

CHE 422: Inorganic Laboratory Technique

Spring 2027, Room 101 Life Science Building
M001: Wednesday 2:15 – 5:15 PM; M002: Tuesday 2 – 5 PM

Instructor: Dr. Weiwei Zheng

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Phone: 315-443-3062

TA Office hours: Monday 2-3 PM, LSB 117

Course Description:

This 1-credit course engages students in the collaborative exploration of authentic research questions related to the synthesis and physical characterization of metal complexes and inorganic nanocrystals through a sequence of inquiry-based laboratory investigations. Emphasis is placed on discipline-based research practices, including synthetic methods, structural analysis, advanced characterization techniques, and interpretation of physical properties. A companion lecture preceding each laboratory module introduces relevant concepts and supports students in developing and refining their experimental approaches. Throughout the semester, students will engage in structured reflection, iterative experimentation, collaboration with peers and the instructor, and professional communication of findings within the scientific context.

Course tags: CHE 422 fosters three Shared Competencies, Syracuse University's university-wide learning goals for undergraduate students.

- Critical & Creative Thinking
- Scientific Inquiry & Research Skills
- Communication Skills

Course goals:

This course is designed to support your development as an emerging inorganic chemist by providing hands-on experience with authentic, collaborative research investigations. You will practice experimental methods used by professional synthetic inorganic chemists while strengthening reasoning, problem-solving, and scientific communication skills. By the end of the course, students will be able to:

1. Design and execute synthetic strategies for organometallic compounds and inorganic nanocrystals in response to defined research questions.
2. Apply and justify characterization and purification techniques (e.g., UV-Visible spectroscopy, emission spectroscopy, thermogravimetric analysis (TGA), X-ray powder diffraction (XRD), centrifugation) to evaluate material structure and properties.
3. Analyze and interpret structural, optical, and thermal data to draw evidence-based conclusions about inorganic nanomaterials, iteratively refining experimental approaches based on data, feedback, and reflection.
4. Engage with and critically evaluate scientific literature to inform experimental design, troubleshoot procedures, and contextualize findings.
5. Collaborate effectively with the instructor and peers in planning, conducting, and interpreting research investigations.
6. Communicate research processes and results professionally through written reports, figures, and oral presentations directed at a scientific audience.

Pre-requisites

- General Chemistry I and laboratory.

Topics Covered:

- Safety in the Laboratory.

- Inorganic Syntheses and Reactions; Inert Atmosphere Techniques.
- Physical Methods for materials characterization: electronic spectroscopy (UV-vis absorption and emission spectroscopy), thermogravimetric analysis (TGA), and X-ray diffraction (XRD).

Materials and textbooks (optional) that are relevant to the course:

- Laboratory Manuals/Handouts will be provided to the students on Blackboard by the Friday before each lab. Safety glasses will be provided.
- Inorganic Chemistry, 5th edition, Shriver & Atkins, Freeman Press, 2010. (*Any inorganic text will be appropriate to use as a reference)
- Solid State Chemistry: An Introduction, 4th Edition. Smart, Lesley E. CRC Press, 2012

Undergraduate Laboratory Supervisor: Gary Bonomo, LSC 012A, email: gbonomo@syr.edu

Teaching Assistants: Anthony Moses, email: amoses@syr.edu

Lab Safety

- First and foremost, you are required to wear safety goggles at all times when in the laboratory. If you are caught without safety goggles on more than once, you will be asked to leave the lab.
- Shorts and open-toed shoes are not permitted in the laboratory.
- No food or drink is allowed in the laboratory at any time.
- Do not sniff or taste any of the chemicals you will be using.
- Toxic substances must only be used under the fume hood. You are responsible for reviewing and understanding the Material Safety Data Sheet (MSDS) of all chemicals used in the laboratory.
- All cell phones, pagers, CD players, MP3 players, *etc.*, must be turned off (or at the very least set to silent) while in the laboratory.
- Know the location and operation of safety equipment, including emergency exits, eyewash stations, safety showers, fire extinguishers, fire blankets, fire alarms, and emergency telephones.
- Immediately inform the instructor/TA of spills, splashes, injuries, or any dangerous situations.

Grading policy:

A-C scale, with 92-100 A; 89-91 A-; 86-88 B+; 82-85 B; 79-81 B-; 76-78 C+; 72-75 C; <72 C-

Pre-lab Questions (15%), Notebook and Laboratory Work (15%), Lab Report (40%), Post lab questions (15%). Final Project (15%). Attendance: 2%.

Final project/presentation:

The final project consists of an in-class oral presentation (~10 minutes, 8–13 minutes total), including slides of introduction, approach, results, conclusion, and references). The final project accounts for 15% of the overall course grade.

Attendance and Tardiness: In order to be successful in this course, your attendance in each lab is mandatory. There will be no makeup labs offered for this course. If you are more than 15 minutes late for class, you will not be permitted to perform the lab.

Notebook and Lab Report: Please buy a regular notebook for this course. No need to buy carbon copy lab notebooks. You do not need to buy a textbook for this class. I will provide handouts or post the relevant material on Blackboard for you. You should print out each lab and must complete a summary of the lab procedure in your notebook before you come to class.

Each lab report is due at the beginning of the lab in the following week. No late assignments will be accepted under any circumstances; emergency situations will be dealt on a case-by-case basis.

Note: We are bound by the rules, regulations, and the honor code of our university in all matters related to this course: attendance, registration, and examinations.

Tentative course outline:

Week	Date	Experiment/Lecture Topic	Due
1	1/13 – 1/14	<i>No lab in the first week</i>	
2	1/20 – 1/21	Course overview, safety and polices (Note: Please bring your computer for survey questions)	
3	1/27 – 1/28	Experiment 1: Preparation of metal complexes: cadmium diethyldithiocarbamate (Cd(DDTC) ₂) and zinc diethyldithiocarbamate(Zn(DDTC) ₂); Lab notebook/report, and Sample purification.	Pre lab 1
4	2/3 – 2/4	Experiment 2: Stability of metal complexes and thermogravimetry (TGA); Data processing and graphing. (Note: Please bring your computer for graphing in lab)	Pre lab 2 & Exp. 1 report
5	2/10 – 2/11	Experiment 3: Optical properties of quantum dots and optical spectroscopy (UV-vis absorption and emission); Optical properties of quantum dots (QDs). (Note: Please bring your computer for graphing in lab)	Pre lab 3 & Exp. 2 report
6	2/17 – 2/18	Experiment 4: Synthesis and optical properties of CdS and ZnS nanocrystals; Inert atmosphere techniques for the synthesis of inorganic nanocrystals.	Pre lab 4 & Exp. 3 report
7	2/24 – 2/25	Experiment 5: Synthesis of CdS/ZnS core/shell nanocrystals; Core/shell nanocrystals.	Pre lab 5 & Exp. 4 report
8	3/3 – 3/4	Experiment 6: Solid state modeling and X-ray diffraction (XRD); Crystal structures and XRD.	Pre lab 6 & Exp. 5 report
9	3/10 – 3/11	<i>Spring Break (no classes)</i>	
10	3/17 – 3/18	Experiment 7: Sensitized solar cells; Solar cells.	Pre lab 7 & Exp. 6 report
11	3/24 – 3/25	Experiment 8: Materials chemistry in sports. Chemistry behind table tennis.	Pre lab 8 & Exp. 7 report
12	3/31 - 4/1	Final project: Applications of Inorganic Materials. Literature searching and how to give a good presentation (Note: Please bring your computer for online literature search)	Exp. 8 report
13	4/7 – 4/8	Final project	
14	4/14 – 4/15	Final presentations (Note: Please bring your computer for survey questions)	Presentation ppt file
15	4/21 – 4/22	Final presentations (Note: Please bring your computer for survey questions)	Presentation ppt file

Stay Safe Pledge

Syracuse University's Stay Safe Pledge reflects the high value that we, as a university community, place on the well-being of our community members. This pledge defines norms for behavior that will promote community health and wellbeing.

Student Health

Well-being and mental health are significant predictors of academic success. It is critical to take care of yourself physically and emotionally and to effectively navigate stress, anxiety, and depression. Please familiarize yourself with the range of resources the Barnes Center provides (<https://ese.syr.edu/bewell/>) and seek out support for mental health concerns as needed. Counseling services are available 24/7, 365 days, at 315-443-8000. I encourage you to explore the resources available through the Wellness Leadership Institute, <https://ese.syr.edu/bewell/wellness-leadership-institute/>."

Use of Class Materials and Recordings

Original class materials (handouts, assignments, tests, etc.) and recordings of class sessions are the intellectual property of the course instructor. You may download these materials for your use in this class. However, you may not provide these materials to other parties (e.g., web sites, social media, other students) without permission. Doing so is a violation of intellectual property law and of the student code of conduct.

University Attendance Policy

Attendance in classes is expected in all courses at Syracuse University. Students are expected to arrive on campus in time to attend the first meeting of all classes for which they are registered. Students who do not attend classes starting with the first scheduled meeting may be academically withdrawn as not making progress toward degree by failure to attend. Instructors set course-specific policies for absences from scheduled class meetings in their syllabi.

It is a federal requirement that students who do not attend or cease to attend a class to be reported at the time of determination by the faculty. Faculty should use "ESPR" and "MSPR" in Orange Success to alert the Office of the Registrar and the Office of Financial Aid. A grade of NA is posted to any student for whom the Never Attended flag is raised in Orange SUccess. More information regarding Orange SUccess can be found at <http://orangesuccess.syr.edu/getting-started-2/>.

Students should also review the University's religious observance policy and make the required arrangements at the beginning of each semester.

Religious Observances Notification and Policy

Syracuse University's Religious Observances Policy (<https://policies.syr.edu/policies/university-governance-ethics-integrity-and-legal-compliance/religious-observances-policy/>) recognizes the diversity of faiths represented in the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their traditions. Under the policy, students are given an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance, provided they notify their instructors no later than the academic drop deadline. For observances occurring before the drop deadline, notification is required at least two academic days in advance. Students may enter their observances in MySlice under Student Services/Enrollment/My Religious Observances/Add a Notification.

Orange Success

(tools to access a variety of SU resources, including ways to communicate with advisors and faculty members) can be found here, at: <http://orangesuccess.syr.edu/getting-started-2/>

Diversity and Disability

Syracuse University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. There may be aspects of the instruction or design of this course that result in barriers to your inclusion and full participation in this course. I invite any student to contact me to discuss strategies and/or accommodations (academic adjustments) that may be essential to your success and to collaborate with the Center for Disability Resources (CDR) in this process.

If you would like to discuss disability-accommodations or register with CDR, please visit Center for Disability Resources at <https://disabilityresources.syr.edu>. Please call (315) 443-4498 or email disabilityresources@syr.edu for more detailed information. The CDR is responsible for coordinating disability-related academic accommodations and will work with the student to develop an access plan. Since academic accommodations may require early planning and generally are not provided retroactively, please contact CDR as soon as possible to begin this process.

Academic Integrity Policy

As a pre-eminent and inclusive student-focused research institution, Syracuse University considers academic integrity at the forefront of learning, serving as a core value and guiding pillar of education. Syracuse University's Academic Integrity Policy provides students with the necessary guidelines to complete academic work with integrity throughout their studies. Students are required to uphold both course-specific and university-wide academic integrity expectations such as crediting your sources, doing your own work, communicating honestly, and supporting academic integrity. The full [Syracuse University Academic Integrity Policy](#) can be viewed by visiting the [Syracuse University Policies website](#).

Upholding Academic Integrity includes the protection of faculty's intellectual property. Students should not upload, distribute, or share instructors' course materials, including presentations, assignments, exams, or other evaluative materials without permission. Using websites that charge fees or require uploading of course material (e.g., Chegg, Course Hero) to obtain exam solutions or assignments completed by others, which are then presented as your own violates academic integrity expectations in this course and may be classified as a Level 3 violation. All academic integrity expectations that apply to in-person assignments, quizzes, and exams also apply online.

Students found in violation of the policy are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered. Students may not drop or withdraw from courses in which they face a suspected violation. Any established violation in this course may result in course failure regardless of violation level.

Discrimination or Harassment

Federal and state law, and University policy prohibit discrimination and harassment based on sex or gender (including sexual harassment, sexual assault, domestic/dating violence, stalking, sexual exploitation, and retaliation). If a student has been harassed or assaulted, they can obtain confidential counseling support, 24-hours a day, 7 days a week, from the Sexual and Relationship Violence Response Team at the Counseling Center (315-443-8000, Barnes Center at The Arch, 150 Sims Drive, Syracuse, New York 13244). Incidents of sexual violence or harassment can be reported non-confidentially to the University's Title IX Officer (Sheila Johnson Willis, 315-443-0211, titleix@syr.edu, 005 Steele Hall). Reports to law enforcement can be made to the University's Department of Public Safety (315-443-2224, 005 Sims Hall), the Syracuse Police Department (511 South State Street, Syracuse, New York, 911 in case of emergency or 315-435-3016 to speak with the Abused Persons Unit), or the State Police (844-845-7269). I will seek to keep information you share with me private to the greatest extent possible, but as a professor I have mandatory reporting responsibilities to share information regarding sexual misconduct, harassment, and crimes I learn about with the University's Title IX Officer to help make our campus a safer place for all.

Blackboard Learning Management System

This class will use the Blackboard Learning Management to house the syllabus, course content, links to external course materials, assignments, quizzes, exams, feedback, and grades. Due dates and times

in Blackboard are stored in Coordinated Universal Time (UTC) and displayed for each user based on the time zone setting of their computer and data from their internet browser. The system will always display the time zone being used. If an instructor sets a due date of 11pm Eastern time, a student in the Pacific time zone will see a due date of 8pm.”

Information about Blackboard is available on [Answers Blackboard](#); alternatively, you can contact Information Technology Services by sending an email to help@syr.edu, calling 315.443.2677, or in-person at the ITS Service Center, located at 1-227 CST in the Life Sciences Complex. Business hours for the Service Center can be found on the [ITS website](#).

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