Integrated optical trap holds particles for on-chip analysis

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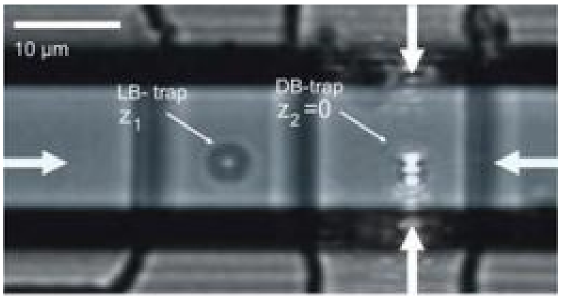

The integrated optical trap allows independent manipulation of trapped microbeads as shown in this view of two microbeads trapped by two different dual-beam traps. Image courtesy of H. Schmidt.

(PhysOrg.com) -- A new type of optical particle trap can be used to manipulate bacteria, viruses and other particles on a chip as part of an integrated optofluidic platform. The optical trap is the latest innovation from researchers at the Jack Baskin School of Engineering at the University of California, Santa Cruz, who are developing new sensor technology for biomedical analysis and other applications.

"Ultimately, it could have applications for rapid detection of bacteria and viruses in hospitals, for cell sorting in research labs, and for process monitoring in chemical engineering," said Holger Schmidt, professor of electrical engineering and director of the W. M. Keck Center for Nanoscale Optofluidics at UCSC.

The new technique offers the potential to create a smaller, cheaper version of the sophisticated equipment used to perform fluorescence-activated cell sorting (FACS), Schmidt said.

"The capabilities of our optofluidic platform are continuing to grow. We have gone from the detection of single molecules and single viruses to now being able to control the movement of particles," he said.

Schmidt's group has received a $400,000 grant from the National Institutes of Health to explore particle trapping and sorting and other applications of the optofluidics platform. An article describing the optical trap for on-chip particle analysis has been published online by the journal *Lab on a Chip*. First author Sergei Kuhn was a postdoctoral researcher in Schmidt's lab and is now at the Max-Born Institute in Berlin. Coauthors include David Deamer and Philip Measor at UCSC and E. J. Lunt, B. S. Phillips, and A. R. Hawkins of Brigham Young University, where the optofluidic chips are fabricated.

Optical traps and "optical tweezers" use the momentum carried by the photons in a beam of light to exert forces on microscopic objects, enabling researchers to manipulate objects ranging from biological molecules to living cells. Schmidt's group developed a new way to perform optical trapping on a chip-based platform.

The technique relies on an earlier innovation from Schmidt's lab: a hollow-core optical waveguide that can direct a beam of light through a liquid-filled channel on a chip. To trap particles, the researchers used two laser beams at opposite ends of a channel. A particle gets trapped at the point where the forces exerted by the two beams are equal, and the particle can be moved by changing the relative power of the two laser beams.

"We can also use this like an optical leaf blower to push all the particles in a sample to the same spot and increase the concentration," Schmidt said. "The goal is to control the position and movement of particles through channels on a chip so they can be studied using fluorescence analysis and other optical methods."

Provided by University of California, Santa Cruz