Discretization of the basic electrochemical properties of oxygen-evolving IrO_2-Ta_2O_5 electrodes as a tool to evaluate the electrode uniformity and operational behaviour

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Analysis of basic electrochemical properties of oxygen-evolving IrO_2-Ta_2O_5-coated titanium electrodes is presented as a tool to evaluate the coating uniformity and corresponding electrode electrolytic stability. Coating was prepared using conventional thermal decomposition. Three random positions at the electrode surface were subjected to the potentiodynamic polarization, cyclic voltammetry, electrochemical impedance spectroscopy and accelerated stability test in 10 % H_2SO_4 solution.

Ti anode was prepared before applying the coating. After cleaning in acetone and deionized water, the anode was immersed in a boiling 10 % oxalic acid solution to obtain a uniform and rough surface. The anode was then cleaned in ethanol and dried at room temperature. Precursor, which is used for the preparation of the coating, $H_2IrCl_6x6H_2O$ and $TaCl_5$, in a certain molar ratio, were dissolved in alcohol mixture and applied in layers, using the drop casting method, on the Ti porous anode.

Evaluated electrocatalytic and electric parameters and their changes upon coating destabilization during oxygen evolution at different current densities were correlated to coating morphology and presented as the coating uniformity indicators. It was found that coating activity relates to morphology-caused distribution of electric parameters, whereas the activity loss is the consequence of IrO_2 exhausting from the coating surface layers. Interior of destabilized coating was found still reach in IrO_2. Presented analysis appears useful for managing the coating composition and structure with respect to required operational conditions.

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