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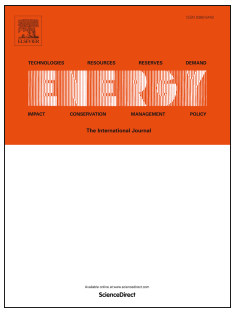

Corrosion and interfacial contact resistance behavior of electrochemically nitrided 316L SS bipolar plates for proton exchange membrane fuel cells

S. Pugal Mani, N. Rajendran

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

S. Pugal Mani and N. Rajendran*

Department of Chemistry
Anna University, Chennai-600 025, India.
E mail: nrajendran@annauniv.edu

Abstract

In the present investigation, electrochemically nitrided surface was developed on 316L stainless steel (SS) through potentiostatic method using an aqueous solution containing 0.1 M HNO_3 and 0.5 M KNO_3 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, Cr_2N and nitrogen incorporated oxides (Cr-O-N). The corrosion behavior of untreated and nitrided SS was studied in 0.5 M H_2SO_4 and 2 ppm of HF. The untreated and nitrided 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 nitrided SS exhibited comparatively higher impedance values at each potential. The lower passive current density and lower metal ions concentration released for nitrided SS in both PEMFC anode and cathode environments indicated higher corrosion resistance. Before polarization, the interfacial contact resistance (ICR) value of nitrided SS matched well with Department of Energy's (DOE's) required value. After polarization, the lower ICR values for nitrided SS indicate enhanced electrical conductivity.

Key words: bipolar plate, nitrides, CrN, Cr_2N, contact resistance