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Electrochemical Detection and Micropatterning Methods for BioMEMS Devices

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The biosensors and biochips utilizing electrochemical detection schemes, such as electrochemical DNA sensors and enzyme-catalyzing glucose sensors, are one of major targets in BioMEMS devices, because the easy miniaturization of whole systems would be beneficial for the creation of implantable devices and point-of-care testing devices. Reference electrodes and working electrodes are crucial components of these electrochemical biosensors and biochips, in terms of their performance. We presents iridium oxide (IrOx) electrodes as quasi-reference electrodes in microfabricated biosensors and biochips that operate in buffered solutions. Moreover, we presents new electrochemical detection methods for working electrodes of array-based devices (immnuosensing using precipitation scheme and DNA detection using displacement scheme).

Biomolecular micropatterning is an essential step in fabrication of many BioMEMS devices. We have developed novel micropattering methods using electrochemical deprotection. Initially, we investigated the possibility that our method can be used to make organic surfaces active chemically or biologically in a mild chemical and electrochemical condition. The use of surface-bound hydroquinone monoester enabled site-selective immobilization of biomolecules. Recently, electrochemical deprotection method was extended to the micropatterning of biomolecules. For this application, hydroquinone-protected biotin monolayer was prepared. Streptavidin was successfully micropatterned on the monolayer by our method.