

MSE 403: Synthesis of Materials

Fall 2021

Prof. Daniel Shoemaker

Class Schedule: Tuesday/Thursday 9:30 – 10:50AM, 2039 Campus Instructional Facility

Email: dpschoema@illinois.edu

Office: 1017 Materials Research Laboratory

Office Hours: Email for appointment

TA: Keith Coffman, devonc2@illinois.edu

Textbook: U. Schubert and N. Hüsing, Synthesis of Inorganic Materials. 3rd Edition, Wiley, 2012.

Additional reading material will be posted on Canvas.

Objectives:

Understand the processes, energy balance, and motivation for compound formation

Practically: Apply MSE 201, 401, and 402 to specific processes

Learn general methodologies for materials synthesis in a variety of systems

Suggest and evaluate reasonable syntheses for a variety of applications

Investigate one arena of synthesis in detail and present a poster to your peers

Topics:

Origins and synthesis of Metals, Ceramics, Polymers:

Astrogenesis

Chemical bonding

Thermodynamics, Phase Diagrams

Thermal synthesis, Oxidation and Reduction

Kinetics and Catalysis

Nucleation and Growth

Smelting

Electrochemistry

Intercalation

Glasses

Single crystal growth

Biomineralization

Hydrothermal methods

Thin film deposition

Sol-gel techniques

Nanomaterials

Carbon-based materials

Metal-organic frameworks and zeolites

Safety in synthesis

Grading:

20% Homework: biweekly, turned in via Compass, 40% late penalty per 24 hours

20% In-class activities, including quizzes, daily reading questions

20% Midterm 1: In-class [Tentative: Oct 7]

20% Midterm 2: In-class [Tentative: Nov 16]

20% “Poster” Project: During Finals slot

Grades will be assigned using the following scale. Round to the nearest integer.

A+ (98–100) B+ (88–90) C+ (78–80) D+ (68–70)

A (94–97) B (84–87) C (74–77) D (64–67)

A– (91–93) B– (81–83) C– (71–73) D– (61–63)

At my discretion, the minimum score needed to earn a certain letter grade may be lowered, but it will not be raised.

COVID-19 Logistics:

It is my expectation that class will be in-person through the entire semester. My expectation is that the CIF will be staffed with a Safer Illinois Building Access Check, so anyone in class has a valid test result or vaccination on file. If check-in at the building is not conducted, it is expected that you will share your Safer Illinois status with members of the class since collaborative face-to-face group work is a vital part of MSE 403. You are expected to follow the campus COVID-19 guidelines here:

<https://covid19.illinois.edu/guides/students/>

Any non-compliance will result in dismissal from the course.

Ethics:

Plagiarism of text, data, figures, graphs, etc., is prohibited. Instances of plagiarism will result in **at least a triple-zero grade** for the assignment for all authors. Please read and understand the rules:

<http://engineering.illinois.edu/online/current-students/policies/academic-integrity.html>

http://studentcode.illinois.edu/article1_part4_1-401.html

Instances in which answers are copied (from *any source*, including references, classmates, content from previous years, or old answer sets) will result in sanctions in accordance with the Illinois Student Code, which may include immediate failure in the course. **Members of the same group turning in partially identical work is plagiarism. Pasting text from a source is plagiarism. Using someone else’s plot without attribution is plagiarism. You are responsible for preparation of your own unique figures and text, although the underlying data may be the same.** All work is checked automatically via SafeAssign against each other and web sources. Incidents are reported via the campus-wide FAIR system in accordance with the Student Code. **If you find yourself behind in the course, or about to plagiarize, the best option is to take a step back and ask for help.**

Resources for Students in Distress:

Take care of yourself, your friends, and acquaintances. For personal or academic issues, it is important to remember that many consulting options are available to students, through the College of Engineering (206 Engineering Hall, walk-in during business hours), McKinley, or the Counseling Center (<http://counselingcenter.illinois.edu/>). **Anxiety and depression are common illnesses and expected human responses to adverse events.** If you would like to speak to someone about a situation you've encountered, please call the Counseling Center at 217-333-3704, or the after-hours Crisis Line at 217-359-4141.

Graphics and Plotting Software:

Any software can be used to create effective graphs and figures, but some are more effective than others. Some suggestions:

Data plotting: Matlab, Octave, Mathematica, Grace, Origin, R, gnuplot, matplotlib

Graphics: GIMP (raster), Photoshop (raster), Inkscape (vector), Illustrator (vector)