**Patterned method of coating on flow field plates of PEM based Electrolyser for Hydrogen production**

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**ABSTRACT**

Hydrogen energy is one of the frontier alternatives to fossil fuels in energy applications. It is a clean and flexible energy carrier that can be used to produce power in all-end sectors. It can be produced either by the reformation of hydrocarbons or water electrolysis process. For on-site hydrogen generation, electrolysis is the best option has the potential to produce hydrogen using renewable energy sources. Proton Exchange Membrane (PEM) Electrolyzers can be operated at higher current densities and under high pressurized conditions with high voltage efficiency compared to alkaline electrolyzers. In PEM electrolyzer, bipolar plate or flow field plate is one of the important components, which simultaneously ensures charge carrier transport from cell to adjacent cell, supply and removal of the reactants (i.e water ), removal of produced gases from the cells (i.e H2 and O2) and provides the mechanical stability to electrolyzer. Titanium is conventionally used flowfield plates for PEM water electrolyzers because of good corrosion resistance and high mechanical strength, but it is prone to oxidation on the anode side and hydrogen embrittlement on the cathode side. Hence a coating of Platinum over the titanium is widely used as a protective and conductive purpose in PEM electrolyser. However, it increases the system cost further.

In the present work, an attempt has been made to reduce the platinum content on Ti-6Al-4V substrate. This was achieved through a patterned platinum coating using electrodeposition technique followed by thermal oxidation or electrochemical anodization for the growth of the TiOx layer. This has reduced the coverage of Pt to 30-40% on the substrate. The patterned substrate was characterized for uniformity and thickness of Pt coating using FESEM and Optical profilometry. The corrosion resistance and the stability of the coating are studied in a simulated PEM water electolyser environment using potentiodynamic and potentiostatic test. The Ecorr and Icorr of Patterned coating were found to be 554 mV and 1.15 µA/cm2. Impedance and Mott-shotky are also used to study the oxide layer characteristics. The results shows that patterned coating on flowfirld plates can reduce the cost without compromising in corrosion protection. These results will be discussed

*Keywords: PEM Electrolyzer, Flowfield Plates, Ti-6Al-4V, Platinum.*