MSE 123 - CERAMIC PROCESSING (3 UNITS)

(Taken from the UC Berkeley Course Guide (http://guide.berkeley.edu))

COURSE OVERVIEW

SUMMARY

This 4-unit course starts with a brief review of the fundamentals of solid-state physics including bands and defects in semiconductors and oxides, and then moves to bulk semiconductor crystals growth and processing including doping, diffusion and implantation, and then to thin film deposition and processing methods, and finishes with a discussion of materials analysis and characterization. Recent advances in nanomaterials research will also be introduced.

PREREQUISITES

MSE 111 (mse111.html) or PHYS 7C (phys7c.html) or consent of instructor

TOPICS COVERED

- To prepare students a) for work in semiconductor processing facilities and b) for graduate studies related to thin film processing and relevant materials science topics.
- To present the relevant materials science issues in semiconductor and oxide processing
- To provide an introduction into the principles of thin film processing and related technologies.

- Basic knowledge of gas kinetics and vacuum technology, including ideal gas, gas transport theory, definition, creation and measurement of vacuum.
- Knowledge of electrical and optical properties of thin films.
- Knowledge of the formation of p-n junction to explain the diode operation and its I-V characteristics.
- Understanding of the mechanisms of Hall Effect, transport, and C-V measurements, so that can calculate carrier concentration, mobility and conductivity given raw experimental data.
- The ability to describe major growth techniques of bulk, thin film, and nanostructured semiconductors, with particular emphasis on thin film deposition technologies, including evaporation, sputtering, chemical vapor deposition and epitaxial growths.
- To have basic knowledge of doping, purification, oxidation, gettering, diffusion, implantation, metallization, lithography and etching in semiconductor processing.
- To have basic knowledge of electronic material characterization methods: x-ray diffraction, SEM and TEM, EDX, Auger, STM and AFM, Rutherford Back Scattering and SIMS, as well as optical methods including photoluminescence, absorption and Raman scattering.
- To understand the concepts of bands, bandgap, to distinguish direct and indirect bandgap semiconductors. Understanding of free electron and hole doping of semiconductors to determine Fermi level position.
- To understand the effect of defects in semiconductors, so that can describe their electronic and optical behaviors, and the methods to eliminate and control them in semiconductors.

WORKLOAD

TIME COMMITMENT

4 hours of lecture per week.

COLLEGE OF CHEMISTRY PEER SERVICES

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