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

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

Designation:
Elective