The Summer Undergraduate Research Fellowship (SURF) Symposium
4 August 2016
Purdue University, West Lafayette, Indiana, USA

Effect of Particle Concentration and AC Field Strength on Particle Trapping in Rapid Electrokinetic Patterning (REP)

Sixuan Li, Avanish Mishra, and Steve Wereley
Department of Mechanical Engineering, Purdue University

ABSTRACT

Rapid Electrokinetic Patterning (REP) is an optoelectric technique for trapping and translating micro- and nanoparticles non-invasively. It uses a combination of laser-induced AC electrothermal flow and particle-electrode interactions in the presence of a uniform AC electric field. The trapping is governed by laser power, electric field strength, AC frequency and dielectric properties of the particle and the medium. A REP trap has an AC frequency, termed critical frequency, above which particles cannot be trapped. It is expected to be dependent on dielectric properties of the particle and the medium. However, we propose that the particle concentration and AC field strength also influence the critical frequency. In our experiments, we test 1 and 2 μm polystyrene microspheres in REP under the condition of three particle concentrations and two electric field strengths while keeping the laser power fixed at 25mW. We find that as the particle concentration increases, the critical frequency increases. Besides, by lowering the AC field strength, the critical frequency decreases. To our best knowledge, this is the first study revealing the effect of particle concentration on critical frequency. Based on these results, by selecting proper parameters, we can separate the smaller particles and hold the larger particles in the trap, opposite to what has been achieved by other researchers. The ability to separate smaller particles will make REP a more prominent and powerful particle trapping method.

KEYWORDS

Optical Tweezers, Electrokinetics, Manipulation, Microfluidics, Lab on a Chip