STEVENS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING

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Carnegie Room 315, Time 1:30 pm

Fabricaton of Three-dimensional Microstructures and Microdevices for Lab-on-a-chip Applications

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With the rapid development of microfluidic systems, there is high demand for fabrication methods for the micro-components that can be used to realize complex three-dimensional (3D) geometrics and high integration levels. In this research, we developed a scanning laser system, which allows rapid processing of freeform multi-layered microstructures. A variety of 3D microstructures have been created which including: oblique micropillar arrays, micro T-plugs, embedded microchannels, and freestanding microcantilevers with controllable beam thickness. Micro-optical components such as concave and convex microlenses have been manufactured and characterized. Many microfluidic microstructures/microdevices, for example microvalve, electrostatic regulator and microparticle capture chip, have been developed by utilizing the three-dimensional and multi-layered manufacturing capabilities of our direct UV laser writing. Furthermore, we have successfully applied our technology for biomedical instrumentation. For example, the manufacture of hollow metallic microneedle array has been demonstrated and its ability of penetrating into skin has been studied.

We have also adapted our scanning system to enable massively parallel measurement on single cells. This system performs the following functions: (i) Rapid individual cells capture and (ii) Rapid cell measurement with a programmed laser scanning across the entire cell capture device. A proof-of-concept realization of microchip for single cell capture has been demonstrated. Single cells are captured in the array of micro-wells through suction; cell diagnosis is performed using a scanning laser and a detector; and after the measurements, the cells are collected by supplying compressed air. Potentially both real-time analysis on large populations of cells and dynamic analysis on one cell could be accomplished with this system.

DR. HUI YU received her Ph.D. degree from the department of Manufacturing Engineering of Boston University in May 2006. Her research interests are primarily focused on developing MEMS-based manipulation and analysis chips for single cell assays, and developing flexible three-dimensional fabrication technologies for disposable micro-devices. Dr. Yu's research work has appeared in journals such as Applied Physics Letters, Journal of Micromechanics and Microengineering, Sensors and Actuators, etc. Her research work has also been collected into various conference proceedings including MEMS, Hilton Head, microTAS, ASME, and MRS.

For more information, please contact Prof. Frank Fisher at Frank.Fisher@stevens.edu or 201-216-8913