

Droplet Actuation Method using the Electrical Charging of a Water Droplet on the Electrode

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In this work, droplet actuation method for microreactor applications is experimentally demonstrated using electrical charging of a conducting water droplet on the electrode. When a DC electric field is applied to the electrodes, a conducting droplet immersed in a very insulating fluid acquires charges during the contact with the electrode. The charged droplet is repulsed from the electrode by Coulombic force and is moved to opposite electrode. The droplet, which approaches the opposite electrode, shows a similar behavior. This process is so-called the electrical charging. For demonstration, we consider transport of a charged droplet and fusion of two two oppositely-charged droplets. The motion of the droplet is captured by high speed CCD camera with 5,000 fps. For the visualization of fusion, the precipitation reaction is used. When subjected to a DC voltage, two droplets charged are moving and merging toward each other due to the Coulombic force and chemical reaction is simultaneously occurred by coalescence of droplets. It may be due to the interchange effect of charge. This actuation method of charged droplets will become very attractive in various fields including the biomechanical system.