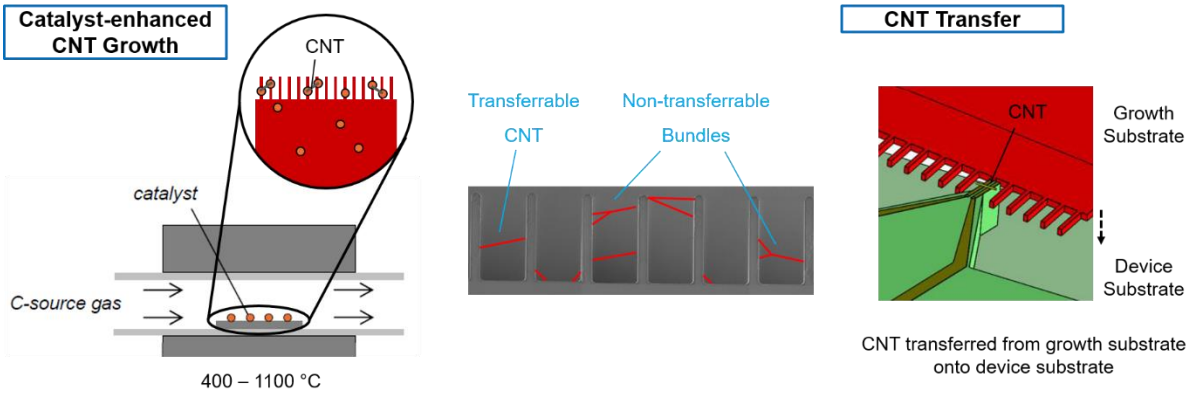
Multi-parameter Optimization of the Growth of Suspended Carbon Nanotubes

Bachelor Thesis, Semester Project, Master Thesis



Keywords
Carbon nanotube, process optimization, cleanroom experience

Motivation

Field-effect transistor (FET) devices with suspended carbon nanotubes (CNTs) have shown remarkable potential in chemical and physical sensing applications. To make these CNTFET sensors, suspended CNTs are grown on a fork-like growth substrate and then transferred onto a device substrate. In order to increase the yield of such devices, it is crucial to maximize the number of transferrable, suspended CNTs. Simply increasing the overall CNT growth density is not an option, as we want to avoid having too many bundles that are not desirable for transfer.

Project

The catalytic chemical vapor deposition (CCVD) growth of CNTs is dependent on numerous parameters such as catalyst concentration, temperature, pressure, and CH_4 flow rate. Testing all possible sets of parameters in a full-factorial experimental design would require several hundreds of experiments. Instead, in this project, you are expected to use a multi-parameter optimization method, which allows you to find the optimal set of parameters with a much smaller number of experiments.

Tasks and Opportunities

- Design a set of experiments using a multi-parameter optimization method, which is widely used in quality engineering (industry/academia)
- Grow CNTs by CCVD to gain hands-on experience in nanomaterial synthesis
- Analyze CNT growth results

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