

DEPOSITION OF CATALYST-CONTAINING CARBON NANOSTRUCTURES ON PROTON-CONDUCTING POLYMER MEMBRANES BY ELECTROPHORESIS

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Introduction

Fuel cells are the quickly developing energetic technology. Achievements in this field will be applied in industry, transport and everyday life. Converting chemical energy of hydrogen, organic hydrogen-containing fuels etc. into electricity and heat without intermediate transformations, the fuel cells are capable of meeting the most of mankind's needs.

This work is focused on the investigation of possibilities of the deposition of carbon catalyst-containing nanostructures on a proton-conducting polymer membrane by the method of

electrophoresis.

Experimental conditions

The proton-conducting polymer membrane of Nafion type has been used. Nanostructural carbon materials that contain Y, Gd and Pt have been produced by arc evaporation of metal-carbon composites in helium. The product has been washed in hydrocarbons using ultrasonic treatment. Electrolysis has been carried out on a special setup at 400 V and 0.68-0.98 mA for 2 h.

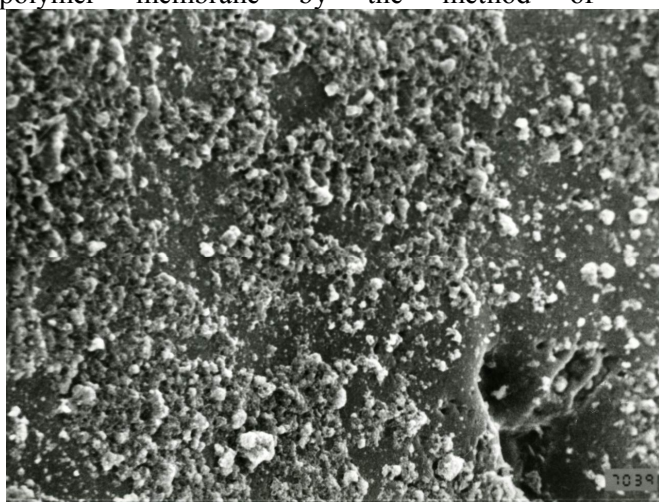


Fig. 1.

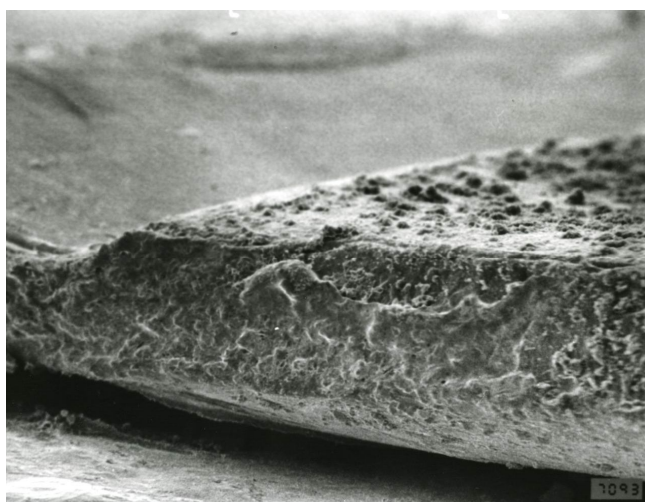


Fig. 2.

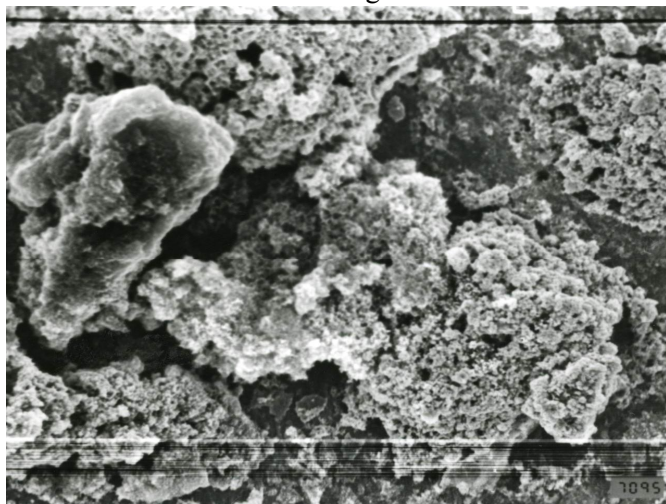


Fig. 3.

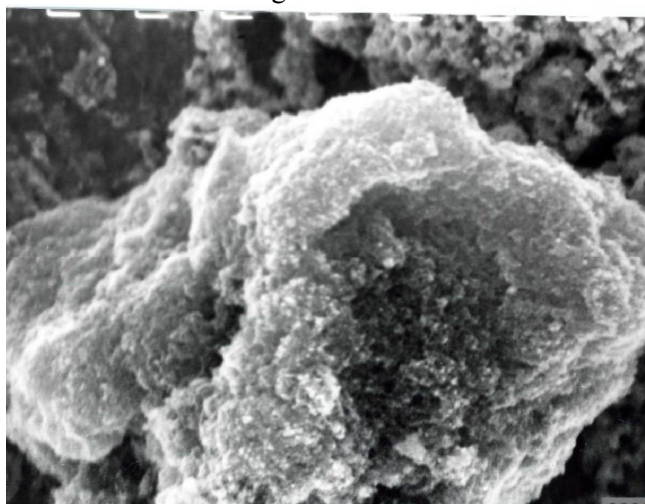


Fig. 4.

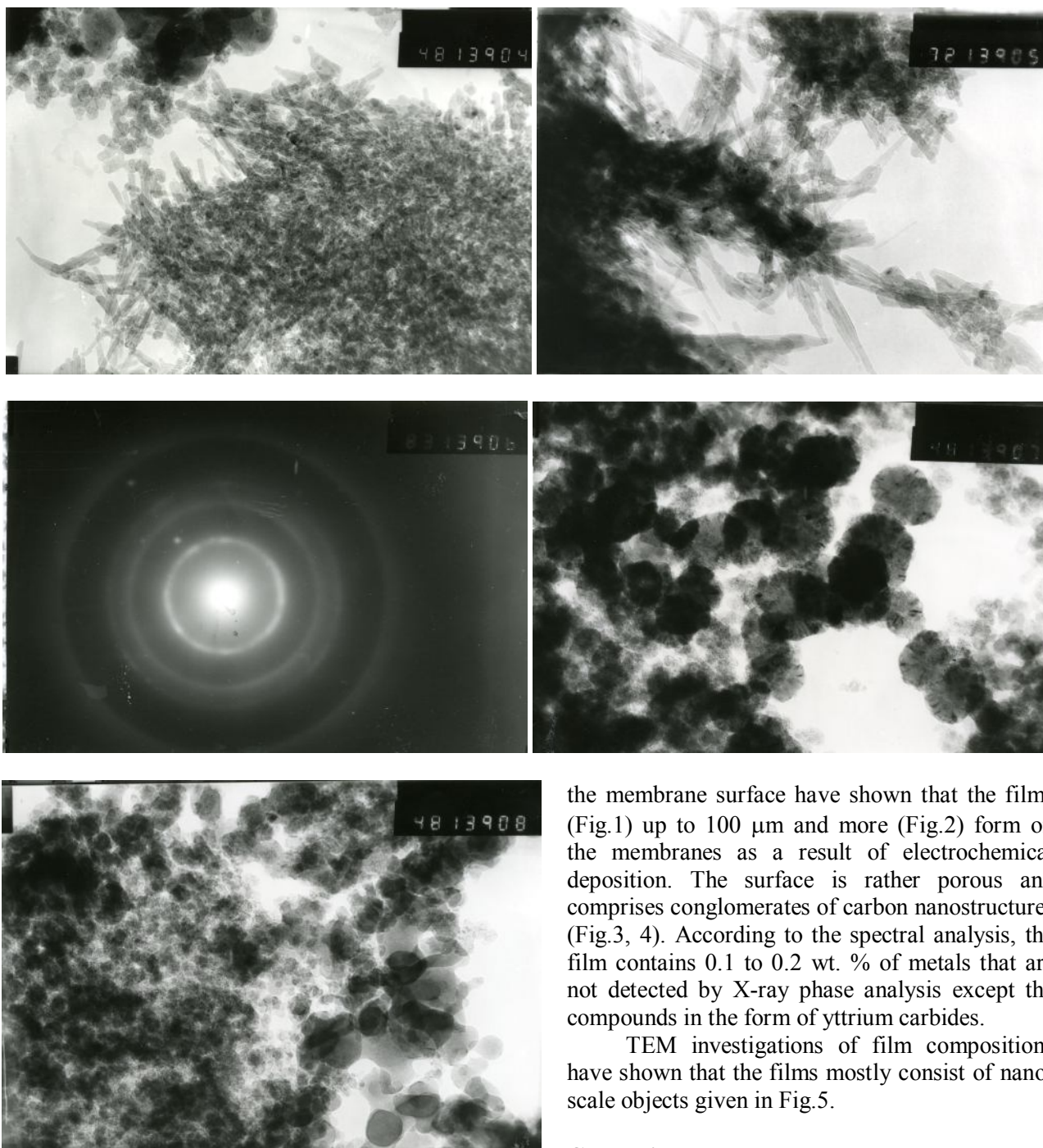
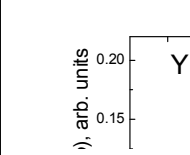


Рис. 5

The samples have been analyzed by transmission and scanning electron microscopy, mass-spectrometry, photometry, spectrophotometry.

Results and discussion

SEM investigations into the morphology of

the membrane surface have shown that the films (Fig.1) up to 100 μm and more (Fig.2) form on the membranes as a result of electrochemical deposition. The surface is rather porous and comprises conglomerates of carbon nanostructures (Fig.3, 4). According to the spectral analysis, the film contains 0.1 to 0.2 wt. % of metals that are not detected by X-ray phase analysis except the compounds in the form of yttrium carbides.

TEM investigations of film compositions have shown that the films mostly consist of nano-scale objects given in Fig.5.

Conclusions

The thin metal-containing (Pt, Y, Gd) nanostructural carbon films have been produced on the polymer proton-conducting membranes. The metal content in the films is 0.1-0.2 wt. % although the initial soot contained more than 1 wt. % of metal.