An Acoustophoretic 3D Microfluidic Platform on the Supehydrophobic Mesh

Yusuke Koroyasu

Manipulating drops at will is an essential technique for automating and improving the throughput of experiments. In digital microfluidics (DMF), droplets are controlled horizontally and vertically on an electrode array by electrowetting on dielectric (EWOD). However, EWOD has a problem of ineffective jumping and low spatial resolution because of the constraint of the electrode array. In recent years, with the introduction of Phased Array Transducers (PAT), it has become possible to generate the sound field at will in the ultrasonic frequency range. In this thesis, it is shown that drops can be controlled on an acoustic transparent superhydrophobic mesh using a focused beam presented by PAT. It was found that the focused beam exerts an acoustic radiation force (ARF) on the drops in the direction of the beam, which can be used to transport the drops vertically. In addition, the convergent beam was found to exert an ARF, attracting a somewhat larger droplet to the focus, which can be used to manipulate the drops in the horizontal direction. The results indicate that an ARF-based 3D-DMF platform is feasible. ARF-based 3D-DMF is more powerful and has a higher spatial resolution than the previous method; therefore, it can be integrated into more varied environments.

(Adviser Yoichi Ochiai, Tatsuki Fushimi)