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Effect of thermal oxidation on the performance of nanostructured porous Si optical biosensors

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The effect of thermal oxidation conditions on the behavior of porous Si optical biosensors, for label-free and real-time monitoring of enzymatic activity, is studied. We compare several oxidation temperatures and their effect on the enzyme immobilization efficiency and the intrinsic stability of the resulting oxidized porous Si ($PSiO_2$), Fabry-Pérot thin films. Importantly, we show that the thermal oxidation profoundly affects the biosensing performance in terms of greater optical sensitivity, by monitoring the catalytic activity of horseradish peroxidase and trypsin-immobilized $PSiO_2$. Despite the significant decrease in porous volume and specific surface area, with elevating the oxidation temperature, higher content and surface coverage of the immobilized enzymes is attained. This in turn leads to greater optical stability and sensitivity of $PSiO_2$ nanostructures. Specifically, films produced at 800°C exhibit stable optical readout in aqueous buffers combined with superior biosensing performance. Thus, by proper control of the oxide layer formation, we can eliminate the aging effect; thus, achieving efficient immobilization of different biomolecules, optical signal stability and sensitivity.

Biography

Giorgi Shtenberg completed his PhD in 2014 in Biotechnology and Food Engineering at Technion–Israel Institute of Technology. He has expertise in Nanomaterials, Semiconductors, Microfluidics, Photonics and Biological Interfaces for biomedical and environmental monitoring applications. He is currently a Scientist and Head of Bio-Nano-Laboratory at Institute of Agriculture Engineering, ARO-The Volcani Center. He is focusing on the development of novel biosensors/bioassays that will transform from a laboratory-based research into real on-site "lab-on-chip" platforms for addressing problems in fields of agriculture, animal diagnostics, food safety and environmental monitoring and detection.

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