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Electrically Controllable Microparticle Synthesis and Digital Microfluidic Manipulation by Electric-Field-Induced Droplet Dispensing into Immiscible Fluids[1] TAEWOONG UM, JIWOO HONG, IN SEOK KANG, POSTECH — The dispensing of tiny droplets is a basic and crucial process in a myriad of applications, such as DNA/protein microarray, cell cultures, chemical synthesis of microparticles, and digital microfluidics. This work demonstrates the droplet dispensing into immiscible fluids through electric charge concentration (ECC) method. Three main modes (i.e., attaching, uniform and bursting modes) are exhibited as a function of flow rates, applied voltage and gap distance between the nozzle and the oil surface. Through a conventional nozzle with diameter of a few millimeters, charged droplets with volumes ranging from a few μL to a few tens of nL can be uniformly dispensed into the oil chamber without reduction in nozzle size. Based on the features of the proposed method (e.g., formation of droplets with controllable polarity and amount of electric charge in water and oil system), a simple and straightforward method is developed for microparticle synthesis, including preparation for colloidosomes and fabrication of Janus microparticles with anisotropic internal structures. Finally, a combined system consisting of ECC-induced droplet dispensing and electrophoresis of charged droplet (ECD)-driven manipulation systems is constructed.

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