

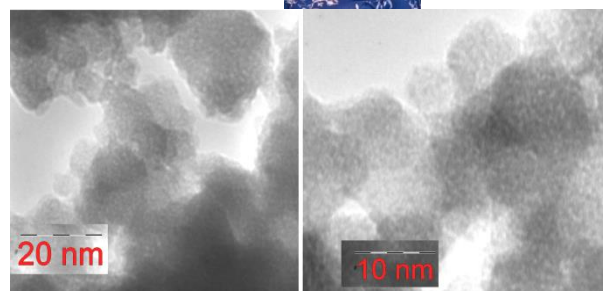
Nanoscale iridium and tin oxide on titanium surface as electrocatalyst in oxygen evolution reaction during water electrolysis in acidic medium

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Abstract:

In this work we propose a novel promising route for the direct synthesis of nanoscale iridium and tin oxide nanolayers by a successive ionic layer deposition method (SILD). An aqueous solution of SnCl_2 and the colloidal solution of $\text{IrO}_x \cdot n\text{H}_2\text{O}$ nanoparticles and $\text{Na}_2[\text{Ir}(\text{OH})_6]$ mixture, obtained by alkaline hydrolysis of H_2IrCl_6 solution, were used as precursors for the synthesis. A number of samples were obtained by the SILD method at various numbers of cycles and heat-treatment temperature. The synthesized nanoscale oxide exhibited electrocatalytic properties in the oxygen evolution reaction (OER) upon water splitting in the acidic medium. It was found that the films obtained as a result of 30 SILD cycles and heated in argon at a temperature of 300°C had the best electrocatalytic properties in the reaction of oxygen evolution in HClO_4 solution. For them, an overpotential value with a current of 10 mA/cm^2 was 288 mV and a Tafel coefficient value totaled 56 mV/dec. Methods of SEM, TEM, EDX, XRD, XPS and FTIR spectroscopy allowed to define that the samples consisted of $\text{Ir}_x\text{SnO}_y \cdot n\text{H}_2\text{O}$ amorphous nanoparticles with the size of 10-20 nm and iridium content, namely, x value equaled 0,7. Based on the obtained results, schemes of chemical reactions proceeding at each stage of the synthesis were constructed. It is suggested that the proposed new synthetic method may serve as the basis for creating a wide range of coatings for electrodes in electrochemical devices, including electrolyzers of water, power sources, electrochemical sensors, electrical stimulators, electrochromic devices, etc.



Biography

M.V. Kaneva is a PhD student at Saint Petersburg State University. She has published 3 articles in journals, indexed in Web of Science and Scopus. Her research interests include the synthesis of new electrocatalysts for hydrogen energy by successive ionic layer deposition method.

Speaker Publications:

“Features of inorganic nanocrystals formation in conditions of successive ionic layers deposition in water solutions and the Co(II)Co(III) 2D layered double hydroxide synthesis”

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