Metalloporphyrin with photo-electrical behavior based on Fe(III) porphyrin

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In this paper are reported the results obtained from the investigation of sensitive structure based on porphyrin Fe(III) chloride mixed with barium stearate(BS), carbon nanotubes(CNT) and sodium dodecyl benzene sulfonate (SDBS) was successfully prepared. The goal of this study was to investigate the photo- electrical behavior of Fe(III) porphyrin, with 3 Langmuir Blodgett thin layers based on the platinum obtained sensor. We proceeded to characterize the sensitivity sensor for ultraviolet light.

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1. Introduction

Due to the richness of their optoelectrical properties, metalloporphyrins play essential functions for life, [1]. Up to date research is focused on synthesizing of novel structures which exhibit properties similar with those of natural porphyrins and on obtaining of thin films of porphyrin derivatives with applications in molecular engineering at different surfaces or interfaces [2]. The well-established methods for conducting preparation of high quality thin films are electrochemical polymerization [3]. It is also of great interest the topography of porphyrin thin films and the supramolecular architecture of the film that may influence the performance of the films [4]. The present approach is regarding a novel structure of Fe (III) porphyrin with one weak-field monodentate axial ligand coordinated to the iron center, that belongs to neutral five-coordinated species type (Fig.1) where Cl is the monodentate anionic axial.

2. Experimental

Fe(III) porphyrin with single walled carbon nanotubes (CNT), sodium dodecyl benzene sulfonate (SDBS) and barium stearate (BS) solution was prepared using benzene as solvent and stirred at 37 kHz for 1 hour in order to obtain a good homogeneity [5,6]. The new solution was deposited onto ceramic body with platinum electrodes (Fig. 1) by Langmuir – Blodgett KSV 5003 device technique with 1mm/min deposition rate and 25 N/m pressure deposition.

Fig. 1. Ceramic body with platinum electrodes.

During the deposition all the environmental conditions were monitored. The deposition of the prepared sensitive 3 layers structure solution gave rise to a sensor with strong sensitivity to UV irradiation and also to O_2 ionization. UV irradiation was carried out with a UV lamp made by Electrotehnica – Bucharest, having the main emission lines in the range of330-340 nm at power density of 116 $\mu W/cm^2$. The Sensor/BS+CNT's+SDBS+Fe(III)porphyrin obtained was electrical and photoelectrical characterized using an experimental setup, containing a UV lamp, having the main emission lines in the range of330-340 nm at power density of 116 $\mu W/cm^2$, a Keithley 2400 Source Measure Unit (SMU). The experimental study is represented by the electrical and photoelectrical characterization of the obtained sensor with a 100µA continuous current injection with a constant current generator (Fig. 2) thermally insulated and with thermic self control developed for this experiment with the following circuit diagram:

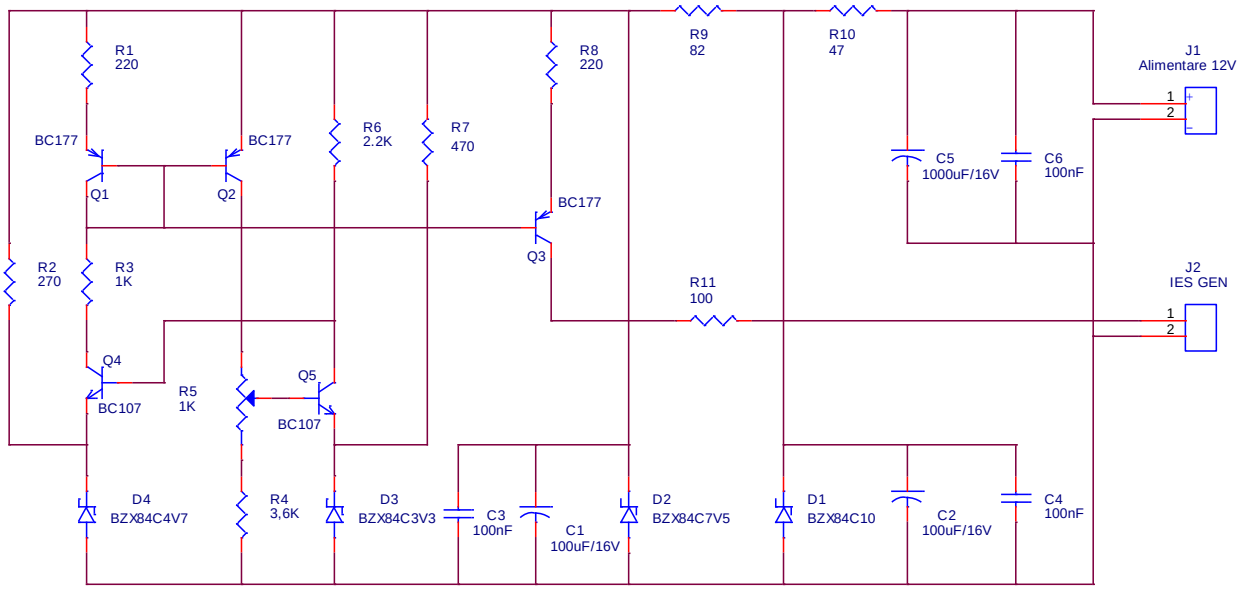

Fig. 2. Circuit diagram for the constant current generator thermally insulated and with thermic self control for 100µA.

3. Results and discussion

The representation of the sensor UV sensitivity after the deposition marked in black having the gradient m = 0.2087, n = -1.0805 and 3 days period after, marked in red with m = 0.1882 , n = -0.8162 is presented in the Fig. 3.

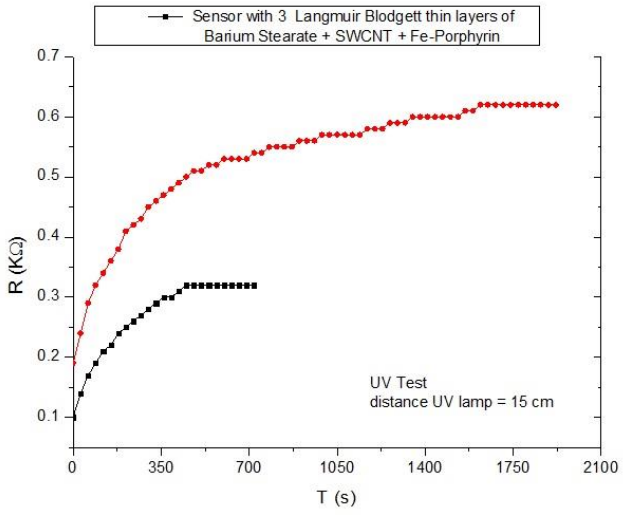

Fig. 3. The effect of UV radiation of 3 Langmuir Blodgett t hin layers sensor based on Fe –porphyrin.

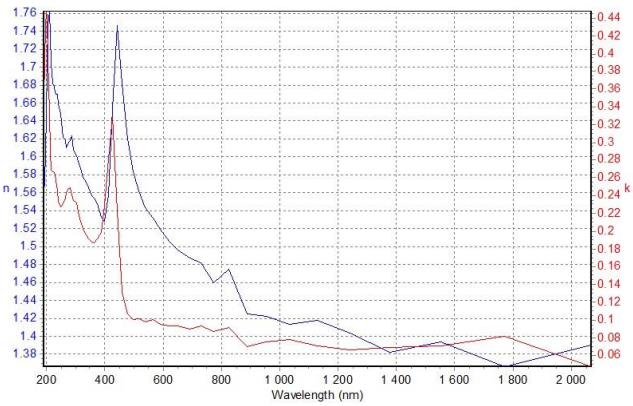

Fig. 4. The elipsometric representation of the n,k coefficients for the 3 Langmuir Blodgett thin layers sensor based on Fe –porphyrin which sustain the UV-vis spectrum around 425nm.

During the deposition all the environmental conditions were monitored. The deposition of the prepared solution gave rise to a sensor with strong sensitivity to UV irradiation and also to O_2 ionization Fig. 5.

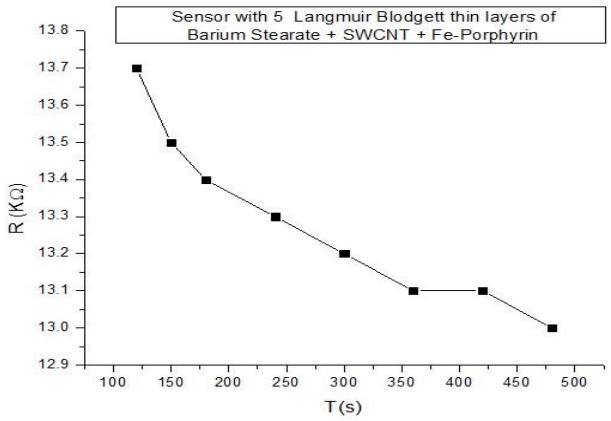

Fig. 5. O_2 ionization sensor behavior at room conditions.

4. Conclusions

The sensitive structure based on porphyrin Fe(III) chloride mixed with barium stearate (BS), carbon nanotubes (CNT) and sodium dodecyl benzene sulfonate (SDBS) with 3 Langmuir Blodgett thin layers gave rise to a sensor with strong sensitivity to UV radiation.

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