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An experimental study on water management and electrical conductivity behaviors of TiN coated polymer composite bipolar plates for PEMFC

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Bipolar plates are a key component of PEM fuel cells because of having a large portion of the weight and total cost of a fuel cell stack. Bipolar plates made of polymer composite materials preferred in PEM fuel cell applications due to their low material and production costs, high strength, low weight and high corrosion resistance. Although polymer composite bipolar plates have such good properties, they can show low electrical conductivity, which affects the efficiency of PEM fuel cells. To overcome this issue, different coating types are suggested. In this study, TiN was coated on polymer composite bipolar plates to improve electrical conductivity. A single cell using the TiN nanoparticles coated bipolar plates has 50 cm² active layers. For surface properties, contact angle and surface roughness were also tested. The wetting measurements demonstrate that TiN nanoparticles coated bipolar plates result in contact angle from 85°. The single PEM fuel cell was evaluated at various conditions. The performance was more than 0.32 W/cm² for polymer composite bipolar plate at 50°C in humidified hydrogen and oxygen conditions. As the results, inexpensive TiN nanoparticle coated type polymer composite bipolar plates would become a possible alternate for the expensive graphite bipolar plates

Keywords

Coating

PEM fuel cell

Bipolar plate

Performance