CHAPTER 5

CONCLUSIONS

As we mentioned in the experiment that carbon-base coating, metal nitrides or carbides and also conductive oxides were investigated for an available choice for metallic bipolar plate coating against corrosion and also conductive. We first investigated with metal doped diamond like carbon in order to reduce the electrical resistance. In this case, we studied film resistant correlated with amount of metal doped and substrate bias. However, the film thickness was very thin inappropriate for bipolar plate coating. The other techniques were plasma immersion and magnetron sputtering deposition. These techniques applied to metallic bipolar plates for fuel cell testing.

5.1 a-C:Mo thin film

Molybdenum-containing amorphous carbon (a-C:Mo) films have been synthesized using a dual-cathode filtered cathodic arc plasma deposition. The experiment results show that both the amount of Mo contained in a-C:Mo films and the bias voltage acting on carbon ions during growth can affect the film resistivity. The sp^2 fraction in the films correlated with electrical conductivity of the films. The film thickness can be controlled by the numbers of deposition pulses. The film resistivity controlled by the Mo/C ratio and bias voltage. This technique can produce ultrathin films that combine properties of hard carbon and a certain conductivity at room temperature that is much higher than for undoped a-C.

5.2 Fuel cell bipolar plates application

Protective surface modification of AISI 304 stainless steel by nitridation and carburization, and surface coating by ZnO and ZnO:Al were investigated for PEMFC

metallic bipolar plates. The chemical composition of the nitride and carbide layer was investigated by GDOES analysis. Interfacial contact resistance (ICR) and static water contact angle of the treated surface were comparable with those of graphite. The corrosion rate can be used to predict initial performance and the lifetime of bipolar plates. In single cell tests, the initial performance of some treated bipolar plates was significantly improved over those of bare AISI 304 bipolar plates although they are still inferior to graphite bipolar plates.