

Bi-layer CrN/Cr Coating on a SS316L Substrate as Bipolar Plate Material for an HT-PEFC

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A bi-layer CrN/Cr coating with an inner adhesive Cr layer and outmost CrN layer was deposited on the surface of 316L stainless steel (SS316L) for the application of bipolar plates in high-temperature polymer electrolyte fuel cells (HT-PEFCs) by means of a reactive magnetron sputtering method. Electrochemical tests, including potentiodynamic, potentiostatic polarization and electrochemical impedance spectroscopy, were carried out to evaluate the corrosion resistance and stability of the CrN/Cr coating in simulated HT-PEFC environments (85 wt.% H₃PO₄ solution at RT and 130 °C). The results show that the CrN/Cr coating could provide the bare SS316L substrate with almost 100% protective efficiency. The corrosion current densities of the CrN/Cr-coated SS316L specimen are ca. 0.01 $\mu\text{A cm}^{-2}$ at RT and 0.1 $\mu\text{A cm}^{-2}$ at 130 °C in the simulated HT-PEFC environment (the requirement of the Department of Energy (DOE) is less than 1 $\mu\text{A cm}^{-2}$).