Nanomodified NiFe-Carbon Felt as Anode in Mediatorless Yeast-Biofuel Cell

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Biofuel cells represent an innovative technology for simultaneous electricity generation and organic waste purification [1,2]. The principle is based on the direct conversion of the biochemical energy of living cells into electrical energy. The utilization of entire microorganisms oxidizing the biodegradable organic matter, the operation at ambient temperatures, and the use of neutral electrolytes and inexpensive carbon-type electrodes are the biggest advantages of the biofuel cells over the chemical fuel cells. The low electrical output, however, is the major drawback for their wide application. The improvement of the electron transfer from the microorganisms to the anode is considered to be one of the most important factors for increasing the biofuel cell efficiency.

In our recent study [3], a significant improvement of yeast-biofuel cell output was achieved by application of Ni-modified carbon felt anodes. In the present study, the electrocatalytic properties of new nanomodified carbon materials were investigated. Nickel-iron nanostructures were electrodeposited on carbon felt by means of pulse plating technique. The newly produced materials were tested for cytotoxicity and applied as anodes in a double-chamber mediatorless yeast-biofuel cell. The obtained by means of polarization measurements results show that the maximum power density of 110 mW/m^2 achieved with galvanostatically electrodeposited NiFe-carbon felt anode exceeds three times those obtained with potentiostatically modified anodes and four times comparing with the nonmodified ones.

A hypothesis for expression of adaptive mechanisms as a response to Ni and Fe presence, resulting in facilitated electron transfer across the cell membrane, is proposed.

References

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