



THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Nanoscale Synthesis and Processing of Electronic Materials

MATSCEN 5552

Credit Hours:

3.00

Course Levels:

Undergraduate (1000-5000 level)

Graduate (5000-8000 level)

Course Components:

Lecture

Course Description:

Processing, structure and stability of materials in micro(nano)electronics. Thin film epitaxy, semiconductor heterostructures, quantum confinement, bandgap engineering, electronic properties of defects, nanolithography, self-assembled nanostructures.

Prerequisites and Co-requisites:

Prereq: 3141 and 3271, or permission of instructor.

Course Goals / Objectives:

- Introduce the processing, structure and stability of materials in micro(nano)electronics; Students will learn the technology involved in silicon processing, design of process flow, engineering aspects of nano-micro-fabrication
 - Introduce thin film epitaxy and semiconductor heterostructures engineering
 - Introduce quantum confinement and bandgap engineering in modern electronic and optical materials
 - Introduce the electronic properties of defects, nanolithography techniques, and self-assembled nano-structures
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Course Topics:

- Introduction and Review: Materials in electronic devices; their role/function in the devices; overview electronic materials.
 - Crystal Growth and Defects [electronic properties of defects]
 - Nanolithography and Etching [photolithography and nanolithography: e-beam, dip pen]
 - Thermal Oxidation
 - Solid-State Diffusion
 - Metallization and Solid-Solid Reactions
 - Ion Implantation & Ion-Solid Interactions
 - Device Packaging & Yield; process integration
 - Materials for non-Si devices vs. Si-based devices
 - Band gap engineering in compound semiconductors and oxides
 - Introduction to heterostructures: electronic properties at solid-solid interfaces, quantum confinement effects for nanoelectronics and photonics.
 - Thin film epitaxy: alloying, lattice matching, strain accommodation, strain relaxation in heterostructures. Misfit and threading dislocations
 - Self-assembled nanostructures: nanowires, quantum dots.
 - Final design project
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Designation:

Elective