Characterization and application of electrochemical oxygen sensors fabricated with platinized platinum microelectrodes

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Oxygen is a molecule that plays an important role in the cellular environment and is also associated with the formation of reactive oxygen species (ROS), which are linked to damage to biomolecules such as lipids, proteins, and DNA. In this context, electroanalytical techniques stand out as valuable tools for investigating the kinetics of relevant chemical and biochemical reactions. One strategy to enhance the oxygen reduction process — whose faradaic current can be exploited as an analytical signal — is the use of modified platinum electrodes, such as platinized platinum. This surface modification promotes improved electron transfer compared to unmodified metallic surfaces and increases the electroactive area of the electrode. The surface of a 25 μm-diameter platinum microelectrode was modified via cyclic voltammetry, applying 100 cycles between 0.3 V and −0.5 V (vs. Ag/AgCl/saturated KCl) in a 1 mmol L^{-1} H_2PtCl_6 and 0.5 mol L^{-1} H_2SO_4 solution [1]. A calibration curve for oxygen was constructed using a deaerated PBS solution, and a linear range of 8.45 to 251.16 μmol L^{-1} was found, with a detection limit of 8.45 μmol L^{-1}. Moreover, the onset potential is shifted to less negative values using the platinized platinum sensor (0.55 V), accompanied by a significant increase in reduction current. Future studies will focus on optimizing the sensor preparation conditions and its application to analyze the oxygen consumption by hemeproteins. We have also demonstrated that the sensor´s signal is not affected by other molecules that participate in the hemeproteins reaction.

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References:

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