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Hybrid Device For On-chip Concentration, Manipulation, Sorting and Sensing of Particles on a Plasmonic Substrate

A novel technique uses coupled heat generation from plasmonic nanostructures and an AC electric field to achieve rapid, high-throughput concentration, manipulation, and size-based sorting of nanoscale particles with reduced power requirements for applications like biosensing.

The trapping and aggregating of submicron and nanoscale analytes is especially important in applications such as biosensing and surface enhanced spectroscopies. The technique known as optical tweezers, which traps particles using a strong optical gradient force induced by a focused laser beam, has been one of the most highly used techniques for the past several decades. The use of plasmonic trapping or plasmonic nanotweezers is also becoming popular in order to overcome some of the deficiencies of optical tweezers. Although this new method improves the confinement of submicron and nanoscale particles, it also suffers from an inherently slow process due to the fact that particles are transported via Brownian motion.

Researchers at Purdue University have developed a new technique for trapping particles, which has greatly enhanced trapping speed and efficiency. This method replaces thin film substrates with plasmonic resonant nanostructures and actually utilizes the collective heat generation capabilities of these nanostructures, which has been considered an undesirable byproduct in the past. By coupling the induced heating of the nanostructures with a low frequency AC electric field, strong microfluidic vortices are created that can rapidly transport suspended particles towards plasmonic nanoantennas where they are captured. This technology describes a way to achieve rapid particle transport, high throughput concentration, dynamic manipulation, and sorting of particles based on size while using less laser power and focusing.

Advantages:

-Greatly increases trapping speed

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Category
Materials Science & Nanotechnology/Nanomaterials & Nanostructures
Biotechnology & Life Sciences/Analytical & Diagnostic Instrumentation

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-Requires less laser power and focusing

-Sorts particles based on size

Potential Applications:

-Biosensing and lab-on-a-chip systems

TRL: 4

Intellectual Property:

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