Potential Application of Novel CoNiMoW Nanocomposites in a Hybrid Direct Borohydride Fuel Cell – Hydrogen-on-Demand System

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Direct borohydride fuel cell (DBFC) is a promising alternative of hydrogen fuel cells for portable applications [1]. DBFCs possess some attractive features such as high open circuit voltage, low operational temperature and high power density [1,2].

In this study, newly synthesized CoNiMoW nanocomposites, electrodeposited under different galvanostatic conditions, were investigated as anode materials in DBFC. As a tendency, higher generated power was obtained with nanocomposite anodes, produced at lower currents. A maximal power of 94 mW was achieved with DBFC using CoNiMoW-anode, electrodeposited at 1 A, and one air gas-diffusion cathode. Proportional increase of the power was obtained with stacks of two or more DBFCs, connected in series. Significant improvement of generated current and power was attained by applying two gas-diffusion electrodes, which indicates that the oxygen reduction reaction on the cathode is the rate-limiting step of the overall process.

In addition, the catalytic properties of applied CoNiMoW nanocomposites towards the "non-productive" borohydride hydrolysis reaction were also examined. Activation energy of 36.5±2.5 kJ/mol was obtained for all materials studied, but the highest hydrogen generation rate of 15 ml/min (at 315 K) was achieved with CoNiMoW electrodeposit, produced at the lowest current.

Summarizing results from both fuel cell and catalytic tests, it can be concluded that electrodeposited CoNiMoW nanocomposites are potential candidates for application in a hybrid DBFC – Hydrogen-on-demand system.

References

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2. B. Liu and Z. Li, *J. Power Sources* 187 (2009) 291.