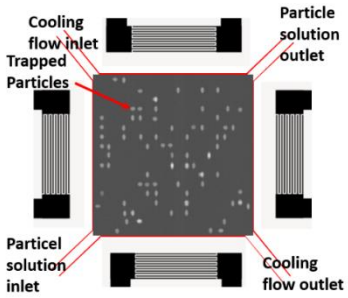
Bachelor-/Masterarbeit

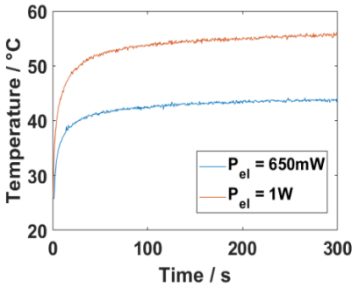
Temperature measurements on the particles trapped by 2D standing surface acoustic waves

Motivation: In numerous biological protocols, manipulating cells spatially and sorting them into a regularly organized pattern is necessary. This can be realized by a cell patterning system based on 2D standing surface acoustic waves (2DsSAW), which is depicted in the figure below (left). In the acoustic field, the cells are trapped by the acoustic radiation force (ARF) in the pressure nodes and anti-nodes. However, as shown in the figure below (right), the first temperature measurements on trapped PMMA particles indicates that cells within the acoustic field will be exposed to heating within a very short time, which can be fatal for living cells. To suppress the heating, an additional fluid flow can be introduced. Better cooling performance is expected with a higher flow rate. However, the flow rate should not exceed a certain upper limit, because particles will be flushed away if the drag force is larger than the ARF.



Left: Top view of the cell patterning system and the pattern formed by trapped particles;

Right: Measured temperature of the particles trapped by 2DsSAW, with electrical input power of 650mW and 1W



Objective: The main objective of this thesis is to find out the optimal experimental condition, under which most of the particles are still trapped and the heating effect of the acoustic field is furthest suppressed. The variable parameters may include but not limited to the flow rate of the cooling flow, size and material of the particles, properties of the fluid, etc.

Working Packages:

- Get familiar with the 2D cell patterning system and the technique for temperature and position measurement
- Measurement of the positions and temperature of the trapped particles under different experimental conditions.
- Processing and evaluation of the measured data based on Matlab

Target group: Students who have an interest in Acousto-microfluidics and measurement techniques.

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