

Nanomaterial-Enhanced Metal-Organic-Framework Composites for Photocatalytic Water Splitting

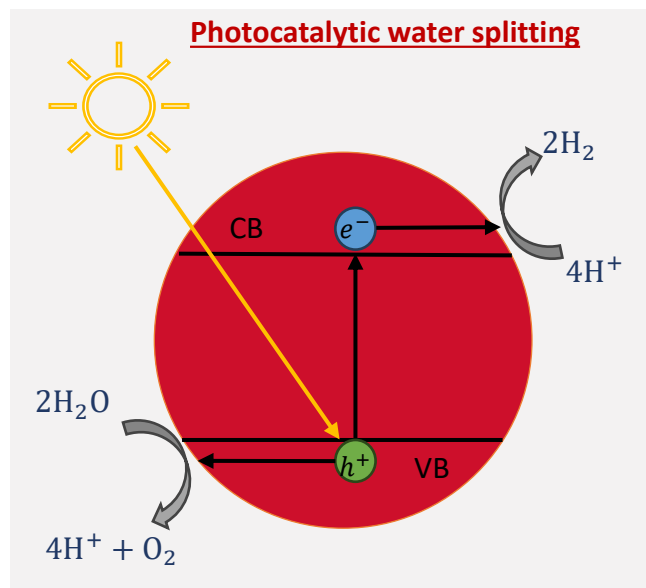
Introduction

Metal-Organic Frameworks (MOFs) are semiconductor-like materials composed of metal nodes and organic ligands. These materials are highly porous, which leads to large surface areas. This makes them excellent candidates as catalysts. Through certain modifications, MOFs can be tuned to absorb light and can be used as photocatalysts [1].

The effectiveness of MOFs as photocatalysts can be enhanced through different methods, where one is through the creation of composites with other materials. The introduction of nanomaterials to MOFs can give different types of enhancement, such as acting as co-catalysts or through plasmonic enhancement. The nanomaterial and MOF composite can potentially give greater efficiencies through their synergies [2,3].

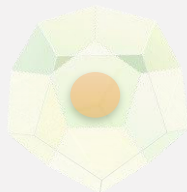
Primary objective

- Synthesise and characterise nanomaterial-enhanced MOFs
- Compare hydrogen production of MOF with nanomaterial-enhanced MOF composites.

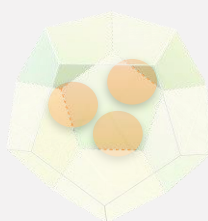


Nanomaterial-enhanced MOF composites

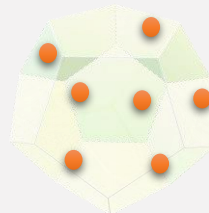
Single-core/shell



Multi-core/shell



Nanomaterial covered MOF



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Estimated progress of the PhD project:

Just started ...

< 50 %

> 50 %

Almost done ☺

Reference

[1] Sergio Navalón, Amarajothi Dhakshinamoorthy, Mercedes Álvaro, Belén Ferrer, and Hermenegildo García. Metal-organic frameworks as photocatalysts for solar-driven overall water splitting. *Chemical Reviews*, 123(1):445–490, 2023. PMID: 36503233

[2] Ma, W.; Yu, L.; Kang, P.; Chu, Z.; Li, Y. Modifications and Applications of Metal-Organic-Framework-Based Materials for Photocatalysis. *Molecules* **2024**, *29*, 5834. <https://doi.org/10.3390/molecules29245834>

[3] Rou Li, Xianfeng Wang, and Ming Chen. Non-noble metal and nonmetallic plasmonic nanomaterials with located surface plasmon resonance effects: Photocatalytic performance and applications. *Catalysts*, 13(6), 2023.