Self-Locking Optoelectronic Tweezer And Its Fabrication

Tech ID: 30126 / UC Case 2015-107-0

SUMMARY

UCLA researchers in the Department of Mechanical and Aerospace Engineering have developed a novel self-locking optoelectronic tweezer (SLOT) for single cell manipulation in conductive buffer over large areas.

BACKGROUND

Optoelectronic tweezers (OETs) use projected optical images to trap and transport tiny particles in parallel with sizes ranging from hundreds of micrometers to tens of nanometers. However, most conventional OET devices cannot operate in high conductivity media, or in regular physiological buffers, and only support the operation across a small field of view (FOV) to maintain the optical resolution required for single cell manipulation. Improvements to OETs will have applications spanning nanowire assembly, in vitro fertilization, tissue engineering, and rare cell sorting.

INNOVATION

UCLA researchers in the Department of Mechanical and Aerospace Engineering have developed a novel self-locking OET to optically manipulate single cells and microparticles over large areas in buffer solutions, outperforming prior OETs. This self-locking tweezer allows selective release of microparticles using light, has improved resolution, and its operation area is not limited by the FOV of the objective lens. This invention is easily scaled up to wafer sizes, with an active slot trapping area around ~500 cm², to trap millions of single cells in parallel, while achieving high throughput (>120,000 particles) manipulation in high conductivity media (>1 S/m). These SLOT chips can be easily reproduced or mass-produced at a low cost.

APPLICATIONS

▶ In vitro fertilization
▶ Rare cell sorting
▶ Tissue engineering
▶ Drug screening
▶ Nanomaterial assembly

ADVANTAGES

▶ Single cell manipulation in high conductivity media (>1 S/m);
▶ Large area single cell manipulation (> 1 cm²)
▶ Self-locking mechanism to trap millions of single cells in parallel
▶ Resolution not limited by FOV
▶ High throughput (>120,000 particles)
▶ Low cost, wafer-scale fabrication

RELATED MATERIALS


STATE OF DEVELOPMENT

Prototype SLOT devices have been developed and shown to work with microparticles (10 µm in diameter) and cells suspended in regular physiological buffers.

PATENT STATUS

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Additional Patents Pending

CATEGORIZED AS

▶ Optics and Photonics
▶ Biotechnology
▶ Engineering
▶ Medical
▶ Sensors & Instrumentation

INVENTORS

▶ Chiou, Pei Yu E.

RELATED CASES

2015-107-0

ADDENTIAL TECHNOLOGIES BY THESE INVENTORS

▶ Mechanisms and Devices Enabling Arbitrarily Shaped, Deep-Subwavelength, Acoustic Patterning
▶ Liquid Metal Enabled Multi-Functional Neural Probes with Ultra-Large Tunable Stiffness
▶ Single-Pixel Optical Technologies For Instantly Quantifying Multicellular Response Profiles
▶ Plasmonic Nanoparticle Embedded PDMS Micropillar Array and Fabrication Approaches for Large Area Cell Force Sensing