

## All-polymer microfluidic systems for droplet based sample analysis - DTU Orbit

(09/11/2017)

### All-polymer microfluidic systems for droplet based sample analysis: Bringing droplet technologies to life: Bridging the gap between academia and industry

In this PhD project, I pursued to develop an all-polymer injection moulded microfluidic platform with integrated droplet based single cell interrogation. To allow for a proper "one device - one experiment" methodology and to ensure a high relevancy to non-academic settings, the systems presented here were fabricated exclusive using commercially relevant fabrication methods such as injection moulding and ultrasonic welding. Further, to reduce the complexity of the final system, I have worked towards an all-in-one device which includes sample loading, priming (removal of air), droplet formation, droplet packing, imaging and amplification (heating).

The project has been broken into sub-projects, in which several devices of simpler application have been developed. Most of these employ gravity for concentrating and packing droplets, which has been made possible by the use of large area chambers bonded by ultrasonic welding.

In the sub-projects of this PhD, improvements have been made to multiple aspects of fabricating and conducting droplet (or multiphase) microfluidics:

- Design phase: Numerical prediction of the capillary burst pressure of a multiphase system.
- Fabrication: Two new types of energy directors for ultrasonic welding of microfluidic systems have been presented:
  1. Tongue-and-groove energy directors.
  2. Laser ablated micropillar energy directors.
- Fabrication: Annealing of polymer devices for use with hydrocarbon based multiphase systems.
- Experimental design and data analysis: Optimised estimators for single-hit limiting-dilution assays.

A range of concurrent activities have also been undertaken:

- TransForm-technologies, a to-be spin-out of this PhD project has been initiated, and 725,000 DKK has been raised and spent on maturation of the mould microstructuring technology, incorporating and testing the technology in a commercial setting, and formulating a business plan.
- Three patent applications have been submitted to the European Patent Office.

### General information

State: Published

Organisations: Department of Micro- and Nanotechnology, BioLabChip, Fluidic Array Systems and Technology

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Number of pages: 258

Publication date: 2016

### Publication information

Place of publication: Kgs. Lyngby

Publisher: DTU Nanotech

Original language: English

Main Research Area: Technical/natural sciences

Droplet, Microfluidics, Digital PCR, Injection moulding, Ultrasonic welding

Electronic versions:

CEPO\_thesis\_all\_M\_ikke\_offentligg\_res.pdf

Source: PublicationPreSubmission

Source-ID: 125030084

Publication: Research › Ph.D. thesis – Annual report year: 2016