Deposition of Vulcan XC-72 coatings on stainless steel bipolar plates by reverse pulsed DC voltage electrophoretic deposition (EPD) for Fuel Cell applications

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Bipolar plates are important components for Polymer Electrolyte Membrane Fuel Cells (PEMFCs). Some of the requirements for cost-effective bipolar plates include easy fabrication and machining, low cost, high corrosion resistance and high electrical conductivity. A number of materials such as graphite, stainless steel and composites have been proposed for the fabrication of bipolar plates. Although graphite has been widely used, its relatively high cost has made different research groups suggest metallic materials as candidates for bipolar plates. Even though, it has been acknowledged that the main drawback of metallic materials is their low corrosion resistance. To overcome this problem, the use of protective coatings has been explored.

In this work, surface coatings of a mixture of Vulcan and polypyrrole were deposited on nitride and oxynitride stainless steel (SS) substrates by EPD under reverse pulsed DC voltage in acetone-methanol solutions. The applied voltage (50-120V) and the time of deposition (2-15 minutes) were varied in order to control the film thickness. The morphology of the coatings was evaluated by SEM analysis. Polarization curves were conducted in order to evaluate the corrosion resistance of the bipolar plates in 0.5 M H_2SO_4, at room temperature and 60°C. The results showed that corrosion current densities are dependent on the nature of protective coatings and also on parameters used to deposit the coatings.