

Towards a Green Revolution: Synthesis of Innovative Materials for CO₂ Capture and Sustainable Hydrogen Production

Adam Duong

University of Picardie Jules Verne

Laboratoire de Glycochimie et des Agroressources d'Amiens

(DuongLab)

Abstract

Our team is advancing the development of innovative materials designed to address key challenges in energy transition, focusing on both CO₂ capture and sustainable hydrogen production. We have synthesized novel photocatalysts based on pyridinediaminotriazinyl ligands, which exhibit remarkable catalytic activity for the hydrogen evolution reaction (HER). By leveraging the unique electronic properties of triazine and pyridine-based environments, these materials enhance charge separation, enabling efficient hydrogen production under visible light. Optimization of ligand structure and reaction conditions has led to significant improvements in catalytic efficiency, with amidine/amidinate groups playing a critical role. Additionally, we have designed porous materials based on the coordination of cymelurate with lanthanide ions for CO₂ capture. Structural characterization and gas sorption studies at room temperature reveal that these materials show promising CO₂ adsorption capacities, offering potential for environmental applications. This work demonstrates the rational design, synthesis, and characterization of functional materials that contribute to sustainable energy solutions. By advancing the understanding of structure-property relationships in both photocatalytic and CO₂ sorbent materials, we provide new strategies for the development of next-generation materials to support the global transition to a greener, more sustainable future.

Recent Publications

Mohamed Essalhi, Midhun Mohan, Nour Dissem, Najmedinne Ferhi, Adela Abidi, Thierry Maris and **Duong, Adam***. *Inorg. Chem. Front.*, **2023**, *10*, 1037-1048.

Ferhi, Najmeddine; Desalegn Assresahegn, Birhanu; Ardila-Suarez, Carolina; Dissem, Nour; Guay, Daniel; **Duong, Adam***. *ACS Appl. Energy Mater.*, **2022**, *5*(1), 1235-1243.

Rana, Love Karan; Kaur, Prabhjyot; Maris, Thierry; **Duong, Adam***. *CrystEngComm*. **2022**, *24*, 5460-5473.

Chair, Khaoula; Luna Caceres, Cesar Augusto; Rajak, Sanil; Schott, Olivier; Ramrez-Caballero, Gustavo E.; Maris, Thierry; Hanan, Garry S.; **Duong, Adam***. *ACS Applied Energy Materials*, **2022**, *5*(9), 11077-11090.

Mohan, Midhun; Essalhi, Mohamed; Durette, David; Rana, Love Karan; Ayevide, Follivi Kloutse; Maris, Thierry; **Duong, Adam**. *ACS Appl. Mater. Interfaces*. **2020**, *12*(45), 50619-5062.

Biography



Professor Adam Duong is a Junior Chair Professor at the **University of Picardie Jules Verne (UPJV)** in Amiens, France, where he leads cutting-edge research on the design, synthesis, and characterization of multifunctional materials derived from natural resources. His work addresses critical challenges in health, environmental sustainability, and energy transition. In 2025, he was appointed **Ambassador of France Chimie**, reflecting his prominent role in advancing chemical sciences. Professor Duong has also guided **high school students** in understanding projects for the **Pierre Potier Award**, promoting science education and inspiring future leaders in chemistry. Previously, Professor Duong was a **Full Professor** at the **University of Quebec at Trois-Rivières (UQTR)**, Canada, where he pioneered research on **functional materials** for **energy storage, hydrogen production, and CO₂ capture**. He has secured over **1 million euros** in funding from agencies such as NSERC, ANR, and CFI. His achievements have earned him multiple awards, including the **Ministry of Foreign Affairs, Trade, and Development Award** (2019). A recognized authority in his field, Professor Duong serves as a peer reviewer for prestigious journals like ACS and Elsevier and evaluates high-impact **grant applications** for agencies like NSERC and CFI. Throughout his career, he has supervised **36 graduate students** and presented his work at over **30 international conferences**, further solidifying his contributions to materials science and chemistry.

Email: adam.duong@u-picardie.fr