373i Functional Bioelectronic Interfaces on Electrolessly Deposited Gold for Bioelectronic Applications

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Bioelectronic interfaces that establish electrical communication between redox enzymes and electrodes have potential applications as biosensors, biocatalytic reactors, and biological fuel cells. This paper describes the fabrication of functional, bioelectronic interfaces suitable for both soluble and membrane-bound enzymes on electrolessly deposited gold films. The suitability of the bioelectronic interfaces for soluble redox enzymes was evaluated using secondary alcohol dehydrogenase (sADH). A multilayered interface was assembled that enabled electron transfer between the electrode and sADH's cofactor (NADPH). The enzyme was then bound by affinity interaction with the cofactor. Membrane-bound redox enzymes must often be embedded in a bilayer lipid membrane (BLM) to express their activities, so a tethered BLM (tBLM) was assembled on the gold film. The bottom leaflet of the tBLM was formed using a mixture of 2-dipalmitoyl-sn-glycero-3-phosphothioethanol (DPTE) and 2-dioleoyl-sn-glycero-3-phosphate (DOPC), and the top leaflet was formed by DOPC liposome fusion. The suitability of the tBLM for incorporating membrane proteins was evaluated using the ion-channel protein valinomycin. Cyclic voltammetry, electrochemical impedance spectroscopy, and fluorescence recovery after pattern photobleaching (FRAPP) were used to characterize the resulting bioelectronic interfaces. These interfaces were then assembled into patterned microarrays using microcontact printing to pattern the surface prior to gold deposition.