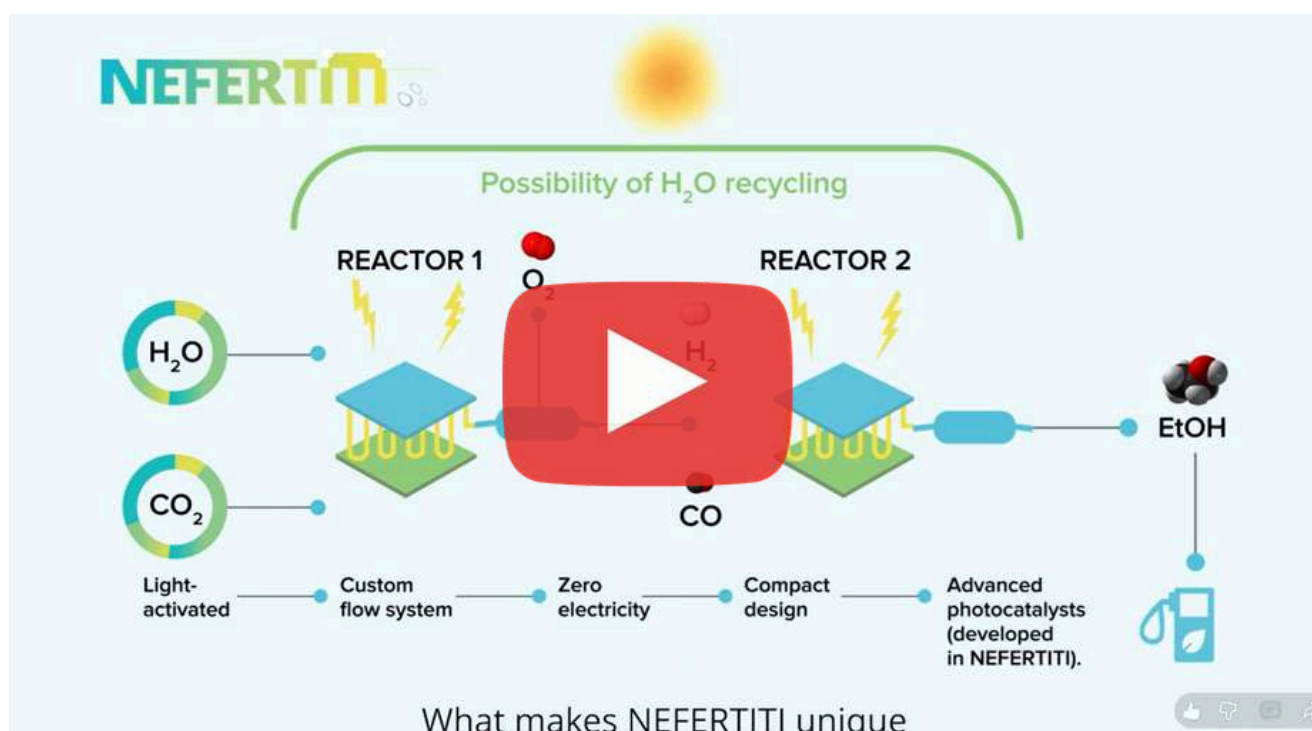




INTRODUCING THE OFFICIAL VIDEO OF THE NEFERTITI PROJECT

The NEFERTITI Project has just released its official video, providing an exciting sight into its groundbreaking work in sustainable energy solutions.

The video effectively communicates the project's vision, objectives and impact, making it a valuable resource for both researchers and the general public interested in the future of renewable energy technologies.



Watch the video here: https://www.youtube.com/watch?v=bfpD_8DUQi4





STRENGTHENING SYNERGIES

NEFERTITI Project was presented at PHOTO2FUEL Final Conference!

On 6 August, the Photo2Fuel Project opened its doors to external researchers and industry representatives for the Photo2Fuel Final Conference.

The programme featured insightful presentations from project partners and invited speakers, covering topics from biohybrid system optimisation to sustainability assessments, and more.



NEFERTITI Project's coordinator -David González Gálvez - presented **"NEFERTITI Project Overview: Innovative photocatalysts integrated in flow photoreactor systems for direct CO₂ and H₂O conversion into solar fuels"**.

The event was a great opportunity to foster connections with sister projects, encouraging knowledge exchange and collaboration across the European carbon utilisation community.





NEFERTITI TECHNOLOGIES

A Glimpse Inside NEFERTITI Reactors

NEFERTITI Partner, **FUNDITEC**, is developing advanced microchannel reactors to improve chemical reactions (PCFR1 – PCFR2).



These reactors allow for efficient catalyst use and better control of reaction conditions, making them ideal for cutting-edge research.

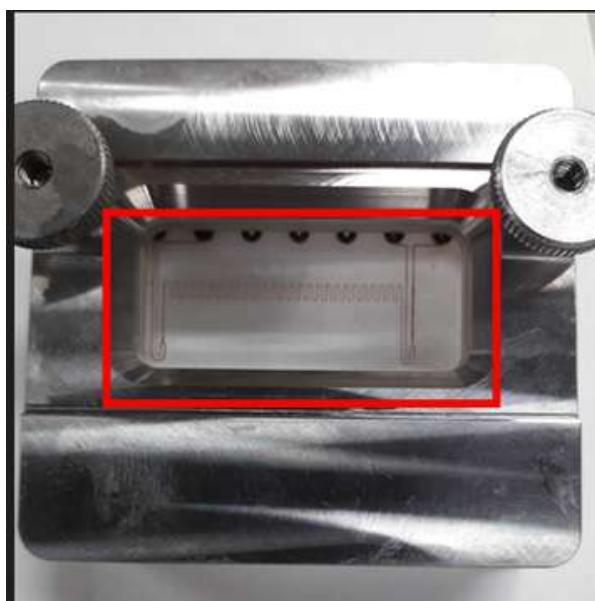
The image above shows an overview of **PCFR1 and PCFR2**, with microchannels carefully heated by an external unit according to **CHEMTRIX** specifications.





NEFERTITI TECHNOLOGIES

A Glimpse Inside NEFERTITI Reactors



Catalytic area(PCFR1).



PCFR1 contains the AuRu@COF catalyst supplied by the University of Galway.

The **catalyst of PCFR1** is attached to the inner walls of the microchannels, giving them a **red-orange color**.



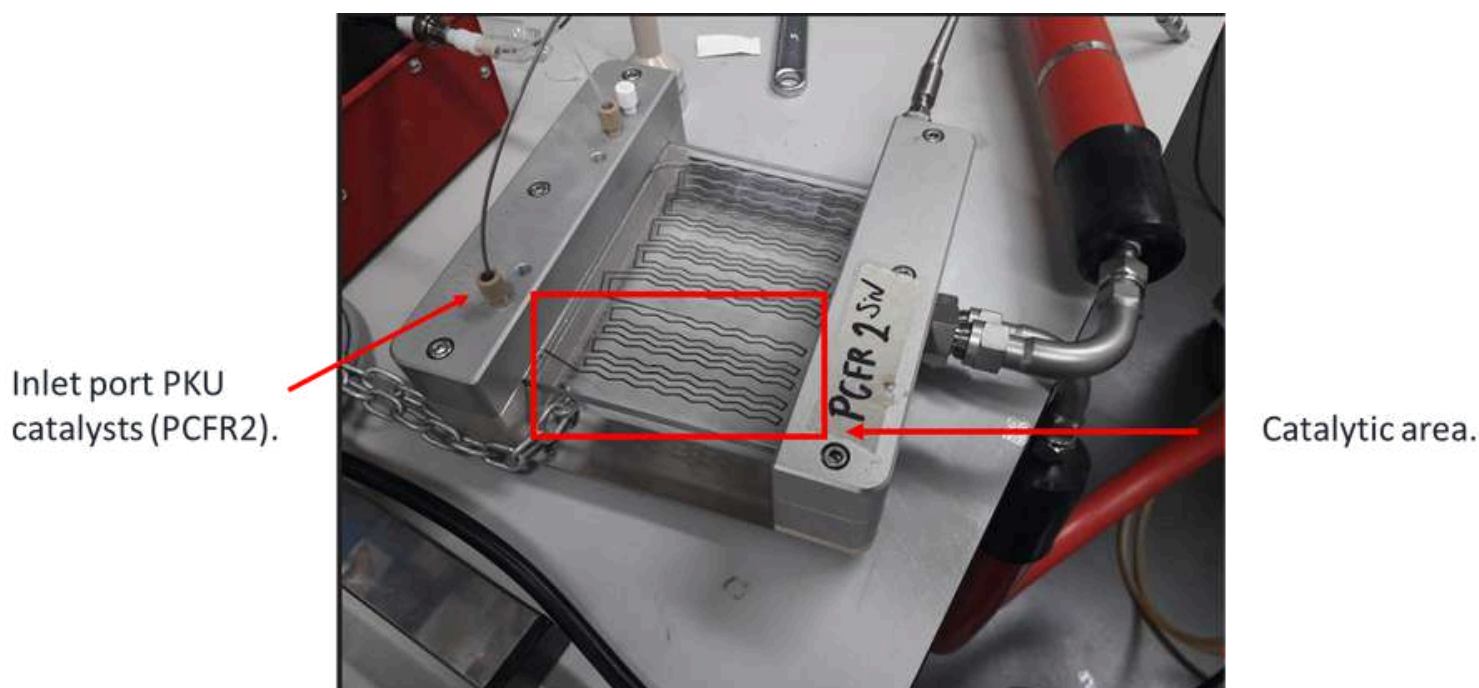


NEFERTITI TECHNOLOGIES

A Glimpse Inside NEFERTITI Reactors

The second reactor, **PCFR2**, features the RhMnLiFe@MWCNTs@POSS catalyst.

This catalyst is developed at Peking University for efficient Fischer-Tropsch reactions.





DISSEMINATION EVENTS

NEFERTITI showcased its innovation at 16th CFRT Continuous Flow Reactor Technology for Industrial Applications



NEFERTITI partner Chemtrix BV participated in the **16th CRFT - Continuous Flow Reactor Technology for Industrial Applications**, held in Prague, Czech Republic, on 24-25 September. The event brought together leading experts and industry professionals to discuss the latest developments in continuous flow reactor technology.

During this event, Chemtrix BV showcased its innovative contributions to the NEFERTITI Project, including the **design and performance of the large-scale NEFERTITI reactor**.

This participation offered a valuable opportunity to share knowledge, foster collaboration, and showcase the project's impact on sustainable flow chemistry





NEW JOURNAL PUBLICATION

"Structural determination of MCOFs: status, challenges and perspectives"

The article, **"Structural determination of MCOFs: status, challenges and perspectives"** has been published at the **"ROYAL SOCIETY OF CHEMISTRY"**, by Chemical Science.

The authors of the article are:

- A. Boran
- R. González-Gómez
- S. Hennessey
- P. Farràs

DOI:

<https://doi.org/10.1039/d5sc03670d>

PARTNER:

University of Galway



Chemical
Science



PERSPECTIVE

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Structural determination of MCOFs: status, challenges and perspectives

A. Boran, R. González-Gómez, S. Hennessey and P. Farràs*

Porous materials have many promising characteristics, including tuneable chemical and optical properties, modifiable porosities and large surface areas. Long-range order frameworks have effective evaluation methods as a result of their crystallinities and in this context, nanoscale analysis, namely single-crystal X-ray diffraction, is a particularly useful approach for optimising the structure-property relationships. Metal-covalent organic frameworks (MCOFs), synthesised by incorporating a metal complex into a stable covalent organic framework (COF) backbone, have shown considerable promise for a variety of applications. Nonetheless, their wide-scale implementation remains hindered due to difficulties in structural mapping them; their typically reduced crystallinities result in major challenges for their structural determination. By classifying MCOFs as metalated COFs (MeCOFs) and metaloligand COFs (MLCOFs), the characterisation of these lower crystallinity frameworks can be carried out according to their distinctive architecture using a combination of complementary structural analysis techniques. This perspective highlights examples of a synergistic approach to the structural elucidation of MCOFs to overcome obstacles related to their crystalline nature, generating an atomic map through a combination of nano and macroscale characterisation procedures supported by theoretical modelling tools. The effective use of structural characterisation methods is considered in this perspective, which can reveal key information regarding the structure-activity relationships as they relate to MLCOFs.

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rsc.li/chemical-science

1. Introduction

Porous materials have garnered considerable interest in recent years due to their attractive properties such as high porosity, large surface area, thermal and chemical stability which make them ideal materials for a wide range of applications, including gas storage, sensing, and catalysis. In this regard, metal-organic frameworks (MOFs) and covalent organic frameworks (COFs), both archetypal porous materials, have been the subject of much attention recently, owing to their tuneable structural features and relatively facile synthesis, making them versatile and multifunctional.^{1–4} Furthermore, their characteristics enable precise control and optimisation of their electronic properties towards more efficient and sustainable processes, including hydrogen evolution, carbon dioxide reduction and photocatalysis.^{5,6}

Despite their unique properties, limitations have reduced their efficiency and hindered their applicability. For instance, MOFs often degrade upon exposure to harsh chemical environments or high temperatures.⁴ Conversely, although COFs feature strong covalent bonds improving the systems' stability, the absence of metal reactive sites demotes their applicability. In terms of light-driven catalysis, MOFs have exhibited

limitations in light absorption, in addition to rapid recombination of photo-generated electron-hole pairs and poor electronic conductivities.⁶ Whereas COFs have shown improved electron transport throughout their networks due to their well-known conjugation system and stacking arrangements, quenching processes have been described owing to non-radiative competing pathways, diminishing their usefulness.⁷ Despite the fact that transition metals have been integrated into porous networks to enhance the materials' catalytic activity, the desired efficiency and stability have not been achieved yet.⁸ Tailored novel frameworks that combine the properties of both MOFs and COFs, complementing each other's shortcomings while retaining their applicability, are highly desired. Metal-covalent organic frameworks (MCOFs) arise as breakthrough versatile porous materials, which incorporate the advantageous properties of MOFs and the structural stability provided by COFs into a unique network.⁹ These materials demonstrate enhanced optical properties compared to their individual counterparts, as well as improved electronic communication, advancing their potential in diverse areas, such as energy storage and catalysis.^{10–12} Nevertheless, alongside MOFs and COFs, their continuous development and multifunctionality are intrinsically related to the understanding of their structure-property relationship.

Different definitions have been given to the MCOFs, making them difficult to explore and evaluate,¹³ recently Dong et al.,

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NEW JOURNAL PUBLICATION

"Solar-powered methanol synthesis from CO₂ hydrogenation with high conversion and selectivity"

The article, **"Solar-powered methanol synthesis from CO₂ hydrogenation with high conversion and selectivity"** has been published at the **"Science China Chemistry"**, by Springer Nature Link.

The authors of the article are:

- Lingzhen Zeng
- Yongfang Sun
- Tingting Wang
- Zeyan Cen
- Maolin Wang
- Oriol Angurell,
- Meng Wang
- Ding Ma

DOI: <https://doi.org/10.1007/s11426-024-2318-8>

PARTNER:

University of Peking – LEITAT

Abstract

Methanol synthesis via CO₂ hydrogenation stands as a pivotal avenue for CO₂ conversion and fixation, garnering extensive investigation. Diverse reactor configurations and energy supplies, alongside a spectrum of catalyst formulations, have been developed to enhance reaction metrics including conversion, selectivity, productivity, and stability. Integrating state-of-the-art Cu-based catalysts from thermal catalysis into a photothermal reactor yielded notable results, achieving an overall CO₂ conversion of 98% and methanol selectivity of 86%. Utilizing the liquid out/gas in concept (LOGIC) reactor, in which only the catalyst bed is irradiated to raise its temperature, facilitated the condensation of products (H₂O and CH₃OH), due to their low vapor pressure. The lower concentration of products in vapor phases ensured the continuous progress of the reaction. The synergistic integration of reactor design and catalyst fabrication could capitalize on the strengths of both components and lead to enhanced performance in methanol synthesis.



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NEFERTITI MOOC IS JUST A CLICK AWAY

If you haven't explored the NEFERTITI MOOC yet, don't miss the chance! Available for free on YouTube and Udemy.

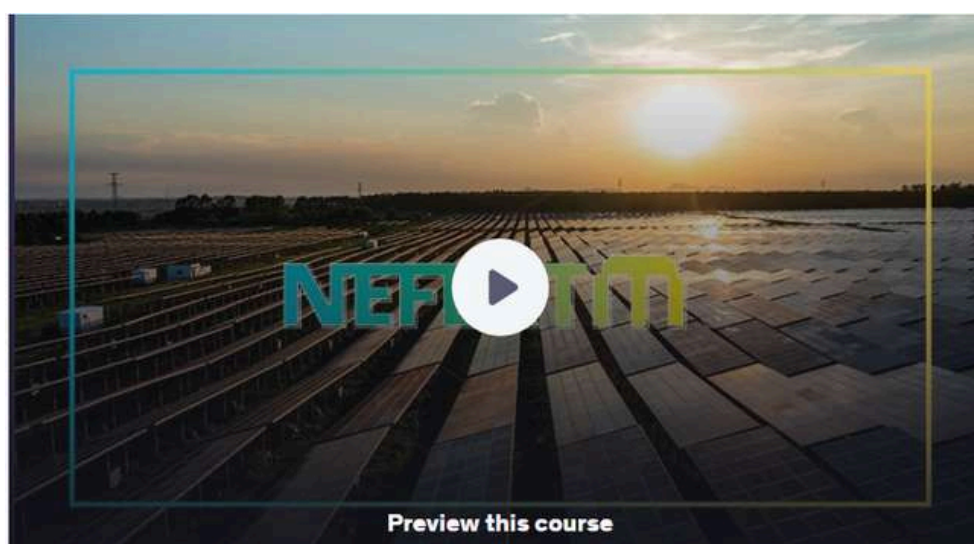
This course is designed to provide a comprehensive overview of the **project's mission**, and deliver **high-quality insights into the innovative approaches and technologies** that are being developed within **NEFERTITI Project**

YouTube playlist:

<https://www.youtube.com/playlist?list=PLc88uGJIRIFUODhS1zCZmgEqQGdglRYgx>

Udemy platform:

<https://www.udemy.com/course/towards-solar-fuels/>





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