High-density Reusable In-plane Microfluidic Interconnects

Ronalee Lo and Ellis Meng

Microfluidic research toward lab-on-a-chip and micro total analysis systems have lead to many chemical and biological advances. Reliable interfaces between the microfluidic systems and the macro world are necessary for continued progress in this area; however, practical and standardized fluidic connections between the micro and macro worlds do not exist. Interfaces to high-throughput systems, systems where large numbers of integrated microfluidic components (microchannels, microvalves, etc) work in parallel, are especially difficult due to space and technology constraints. A minimal footprint and standardized microfluidic interconnect method that eliminates the need for custom solutions using adhesives, precision alignment, or drilling is presented. Interconnects consist of an array of non-coring syringe needles inserted in-plane through integrated polydimethylsiloxane (PDMS) septa located at inputs/outputs of a microfluidic system. Repeated on-demand connections are possible due to the self-sealing nature of PDMS. Microfluidic systems with integrated septa (4-8 input/output ports having uniform spacing) were fabricated to demonstrate multiple simultaneous connections to SU-8 and Parylene C microchannel systems. The insertion and removal forces of needle arrays into PDMS septa were obtained experimentally. Stress concentration points were identified via photoelastic imaging and finite element modeling. Demonstration of repeated and robust (leak-free) fluidic connections to microfluidic systems with 4-8 input/output ports were conducted under pressurized conditions.