NETPORE
Network on porous semiconductors and oxides

PRESENTER INFORMATION

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BIOGRAPHICAL SKETCH

Grzegorz D. Sulka received his PhD in Chemistry (1999) at the Jagiellonian University in Krakow, Poland. In the years 2000-2003 he was a Belgian Government fellow at the Katholieke Universiteit Leuven, and in 2008 the Deutscher Akademischer Austauschdienst fellow at the Max Planck Institute of Microstructure Physics, Halle, Germany. Currently, he is a full professor and head of the Eelctrochemistry Group at the Jagiellonian University. His research interests include electrochemical synthesis of nanomaterials and thin films, photoelectrochemical and semiconducting properties of nanomaterials as well as electrocatalysis. In particular, his interest is focused on the synthesis, characterization and applications of anodic metal oxides in the field of energy conversion and storage, novel biomaterials, and sensing devices. He has also experience in a template-assisted fabrication of nanowire, nanotube and nanodot arrays for electrocatalysis.

TITLE: **Nanostructured anodic metal oxides – synthesis and applications**

ABSTRACT

In recent years, the interest of the scientific world has been focused on nanostructured materials, which, compared to their solid counterparts, are characterized by unique optical, electronic, chemical and catalytic properties. Among various nanostructured materials, densely packed structures with constant periodicity and a high degree of regularity, such as nanopore, nonotubular and nanowire arrays, are of great importance. Unfortunately, a significant problem limiting practical applications of these nanomaterials is a relatively high cost of their fabrications. Among the many different methods and strategies, methods based on controlled electrochemical oxidation of metals (e.g., Al, Ti, W, Sn and others), which lead to the formation of nanostructured anodic oxide layers, seem to be particularly prospective and promising. With the use of appropriate anodization conditions, the oxide layer formed on the surface may have a porous structure strictly defined by parameters such as pore diameter, spacing between pores, porosity and pore packing density.

Nanoporous anodic aluminum oxide (AAO), obtained by anodic oxidation of metal in acidic solutions, plays a crucial role as a template in the synthesis of various functional nanostructured materials. AAO matrices are particularly widely used for the preparation of periodic arrays of nanowires, nanocones and nanotubes, both metallic, semiconductor and polymeric. Potential applications for nanowires include energy storage systems, nanostructured current collectors, thermoelectric materials, electrocatalysis, and chemical and biochemical electrochemical

sensors. On the other hand, nanoporous/nanotubular anodic semiconductor oxides (TiO_2, WO_3, SnO_2 and others) are commonly considered as promising materials for clean energy generation and storage technologies, such as photovoltaics, photoelectrochemical water splitting, hydrogen generation and photocatalysis. Moreover, due to its excellent biocompatibility and its unique surface morphology, nanoporous anodic titanium oxide produced on Ti support is investigated as a potential material for bone implants and controlled drug delivery systems.