

## Syllabus

# EE 507: Micro- and Nano-Fabrication Technology

Spring, 2016

Time: 2:00 - 3:20 pm MW ZHE 252

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**Summary:** Micro- and nano-fabrication are enabling technologies for micro/nano-device and micro/nano-science researches. While both were mainly invented throughout the progress of the semiconductor industry, their applications have gone beyond semiconductor devices and circuits. Understanding the science and technology of micro- and nano-fabrication becomes an essential foundation of successful research in the frontier of electronics, photonics, and circuits.

EE 507 and EE 508 form a two-course sequence in micro/nano-fabrication, and the courses can be taken in either order. The goal of EE 507 is to:

- 1) Survey the landscape of state-of-the-art micro/nano-fabrication technologies.
- 2) Understand the fundamental sciences behind micro/nano-fabrication.
- 3) Provide a starting point for micro/nano-fabrication research.

**Prerequisites:** Graduate standing in Engineering, Physics, or Chemistry

**Course text:**

Handout for each class, and

“Fabrication Engineering at the Micro and Nanoscale”, by Stephen A. Campbell

**Grading:**

20% homework, 20% presentations, 30% mid-term exam, 30% final exam

Weekly topics:

1. Introduction and overview
2. Semiconductor substrates: Czochralski growth, Bridgman growth, float zone growth
3. Diffusion, implantation and process simulations software (first homework assignment)
4. Oxidation, self-limiting oxidation, rapid thermal annealing
5. SOI technologies, thin film physical deposition: evaporation, sputtering (second homework assignment)
6. PECVD, LPCVD, ALD
7. Epitaxy, plating, SAM, LB (third homework assignment)
8. Low dimensional nanostructures
9. Mid-term exam, Flexible substrates (fourth homework assignment)
10. Transfer printing (guest lecture), pattern transfer: fundamentals
11. Pattern transfer: wet etching, ion milling, (fifth homework assignment)
12. Pattern transfer: RIE, ICP,
13. Pattern transfer: deep RIE, CAIBE (sixth homework assignment)
14. CMP, Nano-informatics (guest lecture)
15. Student presentations

Reading materials are assigned after every class.

#### **Statement for Students with Disabilities**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

#### **Statement on Academic Integrity**

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *Scampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.

#### **Statement on Academic Integrity**

The diversity of the participants in this course is a valuable source of ideas, problem solving strategies, and engineering creativity. I encourage and support the efforts of all of our students to contribute freely and enthusiastically. We are members of an academic community where it is our

shared responsibility to cultivate a climate where all students and individuals are valued and where both they and their ideas are treated with respect, regardless of their differences, visible or invisible.