

OPTI 425(525)- Sol-Gel Science

Course Description:

An in-depth review of the chemistry and physics of sol-gel processes used in materials science and engineering.

Textbooks:

Recommended

Brinker, C.J. (1990). Sol-Gel Sciences: The Physics and Chemistry of Sol-Gel Processing. Boston: Academic Press.

Grading Policy:

Lowest 100 points dropped. Total possible points for the course: 500

- Two in-lecture examinations (100 points each)
- Homework assignments (100 points)
- Research/Proposal paper (50 points)
- Presentation (50 points)
- Final (200 points)

Exams will be regraded up to one calendar week after the test is returned. Please provide a written request specifically pointing to what was incorrectly graded. You must have an acceptable reason for the regrade. For example: problem 5: correct product was shown. Note that exams will be photocopied before grading and being returned to you.

Problems will be assigned weekly.

Undergraduate course will have 2 examinations, homework assignments, a research paper and twenty minute oral presentation on a topic in sol-gel science, and a final.

The graduate course will also have 2 examinations, homework assignments, and a final. Instead of a research paper and presentation, the graduates will be expected to write an original research proposal on a novel sol-gel topic and present the proposal to the class.

You may drop this class (if you are passing) with the instructor's signature. You will receive a grade of "W" for the class. A grade of "I" (incomplete) will not be given to cover a low grade. An "I" is only given to a student who is passing, has completed the majority of the course material, and has a very special case of an illness or incapacitation. You will have had one examination returned to you before the drop date. If you do poorly (by whatever measure you wish to apply) on the first examination, you need to see me before the drop date to discuss the course

and your best strategy. Failing the first exam is a warning sign that you need to change your study habits enormously or consider dropping the course.

Honesty is integral to professional behavior. Cheating is grossly dishonest. Cheating on examinations will not be tolerated. If you are observed copying from a neighbor or from a crib sheet, you will be asked to keep your eyes on your own paper twice. On the third time, you will be asked to turn in your examination immediately. Confirmation of cheating will result in a failing grade for the examination. Even if you are not caught during examination, cheating is hazardous to your grades. As there will be multiple variants of each examination, your neighbor's answers will not necessarily be the ones you are being asked for.

I encourage people to study together and work on practice problems together. I don't even mind people working on homework together, but I would remind you that the benefit of rote copying of homework on your grade is miniscule and will defeat the intended effect of preparing you for the examinations and final.

Objectives

Sol-gel science is a broad topic encompassing the chemistry and physics of solution processing for a wide range of materials that are of fundamental importance to optics, microelectronics, separations science, chemical catalysis and coatings science. By definition the sol-gel process starts with chemical precursors that are converted through chemical reactions and physical transformations into solid materials. The resulting films, precipitated powders, fibers or monolithic glasses are widely used in industrial settings.

This course will cover the sol-gel processing of metal oxide, silica and organically modified siloxane based materials. Students will gain a thorough understanding of the hydrolysis and condensation chemistry of the precursors, the solution chemistry and physics of the resulting intermediates, gelation and precipitation, effects of post-gelation processing and drying and structure property relationships.