Department of Chemistry and Biochemistry
The University of Texas at El Paso
General Chemistry 1106
FYRIS Chemistry Laboratory

CHEM 1105 Spring Term, 2024

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T.A. Phone Number at Lab (915-299-1854)

Laboratory will be held on Tuesdays from 12:00 pm to 2:50 PM in PSCI 302. Some sections of the lab may be conducted in 3.0716, Dr. Banda's research lab. You will be notified about lab location appropriately. For questions about the laboratory experiments talk to the T.A. Gopi. His office hours will be Tuesdays from 4:00 – 5:00 pm or by appointment.

COVID-19 PRECAUTION STATEMENT

Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. If you are feeling unwell, please let me know as soon as possible, so that we can work on appropriate accommodations. The Center for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. If you still need the vaccine, it is widely available in the El Paso area. For more information about the current rates, testing, and vaccinations, please visit http://epstrong.org.

Course Description

The objective of this course is to present an alternative section to General Chemistry 1106. This course is designed to be a complementary course to General Chemistry 1306, however, it is designed in a different way that the standard 1106 laboratory is held. We will be performing actual novel and original research concerning the synthesis of highly porous materials called Metal-Organic Frameworks. These materials are of current research interest in the current literature.

Background on nanomaterials and MOFs

Nanotechnology consists of the study of materials at the nanoscale, i.e., at the 10^{-9} m. This scale is slightly larger than the molecular scale (10^{-11} - 10^{-10} m) but much smaller than common chemical materials. Due to their very small size, nanomaterials have unique properties, such as huge surface areas which lead to increased abilities in adsorption, catalysis, and even in magnetism (when appropriate). We will learn and discuss some basic nanotechnology concepts,

and their application towards water treatment. Some materials, that have physical characteristics at the nanoscale are Metal-Organic Frameworks (MOFs). MOFs are formed by linking inorganic and organic units to build highly porous networks formed by strong bonds. This type of synthesis where extended networks are formed (as opposed to simple molecular complexes) is known as reticular synthesis. MOFs offer a wide variety of different porous geometries and porous sizes, which can be tailored to a large degree. This flexibility in obtaining different geometries has resulted in the synthesis of more than 20,000 different MOFs created in the last ten years. The key advantage of MOFs is that they form highly porous structures. Through the formation of these porous structures, MOFs have an immense capacity to allow small molecules to be placed in the many interstices these materials have. This high-porosity physical property has been used to yield some versatile applications. Some MOFs have very small pores, and others have pores at the nanoscale.

In addition to the application of MOFs in storing gases and removing pollutants from water, they are emerging as excellent materials for electrochemical energy storage. Electrochemical energy storage devices, such as Lithium-ion batteries and Lead Acid batteries, store energy in chemical reactions. You must be able to recognize that batteries are used in your laptops, mobile phones and both in electric cars and gasoline-powered cars. Recently MOFs have been used to adsorb and store ions from electrolytes into their extensive pores and store energy. Given the wide diversity of MOFs that can be designed and synthesized, there is significant interest in studying a variety of MOFs for energy storage. In this lab, we will synthesize these supramolecular materials, characterize them, and study their physical properties, with a focus studying them in batteries.

Textbook:

No textbook will be required. Appropriate handouts will be provided as needed. All of these handouts will be uploaded to Blackboard which can be accessed through http://my.utep.edu.

Grading:

The grade for this course will consist on (1) your accurate and up to date research notebook; (2) the result of two presentations throughout the semester; (3) an initial and a final laboratory report at the end of the semester; and (4) your performance in the laboratory.

The grade distribution will be:

- 10% Laboratory Notebook
- 30% Research Presentations
- 15% Initial report on the project
- 15% End of semester research report
- 10% Performance in laboratory practice
- 20% Quizzes

"Laboratory performance" includes attendance, successful execution of the experiment, and proper safety behavior.

Laboratory notebooks will be required. They will be subject to inspection **at all times**, and they will be graded throughout the semester. In these notebooks, the students shall write in detail the experiments performed, results obtained, and any information pertinent to the research. Copies of each entry should be submitted to the T.A. for safekeeping.

5 to 10 minute research presentations at mid and at the end of the semester will be required. In these presentations the students will learn to present their work to a knowledgeable audience. These presentations will be held at the half point and end of the semester.

The initial report will consist in the students performing a literature search of current MOF work. A five-page report including an introduction, current work, a statement of research interest, and a references list (in a third page) will be assigned in the first weeks of the laboratory.
The final report shall include an introduction, a materials and equipment, experimental section, results, discussion, future work and conclusion section. You will need to submit a draft for feedback three weeks before you submit the final report.

Disability If you believe you may qualify for special accommodations due to disability contact CASS: http://sa.utep.edu/cass; 915-747-5148.

Safety A separate safety instruction sheet will be provided. Students will be required to follow these laboratory rules at all times. Use of appropriate eyewear protection compliant to university rules is mandatory at all times during laboratory practice.

Course Drop Policy All grades of Incomplete must be accompanied by an Incomplete Contract that has been signed by the instructor of record, student, departmental chair, and the dean. Although UTEP will allow a maximum of one year to complete this contract, the College of Science requests it be limited to month based upon completion data. A grade of Incomplete is only used in extraordinary circumstances confined to a limited event such as a missed exam, project, or lab. If the student has missed a significant amount of work (e.g. multiple assignments or tasks), a grade of Incomplete is not appropriate or warranted.

Other considerations: Please turn your cell phones off and keep them away during lectures and practices.