講演会のご案内

AxC-PF賛助会員であるカナダ・Institut national de la recherche scientifique (INRS)の教授であり、信州大学アクア・リジェネレーション機構の特別招へい教授を務める My Ali El Khakani 先生をお招きし、下記のとおり講演会を開催いたします。

My Ali El Khakani 先生は、レーザー工学からナノ材料応用まで幅広い分野で優れた研究実績を有する研究者であり、特にナノチューブをはじめとする先端材料研究の第一人者として国際的に高く評価されています。

貴重な機会となりますので、ぜひ多くの皆様にご参加いただき、My Ali El Khakani 先生のご講演をご聴講ください。

【講師】

Dr. My Ali El Khakani

Professor, Institut National de la Recherche Scientifique, Centre INRS-EMT, Université du Québec Canada

信州大学 アクア・リジェネレーション機構　特別招へい教授

- **日　時：2026年 6月 25日（木）　13:30～14:30**
- **場　所：総合研究棟　1階 106室**
- **講演テーマ：Harnessing “2D” Quantum Behavior in Vertically-Oriented “3D” MoS2 Thin Films Grown by Pulsed Laser Deposition for Optoelectronic Applications**

主催：アクア・リジェネレーション機構　特別栄誉教授　遠藤守信

Harnessing "2D" Quantum Behavior in Vertically-Oriented "3D" MoS_2 Thin Films Grown by Pulsed Laser Deposition for Optoelectronic Applications

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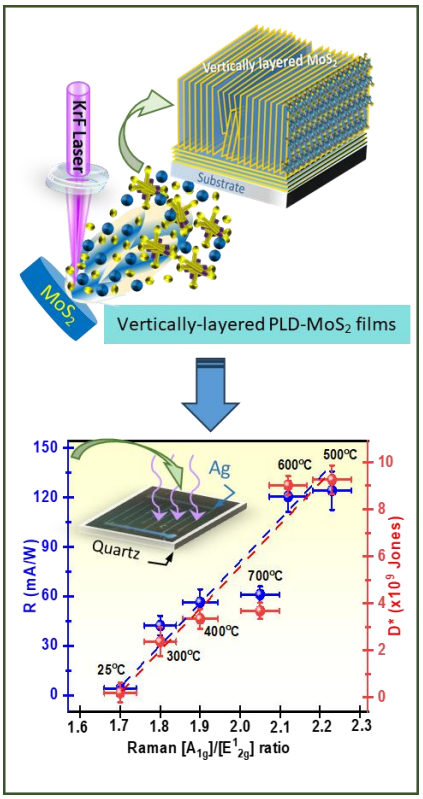
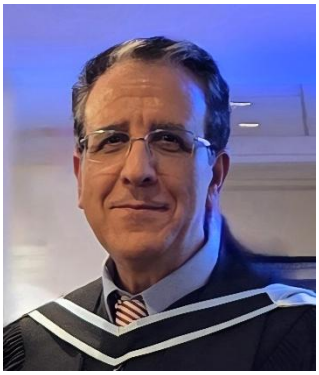
Driven by the breakthrough success of graphene, semiconducting 2D-materials have become a major research focus due to their unique optoelectronic properties and application potential. Among these materials, molybdenum disulfide (MoS_2) stands out for its strong optical absorption, high carrier mobility, and natural abundance. Crucially, its optoelectronic properties can be tuned through quantum confinement. We will particularly focus on the use of the pulsed laser deposition (PLD) technique to grow MoS_2 thin films with a novel nanostructure that enables the exploitation of "2D-quantum" behaviors without being restricted to ultrathin thickness (of 1-2 nm). After briefly recalling the physical principles and unique features of the PLD technique, we present our recent results structured around three key axes: **(i)** PLD synthesis of highly-oriented and vertically layered "3D" MoS_2 thin films exhibiting the attractive quantum behavior of ultrathin 2D monolayers, such as a direct bandgap of 1.8 eV; **(ii)** vertical orientation of MoS_2 layers evolution with film thickness (controlled via the number of laser ablation pulses (N_{LP})). The vertical alignment (as evidenced by HRTEM observations) reaches a maximum proportion of ~70% at an optimal thickness of 80 nm. At this thickness, the films exhibit a single-layer-like optoelectronic behavior with an intense photoluminescence, and remarkable photodetection performance (with a responsivity of 160 mA/W and a specific detectivity as high as 2×10^{10} Jones). Most interestingly, we show for the first time that the photodetection performance depends linearly on the proportion of vertically oriented layers within the films; and **(iii)** *in-situ* doping of MoS_2 films via reactive PLD under a nitrogen background gas. The substitutional N content ([N_{Sub}] as determined by XPS measurements) was controlled over a range of 1.0 to 7.5 at.% by varying the N_2 residual pressure. As the [N_{Sub}] content increases from 1 to ~7 at.%, the optical bandgap continuously decreases from ~1.8 to ~1.4 eV, while the integrated solar absorptance and photothermal conversion efficiency (η_{PT}) gradually increase to a maximum of ~73%. Ultimately, this reactive PLD in-situ doping strategy provides an effective route to induce p-type behavior in MoS_2 films while significantly enhancing their potential for solar energy conversion applications.



[Ref.]: *D. Mouloua, …and My Ali El Khakani, Adv. Optical Mater.* ***2024****, 2302966;* ***DOI: 10.1002/adom.202302966***

Brief Biography of Prof. El Khakani:



My Ali El Khakani is a Full-Professor and Director of the "NanoMat" Group at the INRS Energy Materials and Telecom Center (INRS is one of the constituting institutions of University of Quebec, Canada). Professor El Khakani is an internationally recognized expert in the inter-related fields of laser/plasma based synthesis and hybridization of nanostructured materials and their applications for photo-electronic, photovoltaic and photocatalytic devices. He has published so far more than 340 refereed publications, and he is a co-inventor of 5 patents. His current H-index is 51 (google Scholar) with 9000+ citations so far. To date, more than 95 highly qualified persons (including BSc, MSc, PhD and PDFs) have been trained and graduated under his supervision/co-supervision. Many of his former students are now eminent professors at universities or R&D leaders in research institutions and high-tech industries in Canada and abroad. The R&D contributions and expertise of Prof. El Khakani are well recognized at both national and international levels, as testified by a large number of invited/keynote talks at international conferences, and through appointments as a scientific reviewer and a member of advisory boards for various universities and public/private R&D funding agencies in different countries. He has been serving on the scientific advisory boards of numerous international conferences. He has co-organized several scientific international workshops, symposiums and international conferences. He has been the General Chair of the ICMAP-2018 international conference (Montreal, Qc, Canada) in 2018 and Co-chair of the Opto-X-Nano conferences (Okayama, Japan) in 2024 and 2026. He has served as a reviewer and member of the editorial board of several journals, such as sensors letters, Nanomaterials, Nanotechnology, and Scientific Reports. His list of published papers is accessible on google scholar: https://scholar.google.com/citations?hl=fr&user=Pw6ibJgAAAAJ&view_op=list_works