

## Photocatalytic Functionalization of Thin-Layer Membranes Using Monomer Truncation Strategy

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Within the realm of materials, there exists a special type of expanded organic structure known as two-dimensional polymers.[1] These polymers are typically ordered structures that extend in two orthogonal directions. They have emerged due to the widespread availability of building blocks suitable for their construction,[2] and the wide variety of areas in which these materials can be used. [3,4]

These extended organic materials can be synthesized as thin films using a bottom-up strategies (the most used is the liquid/liquid interface) which is an advantage comparing with the traditional method applied for the synthesis of other materials.[5]

On the other hand, in a previous work, our research group has described an interesting strategy for incorporating photocatalysts into COF-like structures. This approach, termed the monomer truncation strategy, allows the randomly functionalization along the COF backbone with the goal of introducing catalytically active molecular fragments.[6]

With this in mind, herein we describe the synthesis of two novel organic polymer films. These films were created using a liquid-liquid interfacial polymerization strategy involving amine and acid chloride monomers. One film was further modified during its formation by incorporating a modified *N*-phenyl-phenothiazine unit through a strategic truncation. The materials obtained were fully characterized both structurally (FTIR Spectroscopy, SS-NMR, XRD, SEM-EDX, XPS) and optoelectronically (UV-Vis DRS), confirming the formation of the expected structure and the incorporation of photoactive unit.

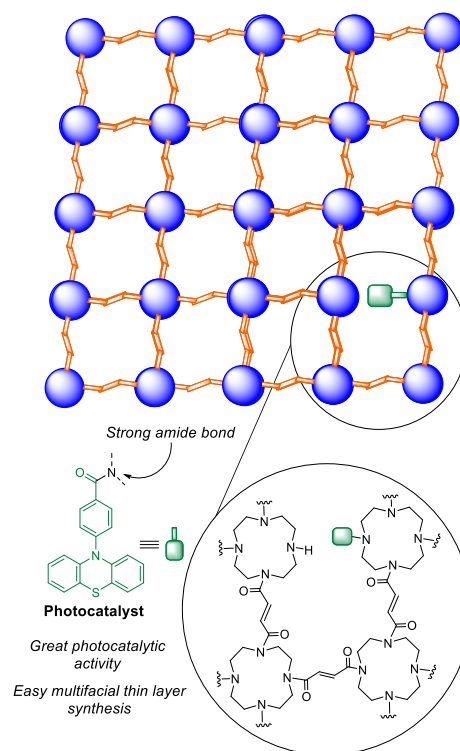
Finally, the film that present the photocatalytic unit was used to achieve the oxidation of various sulfides to their corresponding sulfoxides and the reduction

of aryl bromides in good yields and conversions, respectively.[7]

## References

- [1] H. R. Abuzeid, A. F. M. El-Mahdy and S. -W. Kuo. Covalent organic frameworks: Design principles, synthetic strategies, and diverse applications. *Giant*, **2021**, 6, 100054.
- [2] Z. Zhuang, H. Shi, J. Kang and D. Liu, *Mater. Today Chem.*, **2021**, 22, 100573.
- [3] H.-L. Qian, C.-X. Yang, X.-P. Yan. Bottom-up synthesis of chiral covalent organic frameworks and their bound capillaries for chiral separation. *Nat. Commun.*, **2016**, 7, 12104.
- [4] P. Pachfule, A. Achariya, J. Roeser, T. Langenhahn, M. Schwarze, R. Schomäcker, A. Thomas, J. Schmidt. Diacetylene functionalized covalent organic framework (COF) for photocatalytic hydrogen generation. *J. Am. Chem. Soc.*, **2018**, 140, 1423–1427.
- [5] T. Zhang, Y. Zhao. Interfacial Synthesis of 2D COF Thin Films, in *Covalent Organic Frameworks*. IntechOpen, **2022**.
- [6] A. López-Magano, A. E. Platero-Prats, S. Cabrera, R. Mas-Ballesté, J. Alemán. Incorporation of photocatalytic Pt(II) complexes into imine-based layered covalent organic frameworks (COFs) through monomer truncation strategy. *Appl. Catal. B Environ.*, **2020**, 272, 119027.
- [7] J. Vega, V. Marcos, J. Álvarez, M.J. Capitán, A. Fraile, J. Alemán. Photocatalytic Functionalization of Thin-Layer Membranes Using Monomer Truncation Strategy. *Nanoscale Adv.*, **2024**, Submitted article.

## Figures



**Figure 1.** Scheme of the thin-layer-multifacial synthesis with incorporation of photocatalyst through monomer truncation.