MEMS for Bio Applications

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ABSTRACT

MEMS (Microelectromechanical systems) technology has been developed as a break-through technology for innovation. Pressure sensors, inkjet heads, digital micromirror devices, micro accelerometers, which have been fabricated by the MEMS technology, have changed the market and the world. Recently, the MEMS technology merged to biotechnology, and BioMEMS field are generated. It provides new methodologies to the biotechnology, and new technologies, for examples, lab-on-a-chips (LOC), DNA chips fabricated by Affymetrix, high throughput screening chips, continue to evolve the biotechnology. In this paper, several BioMEMS research tools such as MMA (micromirror array) systems, BAC (bead affinity chromatography) chips and nanoliter liquid manipulation chips are presented.

MMA systems produce peptide micro array on a glass chip using photolithography synthesis automatically. The MMA give the flexibility on biopattern design and fast turn-around analysis. The mirror is silicon micro mirror, 256 arrayed and 100 x 100 μm^2 in size. The large size mirror shows an advantage on protein micro array applications in favor of clear pattern dissolution and fluorescence detection. The automated MMA system is leading surface chemistry on a chip and biological analysis methodology to develop useful protein chip, which can be applied to diagnostic and pathogen identification or peptide screening.

BAC chips are based on the idea using a large surface area of beads to analyze bio target molecules in low concentration. Micro beads have more capability of immobilizing the target molecules than that of a chip surface. Silicon and glass based micromachining make the concentration reaction chamber packed micro beads and micro channel. The immobilized bio target molecules are analyzed by fluorescence detection or mass spectrometry after elution from the beads. Purification and detection of HCV protein (HCV RNA polymerase) are demonstrated using the BAC chip.

Nanoliter fluidic devices control the quantitative nanoliter fluidics for biochemical applications on a chip using only the pressure and the wettability of surface like hydrophobic and hydrophilic characteristics of micro channel. Quantitative manipulation of nanoliter liquid gives the quantitative analysis of bio sample reaction such as protein immobilization on a chip, biochemical reaction and microchip electrophoresis.