

Melanin films as sensing part of miniaturized pH sensors: towards the development of biochemical nanosensors

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Melanin, a class of natural pigments, is a promising conjugate polymer that due their structure has physical and electrical properties of great interest for application in biosensors. Furthermore, the use of organic materials in this type of device is interesting due to its low cost, ease purification and processing. In addition there is the possibility of deposition on a large variety of substrates, including flexible.

Various areas such as industrial processes, biochemistry and particularly in medical diagnostics, require the development of miniaturized pH sensors. This is of great interest due to its extensive application in measuring extracellular pH-related signals on cells and tissues. The EGFETS (extended-gate field-effect transistors) are devices able to electrically detect the pH changes and they present low cost, simple packaging and good long-term stability. EGFETS are constructed by an ion sensitive membrane connected to a commercial MOSFET. The search for membranes with higher sensitivities is the aim of several studies, in order to improve pH sensors development. There are many options of materials that could be used as ion sensitive membranes. In this work melanin thin films were used as active membrane, attached to a commercial CD4007UB MOSFET. Melanin was synthesized by the oxidation of L-3-(3,4-dihydroxyphenyl)-alanine (L-Dopa) in aqueous medium. Thin films were deposited from a solution of melanin by spin coating technique on two different substrates (Indium tin oxide coated glass- ITO and gold coated glass - Au). The structure of the films were investigated by Atomic Force Microscopy and showed that the surfaces of the melanin films are very regular (see Fig 1).

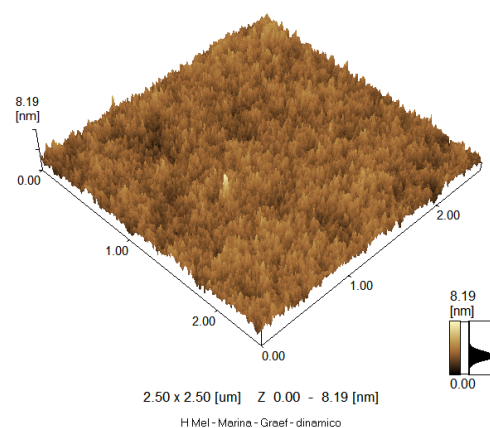


Figure 1 – AFM of a melanin film.

EGFETS with melanin deposited on ITO and on Au into solutions with pH range from 2 to 12 showed sensitivity of 44 mV/pH and 51 mV/pH respectively. Moreover both results are linear across all pH range studied (see Fig 2, for Au).

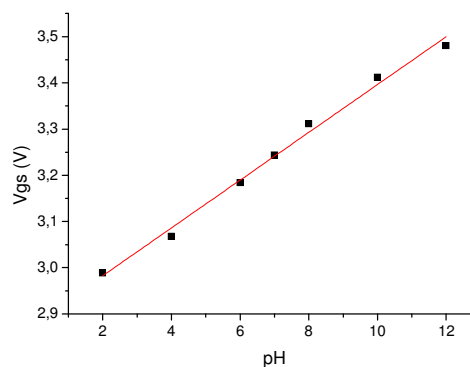


Figure 2 – EGFET results for melanin on Au.

In conclusion, the use of melanin as an active membrane for use as biosensor EGFETS has shown to be promising due of their easy processing and high sensitivity. Work supported by Capes, CNPq and FAPESP.