NEW MATERIALS WITH APPLICATIONS IN CONSTRUCTIONS OF MICROBIAL FUEL CELLS AND THERMOELECTRICAL GENERATORS

Author: Narcis Mihai DUȚEANU

Abstract

The habilitation thesis is structured in 2 parts. First part is shortly describing the main scientific, professional and academic achievements starting from the doctoral dissertation (March 2007) until today. Approached research domains were aiming chemical engineering and because of the approached thematic I can also state that I also targeted environmental protection domain.

Today's most important problem of the human society is the environment's incapacity of powering the growing global energy consumption – derived from industrial and household consumers. During the development of last century's society – electrical energy production and transport issues were noticed and tracked.

Starting from the classical fuel cells technology and correlating this technology with the necessity of advanced remediation of wastewaters, were developed the microbial fuel cells due to the discovery of microorganism able to use an external electrons acceptor. Microbial fuel cells represent electrochemical devices derived from classical fuel cells by replacing the platinum catalytic layers with biological catalytic layers. Due to this modification microbial fuel cells are able to convert organic matter from wastewaters directly into electrical energy concomitant with wastewater remediation.

For a better understanding of the actual development of microbial fuel cells technology I presented the working principle, and based on that it's been established the formula of calculating the tension at its terminals in ideal conditions.

Also, based on this formula – the possible losses occurring in the real functioning system have been evaluated – while explaining the way these losses can be minimized, pursuing the increase of the energy efficaciousness of the considered system.

Starting point of the research was a device cost reduction by replacing the platinum catalyst layers with catalyst layers builds with carbonic materials – as also by replacing the protons exchange membranes with ceramic membranes.
Another research domain is the obtaining of semiconductors applicable in thermoelectric production systems of electrical energy. I considered this domain a priority because very big amounts of thermal energy are not used – therefore becoming residual energy.
During these experiments I synthesized and characterized the Zn4Sb3 semiconductor as also research the way that Ag and Sn doping influence the properties of this material.

The second part of the habilitation thesis presents the planning and evolution of the teaching and research career. Thus, the future research directions are presented as a natural follow up of the research conducted so far.

All habilitation thesis at:
http://www.upt.ro/Informatii_teze-de-abilitare-sustinute_285_ro.html

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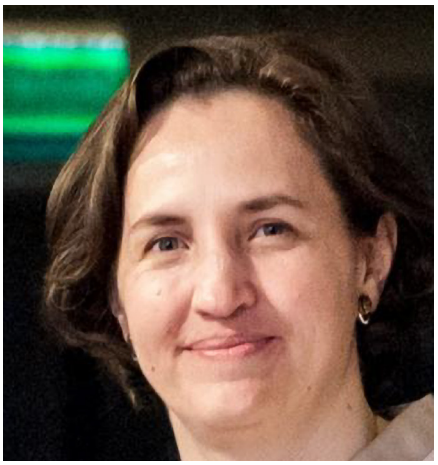
DEVELOPMENT OF NEW VARIANTS OF SYNTHESIS FOR SPINEL NANOSTRUCTURES WITH POTENTIAL APPLICATIONS IN ENVIRONMENTAL PROTECTION

Author: Marcela-Elena STOIA



Abstract

This thesis synthetically presents the results obtained in the field of synthesis, characterization and environmental applications of nanostructured oxides systems.

The first part of this Habilitation Thesis presents the main professional, scientific and academic achievements obtained after granting the PhD title, aswell as a selection and scientific results representative for my activity in the field of development of new variants of synthesis for spinel ferrite nanoparticles with potential environmental applications.

It is well known that the reduction in size of ferrite particles to nanometric scale leads to special properties for these materials, different from those of the bulk (micrometric) material. It has also been demonstrated that the chemical and magnetic properties of nanoparticles in general (and in particular spinel ferrites) are strongly influenced by their composition, structure and morphology, which, in turn, are dependent on the synthesis methodology. Hence the importanceof developing new synthesis variants by modifying the already known synthesis methods so as to provide the most advanced control over the shape and size of nanoparticles and, implicitly, over their properties. In this context, my research activities on the development of new synthesis variants,focused on four of the synthesis methods employed to obtain nanocrystalline spinel ferrite: the thermal decomposition of the precursors, the solvothermal method, the coprecipitatio method and the sol-gel method.

Thus, in the case of the method based on the thermal decomposition of the precursors obtained in the redox reaction between the mixture of nitrates and diols, I have expanded the research by using polyols as reducing agents, such as high molecular weight polyvinyl alcohol.

An important chapter included in the scientific part of this thesis is the testing of MFe2O4/active carbon composites (M = Fe(II), Mn(II)) for the removaloforganic pollutants (phenol, organic dyes) from water. These composites combine the high specific surface area of the activated carbon (which givesthe composites high adsorption capacity) with the magnetic properties of ferrite nanopowders, which ensure a simple separation of the composite from the suspension.The second part of this thesis presents the evolution and development plan of the professional, scientific and academic career, the proposed objectives and the future research directions

The full thesis at:
http://www.upt.ro/img/files/2016-2017/abilitare/stoia/Stoia_Marcela_Teza_abilitare.pdf

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