Anodic oxidation of naphthalene

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INTRODUCTION

Organic semiconductors have attracted much interest because of their promising electronic and optical properties. The latter can be tailored by the possibility of controlling the width of band gap of these materials, e.g. by introducing functional groups to the polymer chain. Substituted polynaphthalenes have potential use in flexible electronic or as blue light sources in OLED diodes [1]. Polymers of naphthalene and of naphthalene derivatives can also potentially play a role in the conversion of solar into chemical energy.

OBJECTIVE

The aim of the research is optimization of anodic oxidation of naphthalene conditions. The influence of electrode material, naphthalene concentration and electrodeposition conditions on the quality of obtained film on the electrodes were investigated.

RESULTS

Influence of the electrode material on anodic oxidation naphthalene:

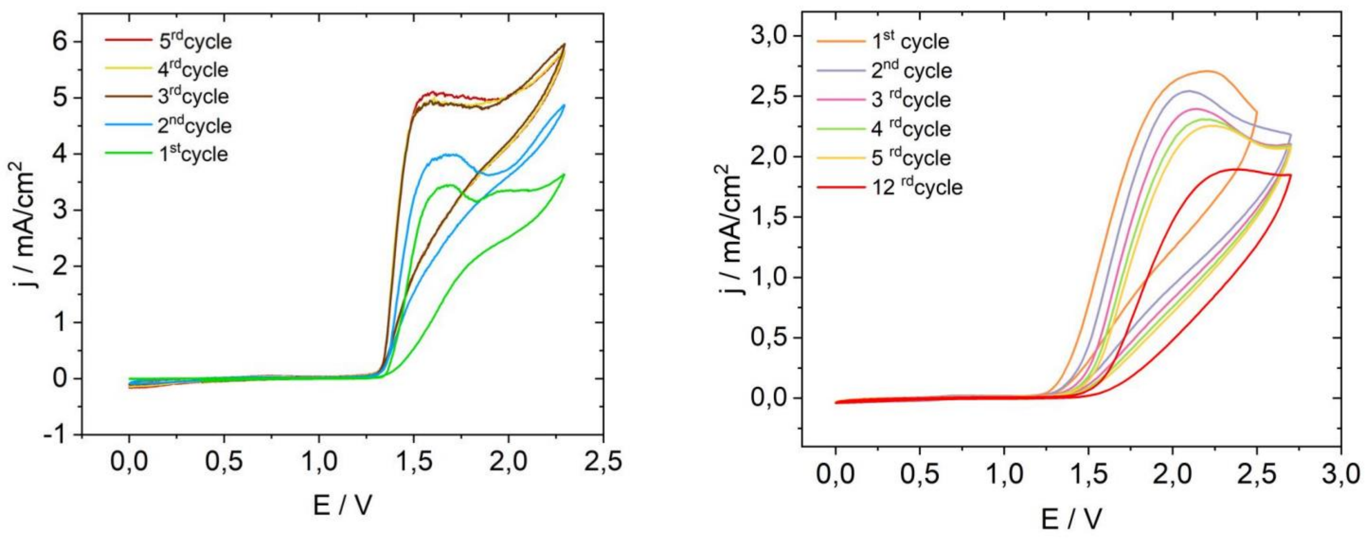

Fig. 1 Voltammetric curves of naphthalene oxidation on the platinum electrode (left), on the FTO electrode (right).

The peak oxidation current on platinum increases with the number of cycles and it stabilizes at the 4th cycle. The naphthalene oxidation peak current at FTO electrode decreases with each cycle and does not tend to stabilize.

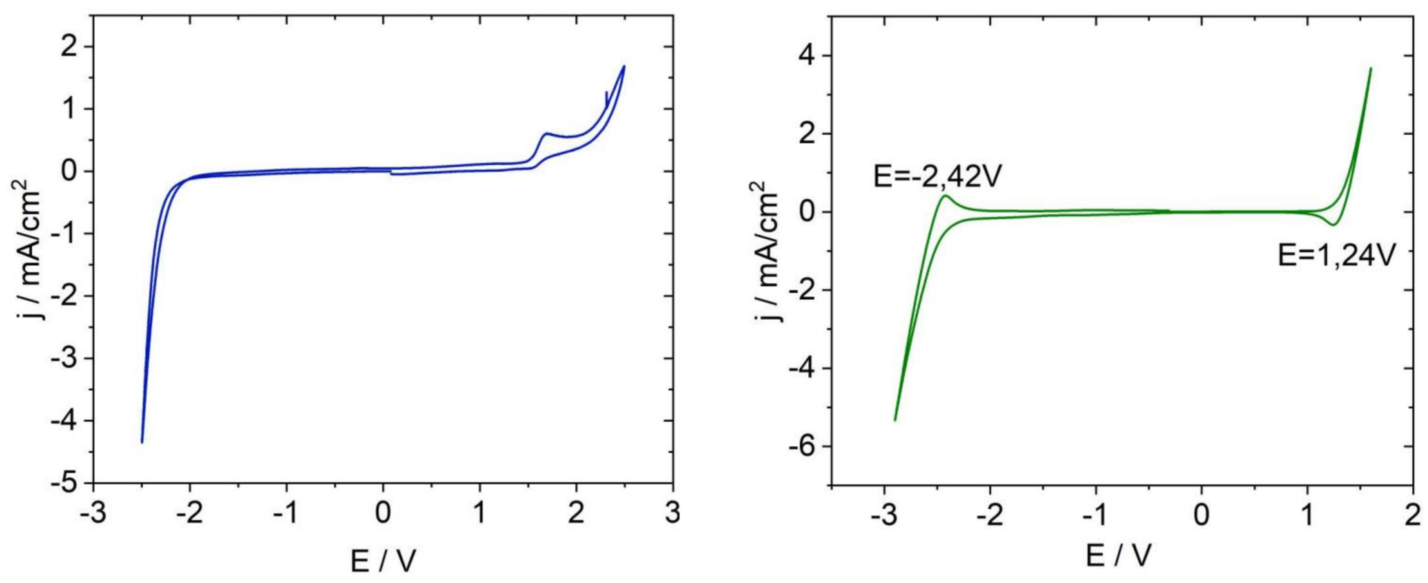

Fig. 2 Voltammetric curves registered after prior oxidation of naphthalene on platinum electrode (left), on the FTO electrode (right).

The film deposited on the FTO electrode has energy gap determined voltammetrically equal about 3.6eV (similar value to the one reported in the literature for polynaphthalene (2)).

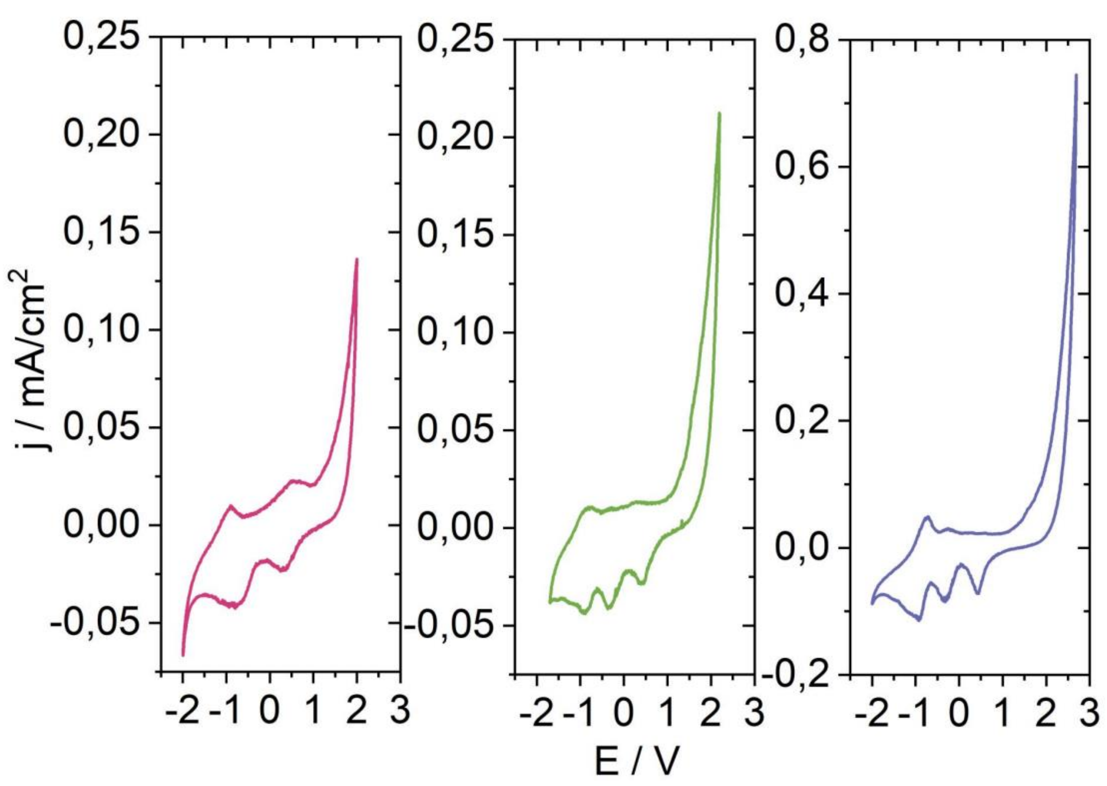

Fig. 3 Voltammetric curves registered on platinum electrode coated by thin film after the potentiostatic oxidation of naphthalene.

Oxidation of the layer deposited potentiostatically on platinum electrode to higher potentials causes an increase of peaks currents of reversible pairs of peaks at lower potentials.

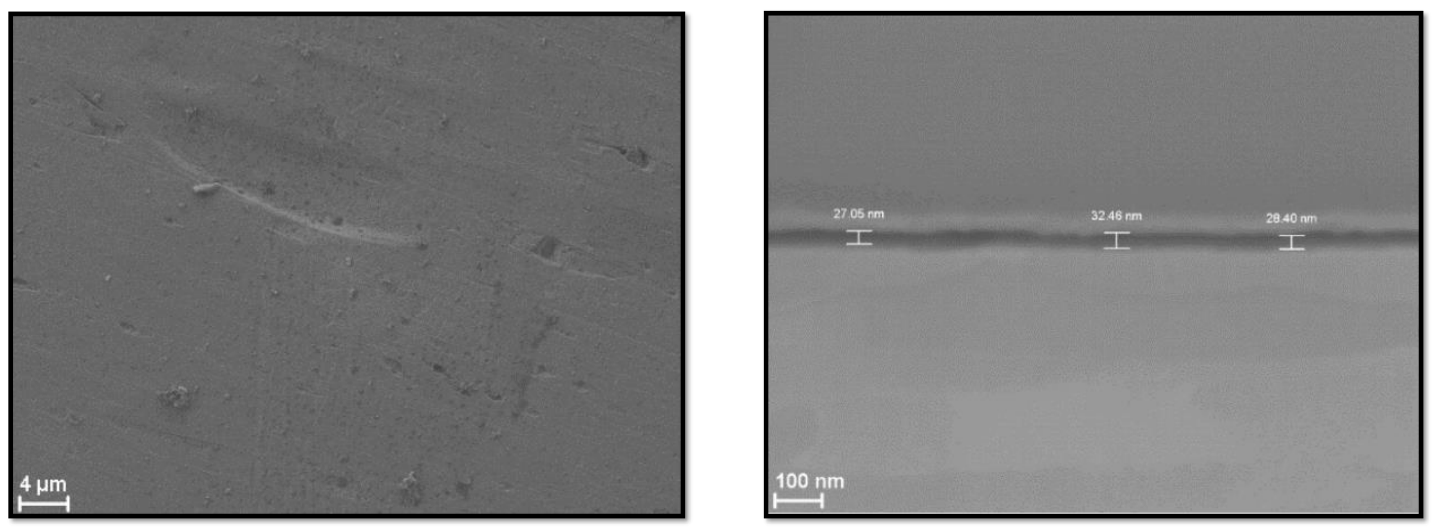

Fig. 4 Results of SEM imaging of the surface (left) and cross profile (right) of platinum electrode coated with a thin film after the potentiostatic oxidation of naphthalene.

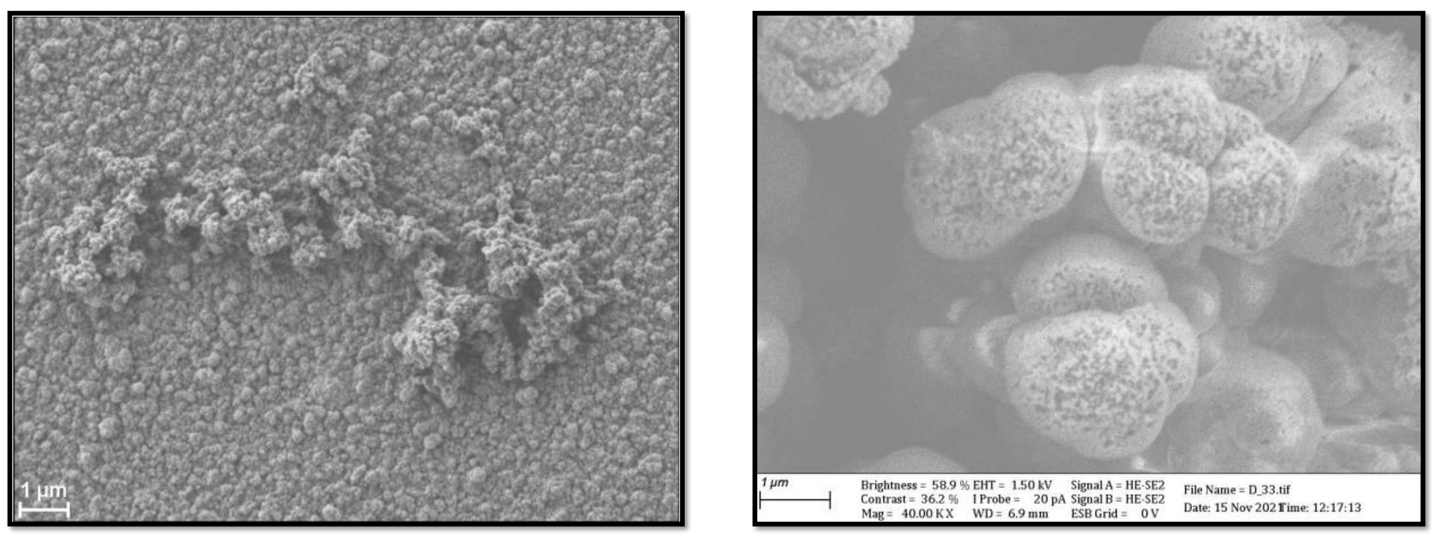

Fig. 5 Results of SEM imaging of the surface of the FTO electrode covered by the film after potentiostatic oxidation of naphthalene at concentration of naphthalene: 3mM (left), 18mM (right).

CONCLUSIONS

- The electrode material has a significant influence on the quality of deposits obtained on the electrode.
- Electrodeposition conditions have an influence on the current characteristics of the deposits received.
- On the platinum electrode it is possible to obtain a smooth, tightly adherent to the electrode layer approx. 30nm.
- The deposits on the FTO electrodes are porous and granular compare with the films on the platinum electrodes.
- The concentration of naphthalene during electrolysis has a significant influence on deposit morphologies on FTO electrodes.
- High concentration of naphthalene during electrolysis on the FTO electrode results in a microporous structure which has nanometer-sized pores too.

REFERENCES

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