UQÀM | Faculté des sciences
Université du Québec à Montréal

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Recruitment offer

Better materials for green hydrogen: Unlocking the secrets of $BiVO_4$ photocatalysts at the nanoscale for green hydrogen production

Summary

Research supervisor
Goubert, Guillaume

Research co-supervisor
Siaj, Mohamed

Research group
Centre de recherche sur les nanomateriaux et l'énergie (NanoQAM)

Application deadline
2026-09-10

Contact email
goubert.guillaume@uqam.ca

Required documents
Cv, cover letter, grade report and letters of recommandation

Funding support
Scholarship 21000$CAD each year

Applicant's status
Doctoral student

Project background

This project contributes to the development of sustainable fuels. Candidates will have the opportunity to develop advanced skills in materials chemistry and to gain expertise in in situ instrumentation within an interdisciplinary environment. These skills, applicable in the energy and semiconductor sectors, open career opportunities in both academia and industry.

Green hydrogen, produced from light energy and water, is a promising renewable fuel for storing electrical energy and a key feedstock in industry (chemicals, metallurgy, steelmaking). Oxygen evolution is the rate-limiting reaction in the production of hydrogen by water splitting. Photoelectrochemical catalysts for oxygen evolution should be inexpensive (free of precious metals), active, and stable.
The selected student will study bismuth vanadate (BiVO4) and MoS2, two promising semiconductors for photoelectrochemical catalysis. Their performance is limited by the recombination of charge carriers (electrons e^- and holes h+) that fail to reach the reaction site. We use the light emitted by electron–hole recombination (photoluminescence, PL) to locate the sites where these losses occur in BiVO4. By combining PL with an atomic force microscope (AFM), we will be able to locate these sites with ~10 nm precision, a method known as tip-enhanced photoluminescence (TEPL). Armed with this new understanding, we will be able to optimize the synthesis and geometry of the catalysts to improve their performance and lifetime.

Project objective

Design more active photocatalysts for oxygen evolution by gaining a new understanding of charge-carrier recombination through advanced in situ nanospectroscopy.

Responsibilities

A. Synthesis of BiVO4 films and BiVO4/MoS2 junctions. The selected student will use the BiVO4 synthesis methods developed by the Siaj laboratory1,2 to fabricate BiVO4 films. As BiVO4 alone is limited, it will then be combined with MoS2, a 2D material that will enhance catalytic activity.
B. Use of TEPL to quantify charge-carrier recombination at the nanoscale in BiVO4 and BiVO4/MoS2 junctions.
The work carried out in A and B will create a feedback loop: understanding the charge-recombination mechanisms will provide guidance for synthesizing more active and stable catalysts.

Applicant profile

• Someone with a master's degree in chemistry, chemical engineering, or a related field (including, but not limited to: materials science, surface science, physics).
• We strongly encourage applications from people with diverse or interdisciplinary backgrounds.
• Experience in photocatalysis or spectroscopy is an asset but is not required. The project will begin with training in the specialized analysis and synthesis techniques used in both laboratories.
• The candidates should show an interest in understanding the surface chemistry of materials, as well as a motivation to use cutting-edge methods to push

the boundaries of knowledge.
- Ability to learn and collaborate in an interdisciplinary environment.

The last update was on 07 July 2026. The University reserves the right to modify its projects without notice.
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Master's and doctoral level can be done in a language other than French.