

SELF-ASSEMBLED LAYERS USED IN BIOSENSORS PROBED BY VIBRATIONAL SPECTROSCOPY

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Research on biosensors is advancing at a high pace, with many important applications in medical diagnosis and environmental or health monitoring [1]. Most of them are based on ultrathin nanostructured organic films, and the robust attachment and organization of molecular biorecognition elements on transducers is essential to reach high analytical performance. For that purpose, Self-Assembled Monolayers (SAMs), Layer-by-Layer (LbL) films and other surface modification techniques have been used to create an adequate environment for biomolecule immobilization [2]. In this contribution we will use both linear and nonlinear vibrational spectroscopy techniques (PM-IRRAS and SFG spectroscopy, respectively) to sensitively probe the molecular organization and interactions in such ultrathin organic layers. They have sub-monolayer sensitivity and can probe molecular conformation, orientation, and ionization state at interfaces. Our recent studies of alkylthiol SAMs on gold used in biosensor fabrication will be discussed. At first we will describe the relation between substrate roughness and molecular organization, which in turn affects the SAM charge transfer properties that are crucial for electrochemical sensors [3]. Furthermore, using a particular genosensor construction [4], we demonstrate that the choice of pH or solvent for self-assembly can control the ionization of carboxylic acid-terminated SAMs, which in turn affects the subsequent molecular assembly of biosensors and their detection efficiency. These insights may contribute to a rational design of biosensors with improved performance.

References

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