ACTS-Keynote

ALIGNMENT AND TIMING CONTROL OF PARTICLES IN MICROCHANNEL FLOW USING DIELECTROPHORETIC FORCE

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ABSTRACT

(200-250 Words)
Microfluidics innovated various application in the fields of medicine, biology, chemistry, and engineering in terms of miniaturizing the system, reducing operating time, sample volume and cost, and enhancing the accuracy. The important phenomena in microfluidics and related micro-devices are the transports of mass, heat, chemical components, and micro-scale objects. Among these, controlling the timing, interval, and velocity of the particles and cells in microchannel flow is an important technique to develop accurate and high-throughput system for sensing, sorting, and encapsulation. We developed a technique that can control the interval between the particles, the timing when they pass the specific location, and particle velocity in the microchannel – making an accurate "pitching machine" in the microchannel – by exerting forces on the particles in periodic form over time and space. We designed the boxcar-type electrodes to produce regions of dielectrophoretic force in which particles accelerate and decelerate periodically. We can make the particles and cells converge to the equilibrium state of even intervals by configuring the on–off cycles of the applied voltage. Through the measurement of the particle motion and the probability density function of the controlling values for the particles and cells, we demonstrated the high accuracy of the present method by showing that the variation to the target value falls in the range of several percent. This technique was further applied to microfluidic droplet encapsulation technique which showed that one-particle-one-droplet encapsulation could be performed with 100% yield under high number density condition of 0.7.

KEYWORDS: Microfluidics, Particle alignment, Timing control, Dielectrophoretic force, Encapsulation