EE 527: Solid-State Laboratory Techniques (Microfabrication)

Winter Quarter 2014

Department of Electrical Engineering, University of Washington

Course Description: the course covers principles and techniques for the fabrication of microelectronics devices and integrated circuits. Includes clean room laboratory practices and chemical safety, photolithography, wet and dry etching, oxidation and diffusion, metallization and dielectric deposition, compressed gas systems, vacuum systems, thermal processing systems, plasma systems, and metrology.

Course Goals: To introduce and train students in safe, controlled, and scientific laboratory techniques which are used in the microelectronics field.

Prerequisites: Graduate standing or permission of instructor.

Textbook: Sami Franssila, *Introduction to Microfabrication, 2nd Ed.* John Wiley & Sons, Ltd., 2010. ISBN = 978-0-470-74983-8.

The course will cover a wide range of topics including,

Fundamental Microfabrication processes:

- Introduction, characterization and silicon
  - Chapter 1: Introduction
  - Chapter 2: Micrometrology and materials characterization
  - Chapter 4: Silicon
- Metallization & thin film deposition
  - Chapter 5: Thin-Film Materials and Processes
  - Chapter 6: Epitaxy
  - Chapter 13: Thermal Oxidation
- Patterning
  - Chapter 8: Pattern Generation
  - Chapter 9: Optical Lithography
  - Chapter 10: Advanced Lithogrphy
- Etching
  - Chapter 11: Etching
  - Chapter 20: Anisotropic Wet Etching

- Chapter 21: Deep Reactive Ion Etching

Other related topics:

- Thermal & doping process: Chapter 14: Diffusion
- Wafer Bonding & Packaging: Chapter 17: Bonding
- Thin film process & equipment: Chapter 33: Vacuum & Plasma
- Cleanrooms: Chapter 35: Cleanrooms

Class Information:

Instructor:	Tai-Chang Chen tcchen[at]uw.edu
Office Hours:	Wednesdays, & Fridays 10:00 – 11:30am
Lectures:	MWF 11:30-12:20am **at EEB 025**
Course Grading:	5 bi-weekly quizzes (50%), Laboratory Participation and Competency (20%), 1 individual SOP report (10%), one group final project (20%).
Quizzes	There will be five in-class bi-weekly quizzes. No make-up exam will be given.
Laboratory	Laboratory attendance and participation is required. The laboratory is the most important part of the course! Laboratory sessions are designed to be completed in about 3 hours, but things may go wrong, equipment may malfunction, or mistakes could be made. You should anticipate that the laboratory sessions may run overtime some weeks. This is simply an inherent feature of doing experimental work. Laboratories will involve extensive hands-on one-on-one with the instructor or TA. This is a skills class, and developing these skills is what the laboratory sessions are for.

Projects

Overall View	The project is to apply the understanding of semiconductor microfabrication technologies students learned in class to newly developed processes/technologies currently. Students should search and pick one of modern processes/technologies to comprehend the functions and applications of it.
Lab Groups:	Each lab group will consist of nominally 2 students.
Tasks:	The project consists of: 1. Motivation/introduction of the process/technology and its applications 2. Current processes/technologies related to the applications 3. Rationale of the processes/technologies

4. Next step (future development of the process/technology and its applications)

Laboratory Sessions:

AA: M 1:30 - 4:30pm, Room B025 EEB or Fluke Hall MFF
AB: Tu 1:30 - 4:30pm, Room B025 EEB or Fluke Hall MFF
AC: W 1:30 - 4:30pm, Room B025 EEB or Fluke Hall MFF
AD: Th 1:30 - 4:30pm, Room B025 EEB or Fluke Hall MFF.

Academic Integrity

If you cheat, you cheat yourself of the opportunity to learn the material, and you cheat your classmates — all of your classmates — out of grades they have earned. If you let someone else copy your work, you are allowing them to devalue your grade and that of your fellow students. Cheating is a bad way to embark on a career in engineering. Cheaters make bad engineers, and you should be a good one. You can help by not tolerating cheating by your fellow students. The TAs and I will monitor for cheating and I will resolve all cheating cases in accordance with College of Engineering and University policy. Please help avoid this by avoiding even the appearance of possible cheating. Cheating can result in failure of the course and/or eventual expulsion from the University.