How to Minimize Problems with Electrode Passivation in Electroanalytical Chemistry

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ABSTRACT

Passivation of electrode materials is one of the biggest problems in practical applications of modern electroanalytical methods in analytical laboratories. Approaches used in our UNESCO Laboratory of Environmental Electrochemistry to minimize this problem will be discussed.

Keywords: Amperometry; Electrode passivation; Novel electrode materials; Voltammetry.

INTRODUCTION

Approaches to minimize working electrode passivation can be briefly classified as follows [1]

- To use electrodes with renewable surface
- To use disposable electrodes
- To use surface modification preventing passivation
- To use measurements in flowing systems minimizing passivation
- To prevent access of passivating compounds to electrode surface
- To use novel electrode materials resistant to passivation
- To use heated electrodes
- To use enzymes converting passivating compounds to non- passivating
- To use intentional electrode fouling

OBJECTIVES

In spite of a number of papers dealing with electrode passivation, non-systematic and more or less random approach still prevails in this field. Therefore, it is desirable to investigate the relationship between structure of the electrode surface, structure of passivating substance and electrochemical behaviour of passivating substances to clarify nature andmechanism of these processes and to find ways how to diminish, suppress or completely eliminate passivation and connected negative effects complicating electroanalysis of real samples.

METHODOLOGY

We have developed or applied many suitable measuring protocols compatible with minimizing electrode passivation. See the following examples

- Silver amalgam electrodes with renewable surface [2]
- Boron doped diamond electrodes resistant to passivation [3]
- Batch or flow injection analysis to suppress electrode passivation [4]
- To use hollow fibers to prevent access of passivation compounds to electrode surface [5]
- To use enzymes to circumvent electrode passivation [6]

CONCLUSION/RESULTS

We believe that most promising approach from the point of view of practical analytical laboratories is the searchfor novel electrode materials more resistant to passivation and their combination with measurement in flowing systems. Other approaches are also efficient but slightly more complex and thus not so attractive to practical laboratories.

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