PÔSTER - RESUMO - SENSORES E BIOSSENSORES

ZINC OXIDE TRANSISTOR FOR THE DETECTION OF METAL IONS IN AQUEOUS SOLUTIONS

Vinicius Jessé Rodrigues De Oliveira Patzer (vinicius.jesse@unesp.br)

Luís Henrique Tigre Bertoldo (luis.bertoldo@unesp.br)

Neri Alves (neri.alves@unesp.br)

The contamination of water sources, such as rivers, lakes, and wells, by heavy metals represents a serious environmental and public health issue. Elements such as lead and mercury, widely used in industrial processes and rudimentary activities, can accumulate in soil and water bodies, compromising water quality, agricultural production, and food security, while also posing severe risks to human health due to bioaccumulation. In this context, monitoring these contaminants becomes essential. Conventional analytical techniques, such as mass spectrometry, atomic absorption spectroscopy (AAS), and cyclic voltammetry, although highly accurate, require complex laboratory infrastructure, high operational costs, and specialized personnel, which limits their field application, especially in resource-constrained regions. As a promising alternative, transistor-based electronic devices have gained attention, particularly Electrolyte-Gated Field-Effect Transistors (EGFETs). These devices enable control of the current in the semiconductor channel through the formation of an electrical double layer at the electrolyte/semiconductor interface, allowing analyses in aqueous solutions at low operating voltages. In addition, due to their fast response, they offer potential reusability and eliminate the need for sophisticated electrochemical instrumentation. Unlike conventional sensors,

the EGFET response can be analyzed through transfer curves, observing parameters such as threshold voltage variation (Vth) and hysteresis behavior (H), which reflect the interactions between metal ions and the semiconductor surface. Although hysteresis is generally considered undesirable in electronic devices, in this work it is explored as a sensitive indicator of ionic adsorption dynamics. Electrolyte-gated transistors were fabricated and characterized using commercial indium tin oxide (ITO) electrodes as conductive substrates and zinc oxide (ZnO) thin films as the semiconductor layer, deposited by spray pyrolysis from zinc acetate precursor solutions. The method was selected due to its simplicity, low cost, and ability to produce homogeneous films. The characteristic curves showed typical n-type semiconductor behavior, with an increase in drain current under positive voltages. The shift in threshold voltage was directly related to the density of charges induced by the presence of metal ions, demonstrating the device's potential as an electrochemical sensor [1]. The use of earth-abundant ZnO as the active layer supports the feasibility of the proposed EGFET-based sensor for portable environmental monitoring applications.

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References

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