

Master thesis, Semester project, Bachelor thesis

# Characterization of thermal actuators for tuning of CNT nanoresonators

## Keywords

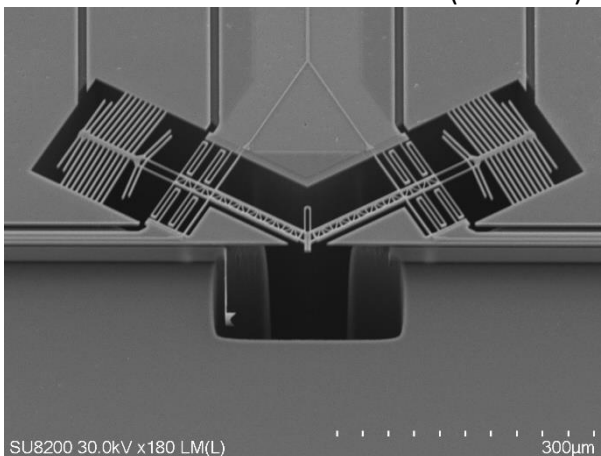
*Microtechnology, MEMS, resonators, thermal actuators, Comsol simulation, SEM, characterization*

## Motivation

CNT resonators can be tuned by straining the CNT similar to a guitar string. To do so, a MEMS platform has been designed, that uses thermal actuators to pull the electrodes, on which the CNT sits on, apart. Because of the high sensitivity to strain, the actuators must be calibrated carefully.

## Goal

The thermal actuators have been fabricated already using standard microfabrication technology. The current-strain characteristics need to be calibrated using SEM optical methods as well as numerical methods (COMSOL).



SEM picture of the MEMS structure with thermal actuators left and right and the electrodes for the CNT in the center.

## Learning Opportunities

- Numerical simulations with COMSOL multiphysics
- Sensor characterization
- Wirebonding and SEM

## Work Description

1. Parameter study of important actuator parameters (e.g. resistance, angle, number of springs). Definition of design criteria for the thermal actuator to allow a low power and precise working range.
2. Measuring displacement via current under SEM microscope.
3. Comsol simulation to support experiments and explore parameter influences.
4. Potential assembly of own devices and design.

## Your profile

- Student of D-ITET/D-MAVT
- Interested in MEMS, characterization, insights in microtechnology
- Structured and independent working style, innovative and creative mindset, will to explore new approaches

## Contacts

Morten Vollmann

[Mvollmann@ethz.ch](mailto:Mvollmann@ethz.ch)

Micro- und Nanosystems, CLA G11.1