

The University of Western Ontario
Chemistry 9546S, Winter 2025
Optical Properties of Solids

Instructor:

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Description:

This quarter course focuses on the phenomenon of luminescence when a material is exposed under an external excitation. It covers several core topics on the optical properties of materials, with a particular emphasis on solids (including colloidal solutions). Fundamental knowledge of light interaction with materials will be introduced. We will discuss how the electronic structure of a material influences its associated luminescence, and the topic further expands to the state-of-art strategies in design and synthesis of materials with novel luminescence properties. Practical experimental techniques on optical spectroscopy measurements, such as UV-visible absorption spectroscopy, fluorescence spectroscopy, quantum yield, and life-time measurements will also be introduced.

Learning outcome:

Upon completion of this course, students will be able to

- Understand the fundamental physical process of luminescence
- Identify the critical microscopic parameters of a material that determines its light emission property
- Correctly interpret experimental obtained from a photoluminescence measurement
- Predict how the luminescence of a material can be controlled or modified through chemical/material engineering

Tentative Topics:

- Introduction
 - ♦ Optical processes
 - ♦ Core concepts in optical physics

- Fundamentals
 - ♦ Absorption processes
 - ♦ Exciton formation
 - ♦ Emission processes, luminescence
- Instrumental and data analysis
 - ♦ Steady-state measurements, quantum yield
 - ♦ Time-resolved measurements
- Luminescence from semiconductors
 - ♦ Excitons
 - ♦ Color-centers
- Luminescence from nanomaterials
- Special luminescence phenomena: persistent luminescence, thermoluminescence, mechanoluminescence, electroluminescence, etc

Resources:

No textbook required.

Lecture notes and handouts will be provided as the course proceeds.

Lectures days (tentative):

Days: Monday and Wednesday, First day of class: January 8, 2025

Time: 10:30 am – 12:00 pm (noon)

Location: TBD

Evaluation

Assignment (50%)

Case study in the form of presentation and group discussion (50%)*

(*specific form of case study evaluation depends on the class enrollment.)

Course attendance and missed/late assignments

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed.

Notes on Academic Honesty

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Health and Wellness

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre.

Numerous cultural events are offered throughout the year. For example, please check out the Faculty of Music web page <http://www.music.uwo.ca/>, and our own McIntosh Gallery <http://www.mcintoshgallery.ca/>. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>. Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html.