Pt-Mo catalyst for CO tolerance in PEMFC

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Introduction

CO-tolerance is of intense importance in the development of PEMFC anode catalysts since most reformate fuels contain 50~100 ppm CO which can easily poison anode Pt catalyst. It was reported that carbon supported Pt-Mo catalyst showed better CO-tolerance than the commercial Pt-Ru/C catalyst[1]. T/J Technologies has also been developing Pt-Mo catalyst. We observed interesting Pt-Mo interaction and its effect to CO-tolerance by using ad-atom, powder microelectrode and CO-stripping methods. We also observed that carbon supported Pt-Mo activity in real fuel cell depends strongly upon the catalyst preparation procedures, for example, borohydride reduction, "colloidal " dispersion, chemical vapor deposition (CVD) etc. Our systematic investigation of the Pt-Mo system illustrates new progress in this area, which will benefit the R&D of other CO-tolerant PEMFC catalyst systems.

Experimental

The Pt/Mo adatom electrode was prepared by soaking Pt powder microelectrode in 10mM $(NH_4)_6Mo_7O_{24}$ solution for several minutes with further careful rising using Nano-pure water. The CO-stripping was performed in powder microelectrode cell[2] with a Pt counter electrode and RHE as a reference as seen in figure 1.

Fuel cell performance was measured at 80^{o}C with zero back pressure H_2(+100ppmCO) and O_2 or air at anode and cathode side respectively. A Scribner load bank was used for testing after 2~3 days' cell conditioning. Nafion 117 was used to prepare MEAs with 0.5mg/cm^2 Pt at the cathode. Total metal loadings of anode electrodes (Pt + Mo or Pt + Ru) were about 0.5 mg/cm^2. The anode Pt-Mo/C catalysts were prepared by T/J Technologies' proprietary procedures, the CO-tolerance activity was compared with that of the commercial carbon supported Pt-Ru catalyst.

Results and discussion

Figure 2 shows CO-stripping profiles on Pt and Pt/Mo adatom electrodes after adsorbing CO at 0.1V for 15 minutes and flushing CO in 0.5M H_2SO_4 with purging N_2 for at least 30 minutes. In the case of Pt/Mo adatom, the CO stripping occurs from ca. 0.2V and displays a clear peak around 0.4V, lower than that of Pt-Ru/C. This may indicate promising CO-tolerance for Pt-Mo system.

Figure 3 shows the fuel cell performance using TJ Pt-Mo/C (a) anode catalyst. It showed enhanced CO-tolerance and H_2 oxidation activity in comparison with the commercial Pt-Ru/C catalyst.

Acknowledgement

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References

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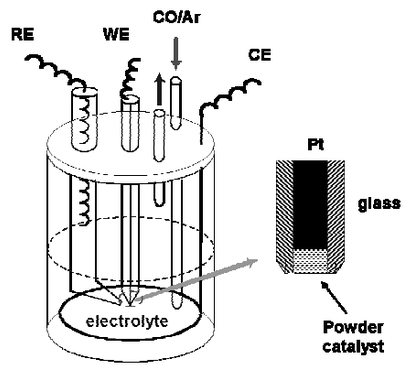

Figure 1. A powder microelectrode cell.

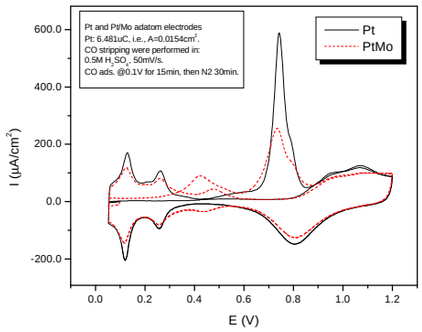

Figure 2. CO stripping profiles on Pt (solid line) and Pt-Mo adatom (dashed line) electrodes.

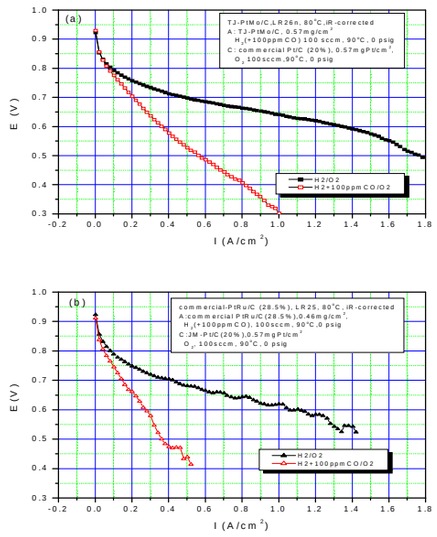

Figure 3. Fuel cell performance comparison of TJ-Pt-Mo/C vs commercial Pt-Ru/C. (a) TJ-Pt-Mo/C, (b) commercial Pt-Ru/C