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Continuous Sorter for Microparticles, Nanoparticles and Crystals

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Background

Continuously sorting targeted particles or cells from a mixture of different particles or cells plays a critical role in many chemical, biological and biomedical applications. Dielectrophoresis (DEP) is a typical electrokinetic method for non-invasive particle sorting. Because electric fields can be scaled down easily at the microscale, many Lab-on-a-chip systems for microparticles or cell sorting were developed using DEP forces. The existing sorting devices achieve particle sorting either by AC-DEP or DC-DEP. Devices using AC-DEP requires a complicated embedded microelectrode. While devices using DC-DEP only requires a type of insulating materials, which makes the system more robust and easier to fabricate. However, devices using insulator based DC-DEP techniques need high voltage and lack "tunability" or the ability to be reconfigured for sorting other types of particles. Researchers are working on improving the insulator based DC-DEP techniques for microparticle and cell sorting purpose.

Invention Description

Current research at ASU has developed technology that is designed to solve the problems associated with insulator based DC-DEP techniques. The innovative microfluidic device separates micro and nanoparticles based on size using a combination of insulator based DC-DEP and electrokinesis. It improves upon existing sorting devices by tuning dielectrophoretic focusing versus electrokinetic forces. By doing so, this new device can sort even smaller particles and can be reconfigured for sorting other particles. The new device also utilized a new type of insulating material, which is cheaper and easier to fabricate. Relatively low DC potentials (max. $\sim 100\text{V/cm}$) are applied to the device for dielectrophoretic focusing.

Potential Applications

- Bioanalyzer
- fs-Nanocrystallography
- Food pathogen detection
- Medical devices for diseases diagnosis
- Environmental analysis tool

Benefits and Advantages

- **Capability of sorting smaller particles** – improved from the order of 1-10 μm to several μm -100 nm in diameter.
- **New insulating material** – easier to fabricate
- **Low electric field** – The maximum electric field is ~ 3 times lower
- **Tunability** – device can be reconfigured for separating other particles.
- **Lab-on-a-chip advantages** – portable, small, cheap and robust