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 cm^2)
- 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

- Y. J. Yang, Y. F. Mao, X. F. Zhu, K.S. Shin, C. O. Chui, & P. Y. Chiou. Single Cell Manipulation in Cell Culture Media with Self-Locking Optoelectronic Tweezers Across a Large Area. 2015 Transducers - 2015 18th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers). 2015.
- Y. Yang, Y. Mao, K. S. Shin, C. O. Chui, & P. Y. Chiou. Self-Locking Optoelectronic Tweezers for Single-Cell and Microparticle Manipulation Across a Large Area in High Conductivity Media. Scientific Reports. 2016.

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.

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OTHER INFORMATION

KEYWORDS

Optoelectronic tweezers, OET, self-locking, self-locking optoelectronic tweezer, SLOT, single cell manipulation, nanomanipulation, in vitro fertilization, nanowire assembly, tissue engineering, rare cell sorting

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Biotechnology**
  - Health
- **Engineering**
  - Engineering
  - Other
- **Medical**
  - Other
- **Sensors & Instrumentation**
  - Medical
  - Other

RELATED CASES

2015-107-0

PATENT STATUS

Country	Type	Number	Dated	Case
Republic Of Korea (South Korea)	Issued Patent	10-2425337	07/21/2022	2015-107
United States Of America	Issued Patent	11,162,060	11/02/2021	2015-107
Japan	Issued Patent	6925967	08/06/2021	2015-107
China	Issued Patent	201580055791.0	01/12/2021	2015-107
United States Of America	Issued Patent	10,465,154	11/05/2019	2015-107

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Mechanisms and Devices Enabling Arbitrarily Shaped, Deep-Subwavelength, Acoustic Patterning
- 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
- A Device For Continuous Focusing And Rotation Of Biological Cells And Its Application For High Throughput Electrorotation Flow Cytometer

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