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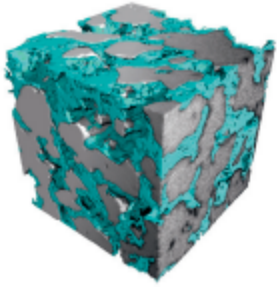
2nd Symposium on Insights into Gas Diffusion Electrodes

From Fundamentals to Industrial Applications



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Rational design of 3-D porous enzymatic electrodes for the production of gluconic acid in bioelectrochemical system

Miroslava Varničić[1], Kai Sundmacher[2,3], Tanja Vidaković-Koch[2,3]

[1]Institute of Chemistry, Technology and Metallurgy, Njegoševa 12, 11000 Belgrade, Serbia
[2]Max-Planck-Institute for Dynamics of Complex Technical Systems, Sandtorstrasse 1, 39106, Magdeburg, Germany
[3]Otto-von-Guericke University Magdeburg, Universitätsplatz 2, 39106, Magdeburg, Germany
e-mail: varnicic@ihtm.bg.ac.rs

Electroenzymatic systems are very promising for development of new sustainable biotechnological processes. This concept is based on utilization of redox enzymes as catalysts where cofactor regeneration can be controlled via electric current or potential. [1] However, the performance of these systems for practical application is still low. Major challenges are related to electrode performance *i.e* low activity and stability of enzymatic electrodes and system integration. Therefore, the focus of this research is on rational design of porous enzymatic electrodes based on *horseradish peroxidase* (HRP) and *glucose oxidase* (GOx) as biocatalysts for gluconic acid production. The aim was to understand the bottlenecks for the highest biocatalyst utilization within the complex porous structures and to evaluate influence of different immobilization strategies on the electrode performance. The optimized electrodes were then tested in a half-cell and flow-through reactor without any separation in-between. The anode has been made with GOx using tetrathiafulvalene (TTF) as mediator, while cathode comprised enzyme cascade, GOx and horseradish peroxidase (HRP) or bilirubin oxidase (BOD). The influence of the electrode preparation procedure, structural and operating parameters on the biofuel cell performance has been checked.

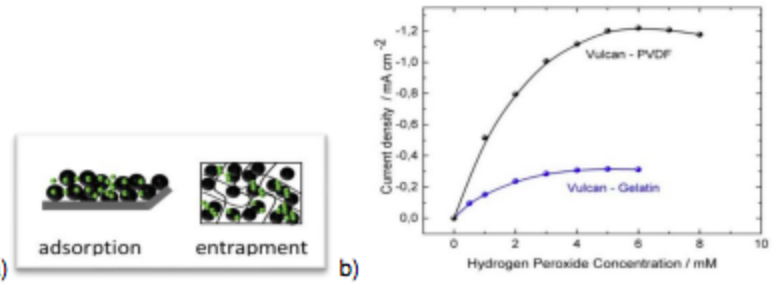

Figure: a) Schematic presentation of different immobilization strategies for preparation of 3-D electrodes b) The electrode performance of HRP-electrode based on different immobilization strategies in different hydrogen peroxide concentrations

References:

[1] I. Ivanov, T. Vidaković-Koch, K. Sundmacher, Energies 3(4) (2010) 803-846.

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Certificate of Participation

Miroslava Vanicic

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