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Study on Properties of Carbon-based Layer for Proton Exchange Membrane Fuel Cell Application

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Abstract : The fuel cell market has considerable development potential, but the cost is still less competitive. Replacing the traditional graphite plate with a stainless steel plate as a bipolar plate can greatly reduce the weight and volume of the stack, and has more cost advantages. However, the passivation layer on the surface of stainless steel makes the contact resistance reach the ohmic level and reduces the performance of the fuel cell. Therefore, it is necessary to reduce the interfacial contact resistance through the surface treatment. In this research, the thickness, uniformity, interfacial contact resistance (ICR), and adhesion of the carbon-based layer was analyzed. On the other hand, the effect of coating properties on the performance of the fuel cell was verified through I-V tests. The results show that after coating the contact resistance is greatly reduced by three stages to the microohm level, and as the film thickness is reduced, the contact resistance is reduced from 229~118 mΩ-cm² to 135~73 mΩ-cm² at a general assembly pressure of 1 to 2 MPa., and the current density at 0.6 V increased from 485.7 mA/cm² to 575.7 mA/cm². This study verifies the importance of the uniformity and ICR of the coating on proton exchange membrane fuel cell (PEMFC), and the surface coating technology is the key to affecting the characteristics of the coating.

Keywords : contact resistance, proton exchange membrane fuel cell, PEMFC, SS bipolar plate, spray coating process
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