DEVELOPMENT OF IRIDIUM BASED ELECTROCATALYSTS FOR PEM WATER ELECTROLYSIS

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ABSTRACT

Europe has set ambitious targets to increase the share of renewable energy sources in its energy consumption. Due to their intermittent character, this increase will largely depend on the development of storing technologies so as to balance the grid loads. The conversion of electricity into an energy carrier, which can be stored and used directly as fuel, is an attractive option. Under this framework, a most promising comprises the conversion of renewable electricity into H_2.[1] The conversion of electricity into H_2 is performed by water electrolysis that can be performed below 100°C using a proton exchange Membrane Electrolyser (PEMEL). PEM technology can be efficient, has an excellent dynamic response to start-up, variable load and on/off cycling and produces "cleaner" H_2, without hazardous substances.[2] However, the technology still remains very expensive, due to the use of expensive electrocatalysts (e.g. Pt and IrO_2) and titanium structure material.

The objective of this work is to develop more efficient anode electrodes (for the Oxygen Evolution reaction, OER) by improving the activity and durability of the electrocatalysts while using minimal precious metal Ir loading. The activities include the synthesis of nanostructured Ir oxide based electrocatalysts of high available and exposed surface area with improved mass activity that can sustain the high applied overvoltage, especially at high current densities. Deposition of catalysts onto high surface area supports enables high dispersion of catalysts and high activity which reduces the loading (and cost) of electrodes.[3]The corrosion stability and durability of the OER electrocatalyst support appears to be one of the greatest challenges, since carbon cannot be used. Electrically conductive sub-oxides and carbides of titanium are developed herein and used as supports for metal deposition**.** Morphological and physicochemical characterization is followed by their electrochemical characterization in terms of activity using the Rotating Disk Electrode method in relative to the application conditions. The catalyst performance is compared to that of commonly used unsupported commercial iridium oxide and the results are correlated towards the understanding of the effect of the support.

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KEYWORDS: Oxygen Evolution Reaction, Substrate, Hydrogen, Ir catalyst, Water electrolysis

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