DESIGN OF AN INNOVATIVE ENERGY BIOGENERATOR FOR MILITARY PORTABLE DEVICES

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Abstract*: This paper presents the development of a micro-fuel cell technology for the direct conversion of bioethanol into electrical energy, founded on the strong technical expertise in this field. Bioethanol offers an attractive alternative as a fuel in low temperature fuel cells because it can be produced in large quantities from agricultural products and it is the major renewable biofuel from the fermentation of biomass. The unique characteristics of this technology provide a significant competitive advantage for portable electronic products which require 5 to 50 watts of power and 10 to 100 watt-hours of energy.*

Keywords*: fuel cells, biofuel, energy, military portable devices.*

Fuel requirements for the military fuel cells relate to: high energy storage density; high availability worldwide; existing distribution infrastructure; low risks; low toxicity; reaction to bullet impact; simple handling.

Recently, alcohol fuel cells have been recognized as a promising alternative electrical power generation device to meet humanity's energy demands. Compared to H_2 fuel, liquid alcohol fuels are easy to store and transport, and can be derived from annually renewable biomass feedstocks mainly produced from fermentation of a wide variety of non-food plant-based materials, most commonly

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grain or sugar crops, cellulosic feedstocks, such as agricultural and forest residues, grasses, and fast-growing trees. Hydrogen production from dimethyl ether and bioethanol for fuel cell applications [1] is not toxic and completely safe.

Fuel cells working with bioethanol at low temperature are considered as possible power sources for military portable electronic devices and automobiles in the future [2].

Transformation of the bioethanol in power source (electricity) is possible through its complete oxidation to CO_2. The complete oxidation of bioethanol is very difficult to be proceeded at low temperature (<100°C) and has as a disadvantage the generation of adsorbed intermediates and byproducts [3-8].

The originality of this study is to substitute usual fuels of fossil origin with renewable energy sources and moreover to contribute to the development of technologies able to reduce the production of greenhouse gases.

The general aim of our researches was to study some new chemical systems based on nanocrystalline frameworks and porous mesoarchitecture to build PEMFC (Polymer Electrolyte Membrane Fuel Cell), which operates with bioethanol as fuel. The ethanol's conversion and selectivity to hydrogen strongly depend on the type of metal catalyst used, type of precursor, preparation methods, type of catalyst support, presence of additives, operating condition and temperature.

The main drawback of this study was the influence of the poisoning effects.

Our study was focused on three directions: i) the synthesis of the anodes by new synthesis routes; ii) the deposition of the electrolytes thin films on the cathode substrate (cathode/electrolyte systems) followed by the deposition of the anodes by chemical and physical methods; iii) the development of novel electrocatalysts with high electrocatalytic activity for bioethanol oxidation. The classical Pt electrocatalyst has a good activity and stability for many small molecules, but it is expensive and the pure Pt is not suitable as anode catalyst for ethanol oxidation at ambient or moderate temperature, because it is easily poisoned by CO intermediates.

Acknowledgements

This work was supported by a grant of Partnerships in priority S&T domains Program (PNII), MEN – UEFISCDI, project number 56/2014.

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