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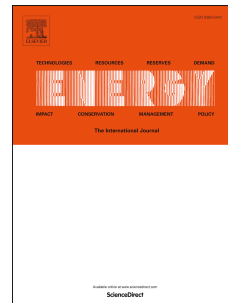
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Corrosion and interfacial contact resistance behavior of electrochemically nitrated 316L SS bipolar plates for proton exchange membrane fuel cells

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Abstract

In the present investigation, electrochemically nitrated surface was developed on 316L stainless steel (SS) through potentiostatic method using an aqueous solution containing 0.1 M HNO₃ and 0.5 M KNO₃ at room temperature. The formation of nitrides was confirmed by X - ray photoelectron spectroscopy (XPS) and the formed nitrides existed in the form of mixed nitrides viz, CrN, Cr₂N and nitrogen incorporated oxides (Cr-O-N). The corrosion behavior of untreated and nitrated SS was studied in 0.5 M H₂SO₄ and 2 ppm of HF. The untreated and nitrated SS showed decrease in impedance value with increasing potential from OCP (Open Circuit Potential) to proton exchange membrane fuel cell (PEMFC) anode and cathode environments and nitrated SS exhibited comparatively higher impedance values at each potential. The lower passive current density and lower metal ions concentration released for nitrated SS in both PEMFC anode and cathode environments indicated higher corrosion resistance. Before polarization, the interfacial contact resistance (ICR) value of nitrated SS matched well with Department of Energy's (DOE's) required value. After polarization, the lower ICR values for nitrated SS indicate enhanced electrical conductivity.

Key words: bipolar plate, nitrides, CrN, Cr₂N, contact resistance

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