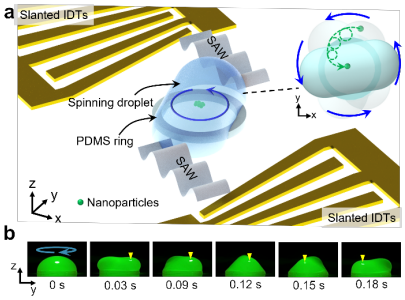
Acoustofluidic centrifuge for nanoparticle enrichment and separation

Unmet Need

Nanoparticle manipulation is highly relevant to biomedical and biochemical fields, and the ability to perform nanoparticle concentration and separation has emerged as a critical need in various settings such as point-of-care diagnostics, bioassays, and liquid biopsies. However, only a few current methods can achieve manipulation of nanoscale objects (ultracentrifugation, nanopore filtration, dielectrophoresis, magnetopheresis, optical tweezing, plasmonic tweezing). While these are useful methods, they each have important drawbacks, such as low sample yields, long processing periods, and small-scale sample manipulation, all of which limit practical application. Thus, there is a need for new methods capable of highly efficient nanoparticle concentration and separation for sample processing and/or reagent reactions.

Technology

Duke inventors have developed a novel system for manipulation of microscopic and nanoscopic particles. This system consists of an acoustofluidic centrifuge that leverages acoustically driven spinning droplets to manipulate nanoparticles. Specifically, it is comprised of one pair of slanted interdigitated transducers (IDTs) and circular containment rings to encapsulate a portion of the droplet and define its shape. It utilizes acoustic radiation force to generate the inner streaming velocity and shear rate within the liquid droplet, which creates a helical trajectory of particles within the droplet and enables their rapid concentration at the center of the droplet. This system is intended to be used to simplify and accelerate the process of separating or concentrating analytes like nanoparticles, extracellular vesicles, and strands of DNA. It has been demonstrated



Duke File (IDF) Number

IDF #:T-007380

Meet the Inventors

Huang, Jun "Tony" "Tony"
Gu, Yuyang "Yuyang"

Department

Mechanical Engineering and Materials Science (MEMS)

Publication(s)

•••

External Link(s)

• From the lab of Dr. Tony Jun Huang
• Sounds waves spin droplets to concentrate, separate nanoparticles (Duke Pratt School Press Release, 2020)
• Acoustofluidic methods in cell analysis (Trends in Analytical Chemistry, 2019)

to be capable of concentrating and separating small particles, down to a few nanometers in size.

Advantages

- High sample yield
- Requires significantly less processing time
- High biocompatibility, versatility, and simple design
- Capable of manipulating many particles