

論文 / 著書情報  
Article / Book Information

題目(和文)	機能性流体ECFを用いた液滴生成器および液滴分別器の開発
Title(English)	Development of ECF-based droplet generators and sorters
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# Outlines

This thesis consists of the following five chapters.

Chapter 1 introduces the droplet-based microfluidic systems, including the fundamentals and the possible applications. Based on the summary of the droplet-based microfluidic systems, two problems are indicated: (1) Materials (PDMS) swelling; and (2) Large external power sources.

Chapter 2 presents that an epoxy-based photoresist SU-8 as a material for the microfluidic devices can be substituted for the conventional silicone rubber (PDMS, polydimethylsiloxane), which has swelling problems. To solve the sealing problems of SU-8 open channels formed on the microchip, the applicant develops a novel SU-8 tape to have both the cross-linked SU-8 (a flexible cover plate with connecting parts) and the non-crosslinked SU-8 (adhesive layer) in the unified structure by using the UV dose control. Its effectiveness is clarified by applying it to the production of a T-junction droplet generator.

Chapter 3 describes the design, fabrication process, and performance of a T-junction W/O droplet generator and O/O droplet generator actuated by ECF micropumps. Two ECF micropumps are necessary for the continuous phase fluid and the dispersed one to flow. The experiments prove that the generated droplets are not stable in the conventional ECF so that new functional fluid is synthesized by adding 3 wt% of the surfactant Span 80 to DBD (dibutyl decanedioate) as a continuous phase fluid. Thanks to this new functional fluid, stable droplets are generated by simply adjusting the applied voltage in a one-chip device.

Chapter 4 presents ECF-driven droplet sorters: (1) ECF jet type and (2) Cantilever type. In the ECF jet type sorter, a microchannel with an ECF micropump is installed in a direction that intersects the continuous phase channel of the T-junction droplet generator. The cantilever type switches the flow path by pressing the cantilever with the ECF-pressurized balloon.

Chapter 5 summarizes the contribution of this thesis and researches that will be done in the future.