

Electrochemical characteristics of Direct Dimethyl ether Fuel Cells

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INTRODUCTION

Dimethyl ether (DME) is one of the most promising fuels for direct fuel cells. It has been reported in 1998 that the direct dimethyl ether fuel cell (DDFC) had same performance as the direct methanol fuel cell (DMFC) [1]. In Fig. 1 using Pt catalyst for anode and cathode, DDFC has an almost the same performance compared with DMFC. In this study, a generation performance of DDFC using Pt-Ru catalyst for anode was investigated.

EXPERIMENTAL

27 % Pt-13 % Ru/C was used as an anode catalyst, and 50 % Pt/C was used as a cathode catalyst. Both anode and cathode contained platinum of 1 mg/cm², and had an area of 5*5 cm². Nafion117 was used for the electrolyte film, and JARI standard cell was used. We measured power generation performance, increasing the temperature in the cell from 80 to 130 °C. Humidified dimethyl ether gas was supplied to anode, and humidified oxygen gas was supplied to cathode.

In order to investigate a generation characteristic, single electrode potentials of anode and cathode were measured, respectively. JARI standard cell was drilled to install the salt bridge. The salt bridge was established so that saturated KCl solution touched a Nafion membrane of membrane electrode assembly (MEA), and then single electrode was measured. Ag/AgCl electrode was used for a reference electrode. We measured single electrode potential with the cell voltage simultaneously.

RESULTS AND DISCUSSION

Effect of temperature on DDFC performance using Pt-Ru catalyst is shown in Fig. 2. The temperature of the cell was varied from 80 to 130 °C. The generation performance was degraded, decreasing the cell temperature, as shown in Fig. 2. Especially, when the cell temperature was less than 90 °C, it was clear that performance is decreased remarkably. It may be caused by CO poisoning on Pt-Ru catalyst. When the cell temperature was more than 100 °C, DDFC using Pt-Ru catalyst showed higher performance than DDFC using Pt catalyst. Our group has reported that, under high pressure and humidity, DDFC using Pt-Ru catalyst has the same performance as DDFC using Pt catalyst even the temperature of 80 °C [2]. We will study electrochemical characteristics to investigate the causes of this performance degradation.

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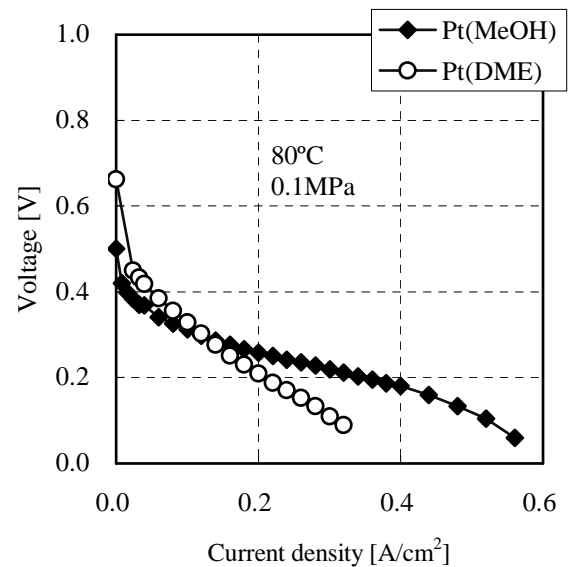


Fig. 1 Comparison of performances power generation of DDFC and DMFC.

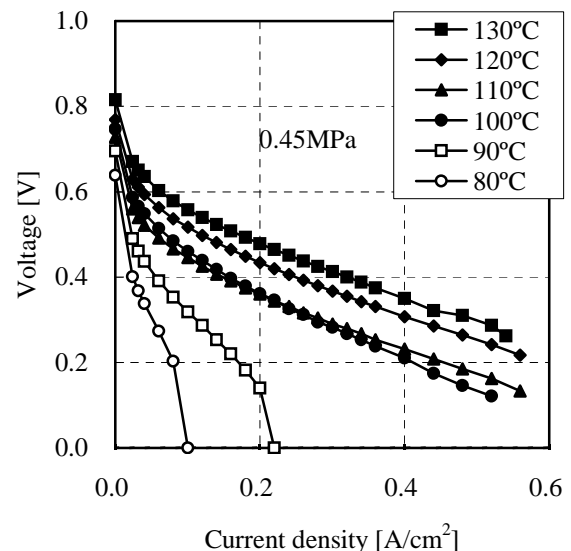


Fig. 2 Effect of the temperature on generation performance of the Pt-Ru catalyst at DDFC.