

Syllabus

EE 508: Nano-Fabrication Lithography

Fall, 2018

Time: 2:00 - 3:20 pm MW

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Summary: Nano-fabrication is one of the enabling technologies of nano-device and nano-science researches. While it was mainly invented throughout the progress of the semiconductor industry, its applications have gone beyond semiconductor devices and circuits. Understanding the science and technology of 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 508 is to:

- 1) Survey the landscape of state-of-the-art lithography technologies.
- 2) Understand the fundamental sciences behind nano-lithography.
- 3) Provide a starting point for 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:

10% homework, 20% oral presentation, 30% mid-term exam, 40% final exam

Weekly topics:

1. Introduction and overview of lithography technologies
2. Overview of lithography technologies and overview of pattern transfer
3. Photolithography fundamentals (first homework)
4. Resolution enhancement technologies: immersion, off-axis illumination
5. Resolution enhancement technologies: phase-shift mask, optical proximity correction, double processes (second homework)
6. Wrap-up photolithography, EUV lithography (system, light sources)
7. EUV lithography (optics, mask, resist and challenges), other photon-based lithographies: interference lithography (third homework)
8. Other photon-based lithographies: phase-mask lithography, maskless lithography, double-photon lithography (fourth homework)
9. Mid-term exam, Electron-beam lithography and SEM
10. Electron-beam lithography and SEM (fifth homework)
11. Focused-ion-beam lithography, Helium-ion-beam lithography (sixth homework)
12. Tip-based lithographies
13. Nanoimprint lithography and soft lithography (seventh homework)
14. Directed self-assembly, lithography with superlattices
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/>.