Hybrid Materials for Electrocatalysis and Photocatalysis

HEAD:

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GROUP MEMBERS:

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RESEARCH PROFILE:

Our interests concern elaboration of materials and compounds of potential application in electrocatalysis, photocatalysis and various type of sensors.

CURRENT RESEARCH ACTIVITIES:

Preparation and electrochemical characterization of novel materials for electrooxidation of oxygen reduction reaction (ORR) based on platinum nanoparticles and nonprecious metal catalysts.
Development of novel integrated electrocatalyst sytems for electrooxidation of polyhydric and monohydric alcohols as alternative technologies to hydrogen based fuel cells.
The investigations focus principally on photoelectrochemical properties of hierarchical semiconducting oxide electrodes, such as tungsten trioxide (WO_3), ferric oxide (Fe_2O_3) and polyoxometalates that are employed to split water or photodecompose organic pollutants present in water.
Development of new colorimetric test for onsite preliminary drugs tests in illicit samples. These studies are conducted in cooperation with the Central Forensic Laboratory of the Police Research Institute in Warsaw.

SELECTED PUBLICATIONS:

1. E. Biaduń, N. Nowak, J. Kowalska, K. Miecznikowski, B. Krasnodębska-Ostręga, Organic matter decomposition before arsenic speciation analysis of water sample - "Soft decomposition" using nano-photocatalysts, Chemosphere. 207 (2018) 481.
2. W.H. Steinecker, K. Miecznikowski, P.J. Kulesza, Z.D. Sandlin, J.A. Cox, Amperometric detector for gas chromatography based on a silica sol-gel solid electrolyte, Talanta. 174 (2017) 1.
3. L. Adamczyk, J.A. Cox, K. Miecznikowski, Activation of a Pt-based alloy by a Keggin-type cesium salt of heteropolytungstate towards electrochemical oxidation of ethylene glycol in acidic medium, International Journal of Hydrogen Energy. 42 (2017) 5035.

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4. B. Krasnodębska-Ostręga, A. Bielecka, E. Biaduń, K. Miecznikowski, Mesoporous film of WO3-the "sunlight" assisted decomposition of surfactant in wastewater for voltammetric determination of Pb, Applied Surface Science. 388 (2016) 746.
5. K. Miecznikowski, A. Ramírez, S. Fiechter, P. Bogdanoff, E. Szaniawska, A. Wadas, P.J. Kulesza, Development of Hybrid Tungsten Oxide Photoanodes Admixed with Borododecatungstate-Polyanion Modified-Hematite: Enhancement of Water Oxidation upon Irradiation with Visible Light, Electrochimica Acta. 179 (2015) 379.
6. M. Murawska, J.A. Cox, K. Miecznikowski, PtIr-WO3 Nanostructured Alloy for Electrocatalytic Oxidation of Ethylene Glycol and Ethanol, Journal of Solid State Electrochemistry. 18 (2014) 3003.
7. L. Adamczyk, K. Miecznikowski, Solid-state electrochemical behavior of Keggin-type borotungstic acid single crystal, Journal of Solid State Electrochemistry. 17 (2013) 1167.
8. K. Miecznikowski, Electrocatalytic Oxidation of Ethanol at PtRh Nanoparticles in Presence of Molybdenum Oxide: Comparison to the System Utilizing Tungsten Oxide, Journal of Solid State Electrochemistry. 16 (2012) 2723.
9. K. Miecznikowski, P.J. Kulesza, Activation of dispersed PtSn/C nanoparticles by tungsten oxide matrix towards more efficient oxidation of ethanol, Journal Power Sources. 196 (2011) 2595.