

ChE 466
Spring 2011
Electronic Materials Processing

Instructor: C.D. Stinespring
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Class: TR 9:30-10:45 AM / Room 215 ESB

Course Objectives:

1. Students will develop a basic knowledge of the crystal structure of solids and thin films typically encountered in electronic materials processing sufficient to understand basic relationships between materials processing and properties.
2. Students will develop a basic knowledge of the chemical bonding in and the electronic structure of solids and thin films typically encountered in electronic materials processing sufficient to understand basic relationships between materials properties and device operation.
3. Students will develop a basic knowledge of vacuum hardware used in electronic materials processing technologies sufficient to allow calculation of simple system requirements.
4. Students will develop a basic knowledge of the basic physical and chemical processes associated with electronic materials processing technologies sufficient to allow the determination of the optimum deposition processes and first order calculation of appropriate process parameters required to achieve desired materials characteristics.

Text: *The Materials Science of Thin Films*, M. Ohring, 2nd Edition, Academic Press (2002)

Evaluation: Student grades will be established on the basis of homework (30%), a midterm exam (35%), and a final exam (35%). One or both of the exams may be take-home exams. As in the case of in-class exams, discussion and collaboration of any form **are not** permitted on the take-home exams. For the homework assignments, discussion is highly encouraged; however, independent development of problem write-ups is required and copying of results is not permitted. The course will not be graded on a curve.

Grades: The following percentage grades will earn the letter grade indicated:

90-100% = A, 80-89% = B, 70-79% = C, 60-69% = D, < 60% = F.

Make-up tests: Make-up tests will be allowed only in the case of certifiable medical emergency or an approved university activity for which advance permission must be sought from the instructor.

Requests for re-evaluation of work: Homework and test problems to be re-evaluated must be submitted within one week after their return and must be accompanied by a written reason for re-evaluation.

Attendance: Class attendance is strongly recommended. Those not in class for any reason are responsible for all material covered and homework assigned in that class.

Prerequisites: Math 261 or Consent

Course Content:

Fundamental properties of solids: Solid state bonding, crystal structure, defects, electronic structure

Fundamentals of vacuum technology: Kinetic theory, vacuum pumping, system design

Basic processing technologies: Evaporation, sputtering, CVD, MBE, plasma deposition, plasma etching

Factors influencing thin film properties and performance: Nucleation and growth, composition, microstructure, stress

Thin film characterization methods: Physical and chemical properties

Current research issues: Diamond, SiC, Graphene, Sensors, Nano science & engineering

Approximate Topic Coverage for ChE 466

Topic	# Classes (1hr 15min)
Crystal Structure	2
Crystal Defects	2
Bonding, Band Structure	2
Thermo – Rxns and Phase Diagrams	2
Kinetics of Diffusion	1
Nucleation, Growth, Film Microstructure	3
Kinetic Theory	1
Pumping Hardware and Instrumentation	2
Pumping Calculations	1
Physical Vapor Deposition (Evaporation / Sputtering)	4
Chemical Vapor Deposition	4
Molecular Beam Epitaxy	3
Plasma Etching	3