

# High-speed droplet microfluidic encapsulation and sorting

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## Summary

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*Thomas Johann Seebeck Department of Electronics at the School of Information Technologies, in collaboration with the Department of Chemistry and Biotechnology at the School of Science, Tallinn University of Technology, Estonia, has an opening for a PhD project with the tentative title „High-speed droplet microfluidic encapsulation and sorting“, as part of the PhD programme Information and Communication Technology.*

Research field:	Information and Communication Technology
Supervisors:	Tamas Pardy Ott Scheler
Availability:	This position is available.
Offered by:	School of Information Technologies Thomas Johann Seebeck Department of Electronics
Application deadline:	Applications are accepted between November 16, 2020 00:00 and December 16, 2020 23:59 (Europe/Zurich)

## Description

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### CONTEXT

Droplet microfluidics is a novel discipline in liquid handling that allows the analysis of single particles or cells in chemical isolation. Droplet microfluidics is a subset of microfluidics that relies on two-phase flows with immiscible phases, typically oil and an aqueous phase. Each droplet can encapsulate a different set of reagents and single cells, behaving like microreactors. In theory, monodisperse droplets can be generated at >10 kHz frequency, enabling high-throughput isolated single-cells analysis. However, the effective generation rate is limited by various technology-related factors that also affect encapsulation rates (e.g. channel geometry, dimensions, precision and switching frequency of pumping equipment).

### OBJECTIVES

The objectives of the PhD project include:

1. Research the system parameters and implement the algorithm to encapsulate microparticles in droplets of various diameters and volumes, at high flow rates, meeting specifications of the PRG620 project.
2. Investigate technology options and methodologies to sort the droplets with encapsulated particles at flow rates comparable to that used for encapsulation.

During the project the student is predicted to spend shorter and longer visits in collaborating microfluidics labs in Hungary and Poland.

### QUALIFICATIONS

- MSc in the field of biomedical engineering, electrical engineering, physics, chemistry or similar discipline
- Good communication and writing skills in English
- Prior knowledge of electronics design and embedded programming (e.g. C/C++) is preferable
- Previous experience in at least one of the following: CAD design, CFD, FEM, rapid prototyping, microscopy
- No previous experience in microfluidics is necessarily expected, but is a bonus

Tallinn University of Technology is an equal opportunity university. Female applicants are particularly encouraged to apply.

### CONTACTS

- Supervisor Tamas Pardy, [tamas.pardy@taltech.ee](mailto:tamas.pardy@taltech.ee)
- Co-supervisor Ott Scheler, [ott.scheler@taltech.ee](mailto:ott.scheler@taltech.ee)

### REFERENCES

- T. S. Kaminski, O. Scheler, and P. Garstecki, "Droplet microfluidics for microbiology: Techniques, applications and challenges," Lab Chip, vol. 16, no. 12, pp. 2168–2187, 2016.
- B. L. Fiedler et al., "Droplet Microfluidic Flow Cytometer For Sorting On Transient Cellular Responses Of Genetically-Encoded Sensors," Anal. Chem., vol. 89, no. 1, pp. 711–719, Jan. 2017.
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