

CLEVELAND STATE UNIVERSITY
Washkewicz College of Engineering
CHE 494/594* (3-0-3)

Catalog Description: CHE 494/594 Selected Topics in Chemical Engineering: “*Synthesis, Characterization and Selection of Solid Materials*” (3-0-3)

Prerequisite: Must have completed Junior Level Engineering Courses/ or be a Graduate Student.

**The graduate students are expected to research one topic provided by the instructor, submit a report and present it to the class.*

Instructor: Surendra Tewari (523-7342, S.Tewari@csuohio.edu), H 464 (Office)/ FH 470 (Lab).

Text: Lecture Notes/ Reference Literature.

Course Objectives:

This course is designed to provide an understanding of

1. Synthesis of solid materials from liquid, solution and vapor.
2. Chemical (such as, XRF, EPMA, EDS/WDS, NMR, IR, Auger Electron Spectroscopy) and structural (such as, X-ray Diffraction, SEM, TEM) characterization techniques for solids.
3. Materials selection for engineering applications.

Expected Outcomes:

Upon completion of this course, the senior students should,

1. Know the strengths and limitations of various physical and chemical characterization techniques and be able to determine the most appropriate techniques for their own materials application.
2. Be able to make use of phase diagrams to predict the resulting microstructures of single and poly-phase alloys and the resulting segregation of solutes in the solidified product.
3. Be able to select optimum materials based on literature reported mechanical and physical properties for their engineering requirements.

Fulfills Program Outcomes:

1. Identification, Formulation & Solution of Engineering Problems
2. Ability to apply Math, Science & Engineering Knowledge
3. Techniques, skills and tools for modern engineering practice

Topics:

1. Synthesis of Solid Materials
 - (a) Phase diagrams.
 - (b) Solid-state Diffusion and Kinetics.
 - (c) Phase Transformation (Nucleation and Growth)
 - i. Liquid to Solid (Solidification).
 - ii. Vapor to Solid (CVD/PVD)
 - iii. Solution to Solid (solution-crystallization)
2. Structural and Chemical Characterization of Solid Materials.
 - (a) Bonding and Crystal Structure (Metals, Ceramics, Polymers)
 - (b) X-rays and X-ray Diffraction

- (c) Scanning and Transmission Electron Microscopy.
- (d) Chemical (Emission/Absorption/NMR/IR/Ionization Mass) spectroscopy.
- (e) Surface analysis techniques (Auger/AFM/STEM)
- 3. Properties and Selection of Materials
 - (a) Mechanical and Thermal Properties.
 - (b) Corrosion/Environmental degradation
 - (c) Materials Selection

Grading:

Home work (7-8)	30%
Midterm	30% (March ..., 2017)
Research Report*/ Final Exam	40% (Final exam on May....., 2017)

Grading Scale

A	91– 100%	B	71-75%	C	56-60%
A-	81-90%	B-	66-70%	D	51-55%
B+	76-80%	C+	60-65%	F	0-50%