Pd Anodes Modified with SnO₂ Nanoparticles for PEFC
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The fuel cell is the system which can convert H₂ to electricity efficiently. When H₂ was produced by reforming natural gas with steam, a considerable amount of CO is also produced. Since CO in the reformed fuel poisons Pt anode, CO-tolerant anode like Pt-Ru has been developed [1]. In this study Pt and Pd anodes were modified with SnO₂ nanoparticles, and the electrochemical activities were examined in the presence of CO.

20 wt% Pd or Pt-(20 wt% SnO₂)/C catalysts prepared by the impregnation method were modified with SnO₂ nanoparticles prepared by sol-gel method [2]. Carbon fiber clothes with an area of 5 cm² (Ballard) were coated with paste containing these catalysts (Pt or Pd loading was 1 mg/cm²). Nafion® 117, was put between the carbon fiber clothes, and was pressed. Cathode catalysts of these MEAs were all Pt/C. Humidified H₂ gas and air were fed to the anode and to the cathode at 85°C, respectively, and the cell performances were examined. When the tolerances to CO of the anode catalysts were measured, 500 ppm CO was added to H₂.

The performances of various Pd and Pt anodes were compared in Fig. 1. Modification with SnO₂ increased the performance of Pd/C anode, while the modification decreased that of Pt/C anode. In Fig. 2, effect of temperature on performance of Pt/C/SnO₂ anode in the presence of CO was examined. The degradation ratio of the performance of Pt/C/SnO₂ is smaller than that of Pt/C during CO poisoning although the performance of Pt/C is better than that of Pt/C/SnO₂ when pure H₂ is fed. Pt/C/SnO₂ is regenered with an increase in cell temperature, since the anode weakly adsorbed CO. Fig. 3 shows the effect of SnO₂ on performances of Pd anode in the presence of CO. Pd/C/SnO₂ anode exhibited excellent tolerance to CO poisoning. It was revealed that SnO₂ nanoparticles contributed to

Fig.1. Comparison of performances of PEFC with various Pd and Pt anodes.
Cell temperature: 85 °C; Anode gas: H₂

Fig.2. Effect of temperature on performances of PEFC with Pt/C/SnO₂ anode in the presence of CO.
Anode gas: 500 ppm CO/H₂

Fig.3. Effect of SnO₂ on performances of PEFC with Pd anode in the presence of CO.
Cathode: Pt/C; Cell temperature: 85 °C
Anode gas: H₂ or 500 ppm CO/H₂