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ELECTROCHEMICAL REDUCTION OF O₂ ON MULTIWALLED CARBON NANOTUBE MODIFIED HOPG ELECTRODES IN ALKALINE SOLUTION

Ivar Kruusenberg¹, Margus Marandi², Väino Sammelselg², Kaido Tammeveski¹

¹*Institute of Chemistry, University of Tartu, Ravila 14 a 50411 Tartu, Estonia*

²*Institute of Physics, University of Tartu, Riia 142 51014 Tartu, Estonia*

e-mail: ivar.kruusenberg@ut.ee

The aim of this work was to study the electroreduction of O₂ on oxidatively pre-treated multiwalled carbon nanotube (MWCNT) modified highly oriented pyrolytic graphite (HOPG) electrodes in alkaline media employing the rotating disk electrode (RDE) technique. A hydrodynamic solution-based method was used for the deposition of MWCNTs and surface morphology of the MWCNT/HOPG electrodes was examined by atomic force microscopy (AFM).

The electrochemical reduction of oxygen has been studied on MWCNT/HOPG electrodes in 0.1 M and 1M KOH solutions using the RDE method.² The distribution and density of MWCNTs on the surface of the modified HOPG electrodes were examined by AFM. Figure 1 presents a typical AFM micrograph of a MWCNT/HOPG sample. The AFM image revealed that the distribution of nanotubes on the substrate surface was rather uniform and no essential agglomeration was in evidence. The main advantage of the hydrodynamic deposition method is that larger aggregates of MWCNTs are swept away and only individual nanotubes attach to the substrate surface.

The results of electrochemical measurements obtained indicate that the electrocatalytic properties of MWCNTs toward O₂ reduction in alkaline media are excellent. It has been suggested that the enhanced O₂ reduction current at pre-wave potentials is caused by quinone functionalities and other oxygen-containing groups on the surface of carbon materials.³ As the O₂ reduction current on HOPG itself at these potentials in alkaline solutions is very low. The experimental RDE results of O₂ reduction in 0.1 M KOH at different rotation rates are presented in Figure 2.

References

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2. K. Tammeveski, K. Kontturi, R. J. Nichols, R. J. Potter, D. J. Schiffrin, *J. Electroanal. Chem.*, **515**, (2001) 101.

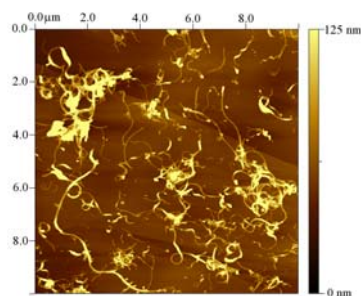


Fig.1. AFM image of an MWCNT-modified HOPG.

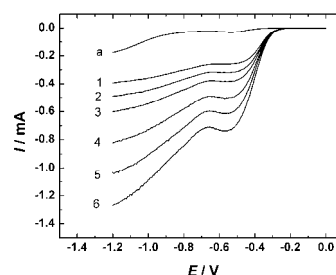


Fig.2. RDE voltammetry curves for O₂ reduction on an MWCNT/HOPG electrode in O₂ saturated 0.1 M KOH. v : 20 mV/s. ω : (1) 360, (2) 610, (3) 960, (4) 1900, (5) 3100, (6) 4600 rpm. (a) RDE voltammetry curve for O₂ reduction on a bare HOPG electrode at 360 rpm.