MICRO-331

Microfabrication technologies

Brugger Jürgen

Cursus	Sem.	Type
Biomedical technologies minor	H	Opt.
Microtechnics	BA5	Obl.
Photonics minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	4 weekly
Number of positions	

Summary

The student will learn process techniques and applications of modern micro- and nanofabrication, as practiced in a clean room, with a focus on silicon, but also multi-material microsystems and flexible/stretchable systems technologies.

Content

Technology content

1. Cleanroom basics
2. Overview of successful Microsystems (MEMS)
3. Bi-morph cantilever as case study
4. Chemical Vapor Deposition (CVD)
5. Physical Vapor Deposition (PVD)
6. Lithography (UV and electron beam)
7. Dry etching
8. Wet etching
9. Inspection & Metrology

Application content:

1. Nanoelectronics for sensor applications
2. Bio-nanosystems
3. Soft microsystem for neuro-applications
4. Nanoscale systems
5. Flexible electronics
6. Implantable electroncs

Keywords

- Cleanroom technology
- Microlithography
- Thin film processing
- Surface and bulk micromachining
- Integrated microsystems
- Sensors and actuators

Learning Prerequisites

Required courses

Knowledge in physics and chemistry required to be able to understand the fundamentals of fabrication processes.

Recommended courses

Physics
Chemistry
Electronics

Important concepts to start the course

We all are using smart phones, tablets, computers, smart watches, pacemaker, implanted electrodes, sensors in the cars, drones, robots, and airplanes, biosensors, medical care, etc. to assist in our daily life situations. Such high-tech devices ubiquitously available because they are all made by advanced micro and nanofabrication methods in sophisticated cleanroom/manufacturing/assembly centers. This course presents the basics of those fabrication steps so that you are prepared in case you are interest to join a company in this field of activity, or are interested in performing R&D.

Learning Outcomes

By the end of the course, the student must be able to:

- Select appropriately the right order of the fabrication sequence
- Classify various fabrication methods
- Apply various fabrication steps as function of materials involved.
- Organize the order of the process flow accordingly to the materials compatility and system design.
- Create develop, propose a fabrication sequence and/or method for a device
- Critique interpret, examine and discuss a fabrication sequence and/or method
- Describe explain, present a fabrication sequence and/or method

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.
- Give feedback (critique) in an appropriate fashion.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Make an oral presentation.

Teaching methods

This course using following methods:

- MOOC (self-studying)
- Online quizzes (ungraded) for self-assessment
- Ex-cathedra lectures by Professors with real-world application examples
- Student-led-tutorials (SLT) where students present solutions to exercises in groups of 20, moderated by TA's and AE's.

Expected student activities

- The students follow the MOOC and prepare related questions before the lectures. They can also use the forum to contact other students, TA's and the Professors.
- The students prepare the answers to the SLT (student led tutorials) sessions and present the answer in the group when randomly selected (this part counts for 15% of the final exam)

Assessment methods

- SLT participation and quality of answer/discussion (counts for 15% of total grade).
- Written exam in January (counts 85% of total grade)

Supervision

Assistants	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Notes/Handbook

All course related material and links will be provided by the MOODLE.
MOOC material and handouts.
Handouts for the ex-cathedra guest lectures.

Moodle Link

- https://go.epfl.ch/MICRO-331

Videos

- https://www.edx.org/course/micro-nanofabrication-mems-epflx-memsx-0