Preparation of CO-tolerant Pt and Pd Anodes Modified with SnO_2 Nanoparticles for PEFC

Yuri Anzai, Tatsuya Takeguchi, Wataru Ueda,
Catalysis Research Center, Hokkaido University,
Kita 21 Nishi 10, Kita-ku, Sapporo 001-0021, Japan
Ryuji Kikuchi, and Koichi Eguchi
Department of Energy and Hydrocarbon Chemistry,
Graduate School of Engineering, Kyoto University,
Katsura Campus, Nishikyo-ku,
Kyoto 615-8510, Japan

The fuel cell is the system which can convert H_2 to electricity efficiently. When H_2 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 SnO_2 nanoparticles, and the electrochemical activities were examined in the presence of CO.

20 wt% Pd or Pt-(20 wt% SnO_2)/C catalysts prepared by the impregnation method were modified with SnO_2 nanoparticles prepared by sol-gel method [2]. Carbon fiber clothes with an area of 5 cm^2 (Ballard) were coated with paste containing these catalysts (Pt or Pd loading was 1 mg/cm^2). Nafion® 117, was put between the carbon fiber clothes, and was pressed. Cathode catalysts of these MEAs were all Pt/C. Humidified H_2 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 H_2.

The performances of various Pd and Pt anodes were compared in Fig. 1. Modification with SnO_2 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/SnO_2 anode in the presence of CO was examined. The degradation ratio of the performance of Pt/C/SnO_2 is smaller than that of Pt/C during CO poisoning although the performance of Pt/C is better than that of Pt/C/SnO_2 when pure H_2 is fed. Pt/C/SnO_2 is regenerated with an increase in cell temperature, since the anode weakly adsorbed CO. Fig. 3 shows the effect of SnO_2 on performances of Pd anode in the presence of CO. Pd/C/SnO_2 anode exhibited excellent tolerance to CO poisoning. It was revealed that SnO_2 nanoparticles contributed to

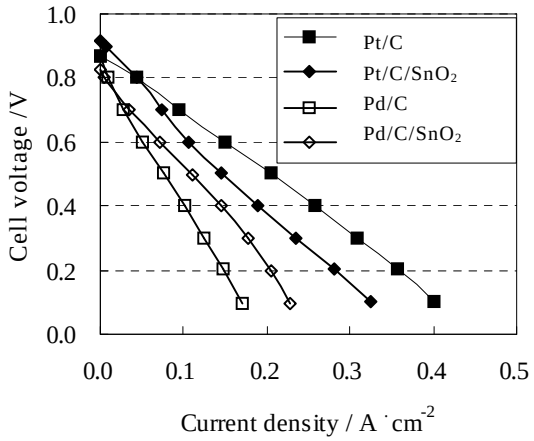

Fig.1. Comparison of performances of PEFC with various Pd and Pt anodes.
Cell temperature: 85 ºC; Anode gas: H_2

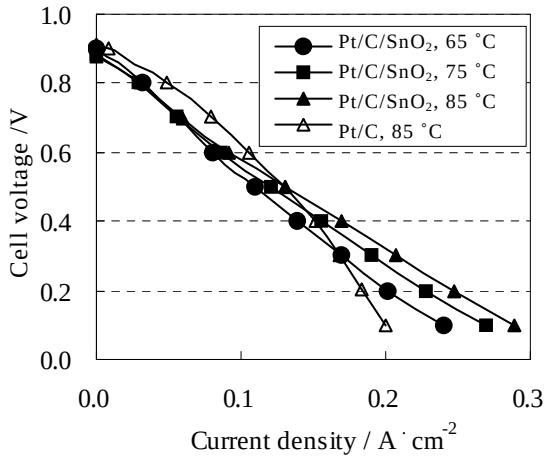

Fig.2. Effect of temperature on performances of PEFC with Pt/C/SnO_2 anode in the presence of CO.
Anode gas: 500 ppm CO/H_2

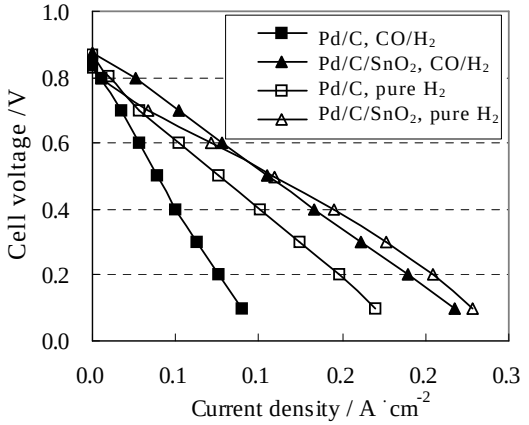

Fig.3. Effect of SnO_2 on performances of PEFC with Pd anode in the presence of CO.
Cathode: Pt/C; Cell temperature: 85 ºC
Anode gas: H_2 or 500 ppm CO/H_2