

Faculty of Science Course Syllabus Winter 2021Department of *Chemistry*

CHEM 4105/5105 (online)

Inorganic Materials Chemistry

Winter 2021

Instructor: Dr. Mita Dasog

Email: mita.dasog@dal.ca

Contact information: If you have any questions please email me. I will try to reply within 24 hours, although emails sent in the evening or on weekends may not be seen until the next business day. **Please use your dal email address for correspondence.**

Office hours: Office hours will be held on Mondays (11:00 a.m. – noon) or by appointment. The office hours will be held on Microsoft Teams. Links will be made available on Brightspace/email. It will be helpful if you can **email me your questions in advance.**

Lectures: Asynchronous delivery – videos available through the course Brightspace page.

Course Description

This course introduces students to the synthesis of advanced functional inorganic materials typically used in energy, optoelectronics, catalysis, and other applications. Topics in the course include solid-state synthesis, sol-gel synthesis, gas-phase synthesis, nucleation and growth of nanoparticles, thin film fabrication, and soft lithography.

Course Prerequisites

CHEM 2101 and CHEM 2301 or equivalent with a grade of C- or better

Learning Objectives

Upon completion of this course, students should be able to:

- Differentiate and describe various methods that can be used to synthesize inorganic materials.
- Discuss the advantages and disadvantages of each synthetic method.
- Discuss the underlying thermodynamic and kinetic principles for the synthesis of inorganic materials and for the formation of metastable products.
- Design suitable precursors (starting materials) for different synthetic methods.
- Critique the suitability of different synthetic methods to prepare materials for specific applications.

Course Materials

There is no formal textbook for this course. Class notes will be made available through the course website, and various reference books will be highlighted for further reading.

Website: Lecture notes/videos and other necessary information will be made available through Brightspace.

Course Delivery (online)

- Asynchronous delivery. Lecture videos will be uploaded weekly on the course Brightspace page.
- Course assessments (assignments, term paper and presentation details) will be posted on Brightspace in their respective folders.
- Quizzes will be made available on Brightspace on the day of the quiz.

Course Assessment

CHEM 4105 (Undergraduate students)

| Component | Grade (%) | Due date |
|----------------------|-----------|------------------------------|
| Quizzes | 40 % | See below |
| Homework assignments | 40 % | See below |
| Midterm | 20 % | March 1 st , 2021 |

CHEM 5105 (Graduate students)

| Component | Grade (%) | Due date |
|----------------------|-----------|----------------------------------|
| Quizzes | 40 % | See below |
| Homework assignments | 20 % | See below |
| Term paper | 25 % | February 26 th , 2021 |
| Oral presentation | 15 % | March 3 rd , 2021 |

Quizzes:

Quiz schedule

Quiz 1: January 20, 2021

Quiz 2: February 3, 2021

Quiz 3: February 24, 2021

Quiz 4: March 10, 2021

Quiz 5: March 31, 2021

Five quizzes will be given, and the lowest quiz grade will be dropped when calculating the final mark. **The quizzes will open on Wednesday mornings at 9 a.m. (AST) and will be available for 12 hours (i.e. until 9 p.m. (AST)).** The topics covered by each quiz will be posted on Brightspace. Quizzes are **individual assessments**; therefore, collaboration of any sort is prohibited and would be considered academic misconduct. This includes, but is not limited to, discussing the quiz with your friends/peers/classmates, TAs/instructors, siblings/family members, and on discussion boards. You are permitted to use the lecture material provided to help you answer the quizzes (i.e., quizzes are “open book”). The use of any other external source of information (such as other

books and webpages) is prohibited and would be considered academic misconduct. Because one quiz grade is already being dropped, there are no make-up quizzes or deadline extensions.

Homework assignments:

Assignment schedule

| CHEM 4105 | | | CHEM 5105 | | |
|--------------|-------------------|-------------------|--------------|-------------------|------------------|
| Assignment # | Grade (total 40%) | Due date | Assignment # | Grade (total 20%) | Due date |
| 1 | 10 % | January 29, 2021 | 1 | 10 % | January 29, 2021 |
| 2 | 10 % | February 26, 2021 | 2 | 10 % | March 26, 2021 |
| 3 | 20 % | March 26, 2021 | | | |

The homework assignments are designed to test your understanding of the lecture material and your ability to apply that knowledge to synthesize new materials. You may be asked to compare different synthetic techniques and identify ideal fabrication methods for a given situation. You may be asked to design precursors and plan syntheses for a specified material.

The assignments will be made available **at least** a week in advance. The instructions for assignment # 3 (CHEM4105) will be made available in January. **You will submit your assignments through Brightspace by 11.59 p.m. (AST) on the due date.** Late assignments are subjected to a 10% deduction for each late day. However, accommodations will be made under special circumstances. Please inform me of the situation as soon as you can and ideally before the due date.

You are encouraged to discuss assignment questions with other members of the class. You may also use the class lecture materials; however, the answers should be written in your own words and should not be identical to your classmates. Otherwise, it will be considered academic misconduct. You are not allowed to post assignment questions on student services websites such as Chegg. Otherwise, it will be considered academic misconduct.

Midterm: The midterm exam will be held on March 1st, 2021 only for CHEM 4105 students. **The exam will be available at 9 a.m. (AST) and due at 9 p.m. (AST) the same day.** It should not take you more than an hour to complete the exam. The exam is open book but an individual assessment. Discussing the questions with your classmates is not allowed. You are not allowed to post exam questions on student services websites such as Chegg. Otherwise, it will be considered academic misconduct.

Term paper: Graduate students (CHEM 5105) are required to submit a term paper on a preassigned synthetic method. The topics will be assigned early in January. The rubric and other details for the term paper will be made available in January as well (on Brightspace). **The term paper is due on February 26th, 2021 by 11.59 p.m. (AST).** This will be worth 25% of your total grade. Plagiarism software will be used to check the term papers and any significant resemblance to previous work will be considered academic misconduct.

Oral presentations: Graduate students (CHEM 5105) will also give a ~20 min presentation on their term papers. The tentative date for the presentations is March 3rd, 2021. The presentations will be held live through Microsoft Teams. Graduate students are required to attend all the presentations. Undergraduate students are encouraged to attend them.

No additional assessments (extra credit assignments or supplementary homework/quiz retakes) will be given. Final grades will be calculated based on the assessments laid out in this syllabus only.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

Undergraduate (CHEM 4105):

The usual Faculty of Science scheme for converting numerical grades to letters will be used:

| | | | | | |
|-----------|----------|----------|----------|---------|--------|
| 90-100 A+ | 85-89 A | 80-84 A- | 77-79 B+ | 73-76 B | |
| 70-72 B- | 65-69 C+ | 60-64 C | 55-59 C- | 50-54 D | 0-49 F |

Graduate (CHEM 5105):

The usual Faculty of Graduate Studies scheme for converting numerical grades to letters will be used in this class:

| | | | | | | |
|-----------|---------|----------|----------|---------|----------|-------|
| 90-100 A+ | 85-89 A | 80-84 A- | 77-79 B+ | 73-76 B | 70-72 B- | <70 F |
|-----------|---------|----------|----------|---------|----------|-------|

Course Content

1. Introduction to materials science
2. Characterization of solids
3. Solid-state reactions
4. Precursor and low-temperature methods
5. Solids from gas phase
6. Colloidal synthesis

Copyright: The lecture and any other materials provided for this course are subject to the copyright of the course instructor and may not be reproduced or copied in whole or in part without the consent of the instructor. Students who are enrolled in the course who have received this lecture, or any other material may reproduce it in order to view it at a more convenient time but must destroy the reproduction within 30 days of receiving the final course evaluation. The course instructor retains copyright for the material, and any use by the Board of Dalhousie or its administration are governed by Section 23.06 of the Collective Agreement.

Important dates

Jan 6: First day of classes

Jan 20: Quiz 1 (CHEM 4105/5105)
Jan 29: Last day to drop class without a "W"
Jan 29: Assignment # 1 due date (CHEM 4105/5105)
Feb 3: Quiz 2 (CHEM 4105/5105)
Feb 15 – 19: Winter study break
Feb 24: Quiz 3 (CHEM 4105/5105)
Feb 26: Assignment # 2 due date (CHEM 4105)
Feb 26: Term paper due date (CHEM 5105)
Mar 1: Midterm (CHEM 4105)
Mar 10: Quiz 4 (CHEM 4105/5105)
Mar 26: Assignment # 2 (CHEM 5105) or (CHEM 4105) 3 due date
Mar 31: Quiz 5 (CHEM 4105/5105)

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Missed or Late Academic Requirements due to Student Absence

As per Senate decision instructors may not require medical notes of students who must miss an academic requirement, **including the final exam**, for courses offered during fall or winter 2020-21 (until April 30, 2021).

Information on regular policy, including the use of the Student Declaration of Absence can be found here: https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html.

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: <http://www.dal.ca/cultureofrespect.html>

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

https://www.dal.ca/academics/important_dates.html

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Student Resources and Support**Advising**

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: <https://libraries.dal.ca/>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html

Student Advocacy: <https://dsu.ca/dsas>

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: <https://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>