Delivering Bio Micro Solutions

Bio Micro Solutions Newsletter - July 25, 2007

Particle Sorting Demonstrated in a Custom Flowcell with Integrated Electrodes

Complex, laser-patterned electrode pair sandwiches ALine's custom flowcell, supporting successful Phase I SBIR for CFD Research Corporation (CFDRC)

Intelligent discrimination of target particles of interest from a complex liquid matrix is of critical interest in biodefense and homeland security applications. A miniaturized system for dielectrophoresis (DEP) based particle and cell sorting is being developed by CFD Research Corporation (CFDRC), Huntsville, AL.

Important for the realization of miniaturized and multiplexed systems is the requirement for laminar flow and the movement of particles/cells in response to an electric field. Such a system requires the use of micron-sized flow channels with a very small electrode gap (10 – 50 microns) to obtain the electric field strengths necessary to effect particle sorting at nominal values of the applied voltage.

To achieve the design requirements, ALine used a laminate fabrication approach to design a simple flowcell that allowed the transparent patterned ITO electrodes on glass to be aligned and bonded directly to the top and bottom of the flow channel, as shown in Figure 1. Using our approach dozens of prototypes, which were supported in a custom fabricated acrylic holder allowing electrical connections and easy observation under a microscope, permitted direct observation of fluorescently tagged particles.

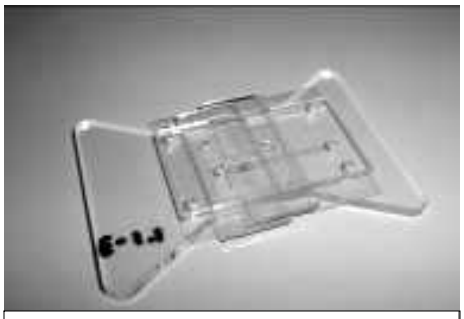

Figure 1: Flow channel with inlets and outlets is sandwiched between a set of electrodes that are offset to allow electrical connection with alligator clips. The entire prototype is supported on a plastic holder to keep the channels flat, ensuring even flow in the device.

"The first generation prototypes successfully demonstrated the proof of concept, which lead to Phase II funding for our program", remarked Dr. Kapil Pant, Manager, Biodefense Technology, at CFDRC. "We appreciate ALine's responsiveness and

ability to bring together cutting-edge fabrication techniques to produce high-quality functional prototypes."

Dr. Levine, founder of ALine concurred, "Our ability to create laser patterned electrodes, without the hassle of the traditional masking and wet chemical methods, provided a cost effective and flexible means for incorporating the complex electrode design required. In addition, alignment and direct bonding to the top and bottom of the flowcell using a bio compatible pressure sensitive adhesive (PSA), offered a convenient, approach for creating the channel heights needed."

The laser patterned circuits had features separated by 40 microns, with a minimum feature size of 10 microns possible. The patterning process requires no tooling. Because they are bonded to the flowcell with a PSA, they can be removed and re-used in a new set of flowcells.

The principle of operation of the device in shown below.

DEP OFF, no deflection of particles
(Flow is from left to right in both figures)

DEP ON, particles deflected
into side channel at the top of the figure

In the absence of applied electric field (DEP OFF), the bulk of the particles continue along the main channel with some entering the side channel due to the hydrodynamic flow split. However, upon energizing the electrodes (DEP ON), all of the particles are deflected into the side channel. Additional information on CFDRC's programs in the area of micro- and nano-systems can be found by clicking here.

Gold interdigitated electrodes have also been successfully developed which were bonded to a flowcell using biocompatible PSA s. Patterned gold or ITO coated materials can be either glass or plastic and are transparent for viewing under a microscope.

A simple approach for incorporating an electrode is to replace it with one of the window film materials in our standard product, the FluoroVette. This allows

spectroscopic observation of changes in the sample cell using a standard spectrophotometer or fluorimeter.

The versatility of our laminate fabrication approach and the ability to incorporate complex patterned circuits and electrodes, heaters, valves, and porous membranes, offers life science researchers and product developers a valuable tool box for the realization of novel bio micro fluidic products.

For further information contact Dr. Levine .

ALine is a leading supplier of high functionality bio micro solutions to biological, healthcare, chemical, environmental, instrumentation and research markets. View ALine, Inc. web site.