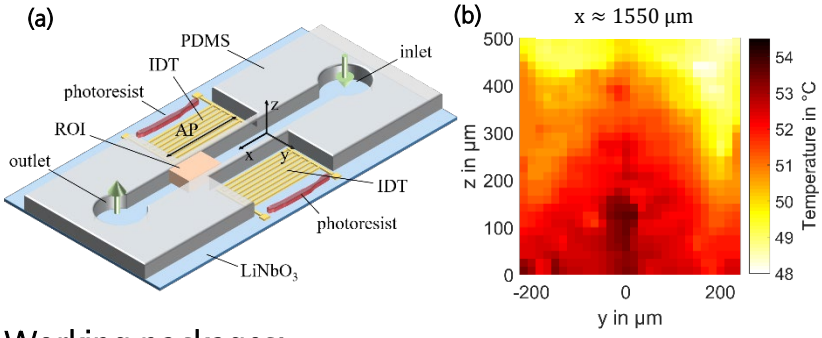
BA-/MA-thesis or project work

Scope and tasks will be adapted to the actual work

Temperature measurements in microfluidic systems with surface acoustic waves

Motivation: The acoustic manipulation of biological samples has gained tremendous interest in biology and medical research, since it provides a precise, contactless and label-free manipulation of particles and cells in a biocompatible manner. However, excessive heating can be induced in microfluidic systems utilizing surface acoustic waves (SAWs). Temperatures up to 55°C within a few seconds have been reported, which compromises the biocompatibility of those devices. The actual temperature rise depends on many parameters, e.g. duration of acoustic excitation, acoustic power, fluid volume and flow rate as well material used to built the microfluidic chip.

Task & goal: The main task of this work is to measure the temperature of the fluid within microfluidic systems given, which are using SAWs. For this, astigmatism particle tracking velocimetry (APTV) and luminescent lifetime imaging (LLI) will be combined to determine the temperature distribution volumetrically [1]. In conjunction with a variation of some parameters mentioned above, knowledge will be gained regarding the temperature distribution within the microfluidic systems induced by SAWs.



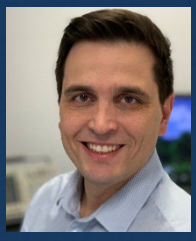
(a) Schematic of a microfluidic device with acoustic waves excited by interdigital transducers (IDT) on a piezoelectric $LiNbO_3$. **(b)** Cross-section of the measured temperature distribution within the region of interest (ROI).

Working packages:

- Literature review and getting familiar with APTV and LLI
- Calibration measurements
- Study of temperature distributions in microfluidic devices existing, applying a parameter variation
- Evaluation of the data, preparation and discussion of the results

The right thesis for you, if interested in fluid mechanics or microfluidics or measurement techniques, and love to work experimentally.

Contact:



Dr. - Ing.
Jörg König

Raum M 402
Tel.: (03677) 69 1827
Joerg.Koenig@
tu-ilmenau.de

Fachgebiet Technische Thermodynamik
Prof. Christian Cierpka
www.tu-ilmenau.de/ttd

TECHNISCHE UNIVERSITÄT
ILMENAU

[1] Z. Deng et al. Meas. Sci. Technol. **33** (2022) 115301 (12pp) https://doi.org/10.1088/1361-6501/ac82da