

Preparation of carbon-coated stainless steel as bipolar plates for polymer electrolyte fuel cell

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Introduction

Polymer electrolyte fuel cells (PEFC) have been studied as the power sources of fuel cell vehicles, portable electronic devices, etc. Metallic materials such as stainless steel are very attractive for preparation of thin bipolar plates. However, anti-corrosion metal shows low electronic conductivity, which is disadvantage as current collector. If a carbon layer is coated on the surface of stainless steel whose passive film has been completely eliminated, the electronic conductivity will be sufficiently high. In this paper, a preparation of carbon-coated stainless steel by plasma-assisted CVD and its characteristic as bipolar plates were reported.

Experimental

Carbon-coating on substrates was carried out by using plasma-assisted CVD [1]. The substrate material is stainless steel (SUS304). The interfacial contact resistance (ICR) of the obtained carbon-coated metal was evaluated. As the corrosion test, linear sweep voltammetry was conducted under the simulated PEFC operating condition.

Results and discussion

ICRs of carbon-coated SUS304 were drastically small compared with ICRs of SUS304 due to its passive film. This result indicated that carbon-coat can give high electric conductivity to the surface of SUS304 and passive film might be removed.

Based on the dynamic polarization curves at 80 °C in 0.5 moldm⁻³ H₂SO₄ bubbled with O₂ (Fig.1) A clear anodic current was observed for SUS304 due to the dissolution of metal. On the other hand, anodic current for carbon-coated SUS304 was much smaller than that for SUS304 and immersion potential of carbon-coated SUS 304 was close to carbon materials. Hence, it was clarified that carbon-coat is effective to impart high corrosion resistance to SUS304. From these results, ICR and polarization curves, it is considered that carbon-coated SUS304 is suitable for metal bipolar plate materials of PEFC.

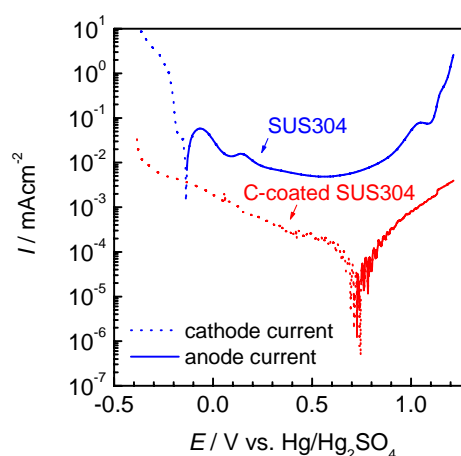


Fig.1 Dynamic polarization curves of SUS 304 and carbon-coated SUS304 at 80 °C in 0.5 moldm⁻³ H₂SO₄ bubbled with O₂.

References

- [1] T. Fukutsuka, T. Yamaguchi, S. Miyano, Y. Matsuo, Y. Sugie, Z. Ogumi, *J. Power Sources*, **174**, 199 (2007).