Immobilization of Biomaterials on a Microdevice

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Abstract—The two step immobilization method to immobilize biomaterial to construct microbiosensing device and systems were developed. Materials are indirectly immobilized via microparticles as support material as the first step. The particles are placed or stuck on a chip in the second step. The combination of the methods enables us to immobilize various kinds of biomaterials densely on a chip.

I. INTRODUCTION

Biosensor consists a transducer and immobilized biofunctional material. Typical biosensor systems require a site-specific immobilization of biofunctional materials for parallel analysis reducing a cross-talk. Fabrication procedure is constrained by fragile nature of biomaterials and the device structure. In order to avoid such a problem, two-step immobilization method was applied to immobilize biomaterials on a microdevice (Figure 1) [1].

II. MICRO PACKED BEAD COLUMN

In early 1990’s, first our target was microfabricated flow-type biosensing system, which required a site specific immobilization of enzyme in a microchannel. Enzymes degrade their activity at the bonding temperature of microdevice and enzyme immobilization reagents can activate whole flow path. Thus we choose a packed bead column method. The first step was immobilization of enzyme onto glass beads without a microdevice and the second step was the handling of the support into the microdevice. Many conventional immobilization method is applicable to the first step. Just a dammed structure is enough to locate the beads in a microflow channel. [2,3]

III. BIOSENSING WITH A SINGLE BEAD

Sophisticated detector with high spacial resolution and high sensitivity can detect a signal from a single bead, while a lot of beads were employed in a packed column. Each enzymes was immobilized on a bead and placed in a chamber array. Chemiluminescence and fluorescence signal from a single bead in such an array were detected. Employment of small chamber enriches the product resulting a high sensitivity. Not only a conventional glass bead, but microfabricated plain particle for total reflection evanescent fluorescence method, and micro electroplated particle for electrochemistry was applicable. Some of particles was colored or bar-coded to identify after random arrangement.[4,5]

IV. COMBINATORIAL CHEMISTRY

Combinatorial chemistry method can create multiplied number of biomaterials. We applied split synthesis of oligo peptide to have a lot of peptide on a bead. The particles in a microchannel array were screened with its affinity, and the particle with very high signal was again collected to be analyzed by protein sequencer.

V. SENSOR LSI

When the particle in this method is used not only a support but transducer, the signal should be transported from the particle to another circuit. Though a microscope with sensitive camera was enough to detect luminescence and/or fluorescence, application of metal particles to electrochemistry met a lot of problems. In order to report the signal by RF, 1 chip sensor LSI for amperometry was designed. Modules for potentiostat, AD converter and controller was about 1 mm², but the size of a antenna and power supply are still big problem. [6]

REFERENCES