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Research Scholarship for Overseas Students

Developments of Covalent Organic Frameworks and Their Photocatalytic Applications

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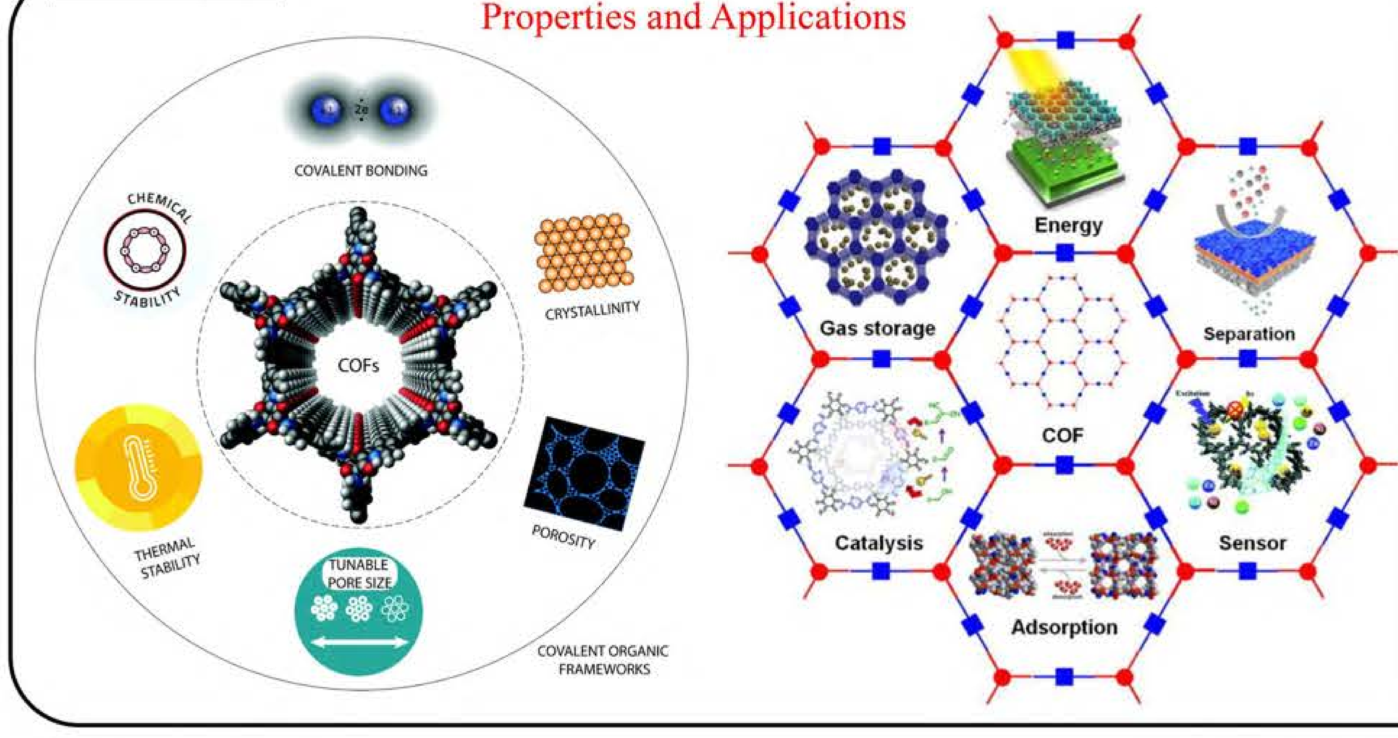
Abstract

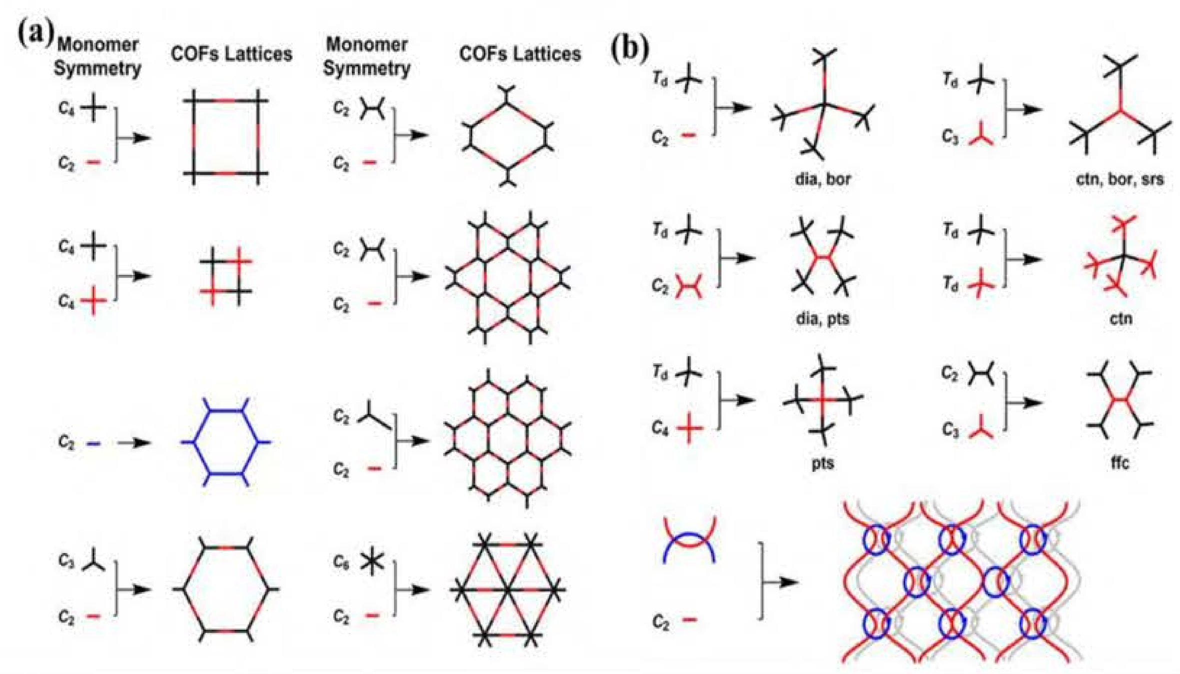
The strategic objective of crystal engineering involves creating crystalline materials with predictable structures and desirable properties. Covalent organic frameworks (COFs) belong to a category of crystalline porous substances formed by polymerizing organic building blocks. These frameworks possess a structured arrangement due to the size, symmetry, and connectivity of their linkers, granting precise control over the spatial positioning of constituents in two and three dimensions. This unique control leads to the synthesis of highly ordered structures and enables fine adjustments to their chemical and physical characteristics. COFs offer significant potential across various domains, including gas storage, separation, adsorption, and catalysis, owing to their substantial surface area, robust stability, customizable structures, and active binding sites. Their regularity and interconnectivity of organic units render them promising contenders for applications dependent on charge transfer, such as catalysis. Additionally, COFs' distinctive attributes make them well-suited adsorbents for eliminating contaminants, as they can be tailored with specific skeletons or functional groups to effectively capture target pollutants. As a result, multiple methods for processing COFs linked by imine, amine, and benzoin bonds have been devised, particularly for applications involving solar energy generation. The effect of solvent polarity on COF crystallization and photocatalytic performance for hydrogen evolution under visible light irradiation were investigated.

Introduction

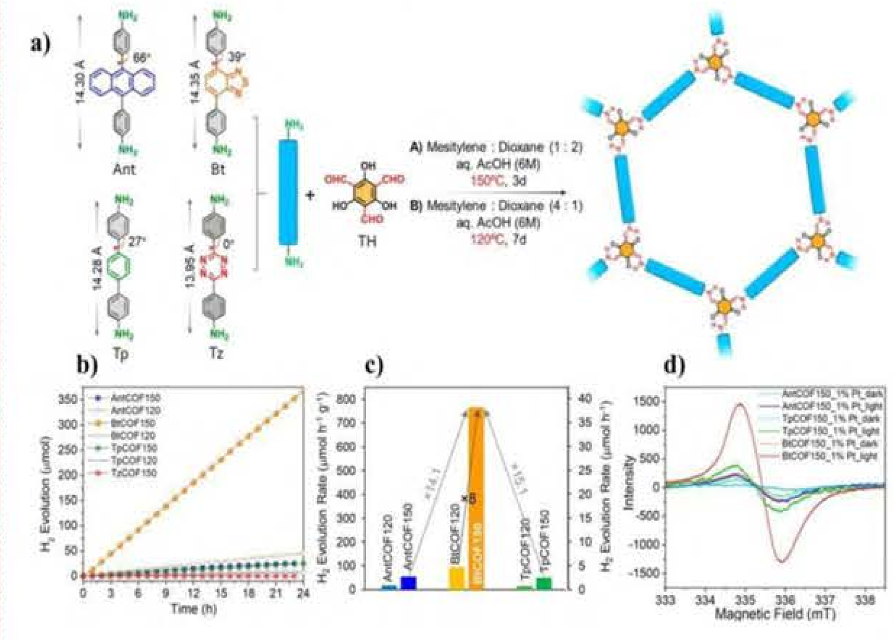
Properties and Applications



Topology



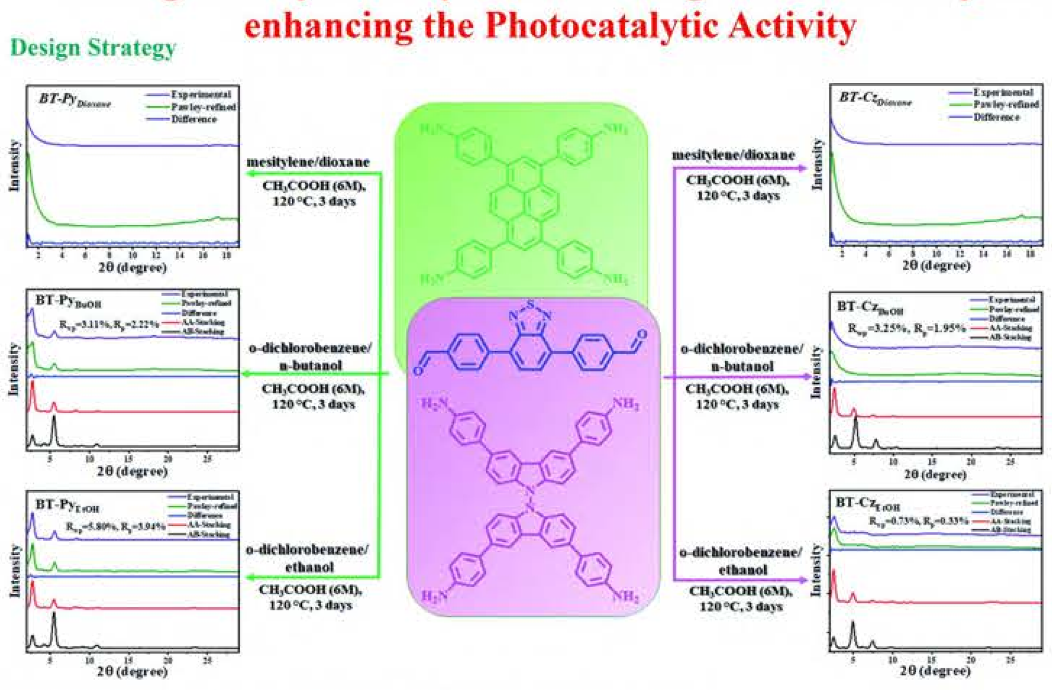
Photocatalytic hydrogen production with D-A system



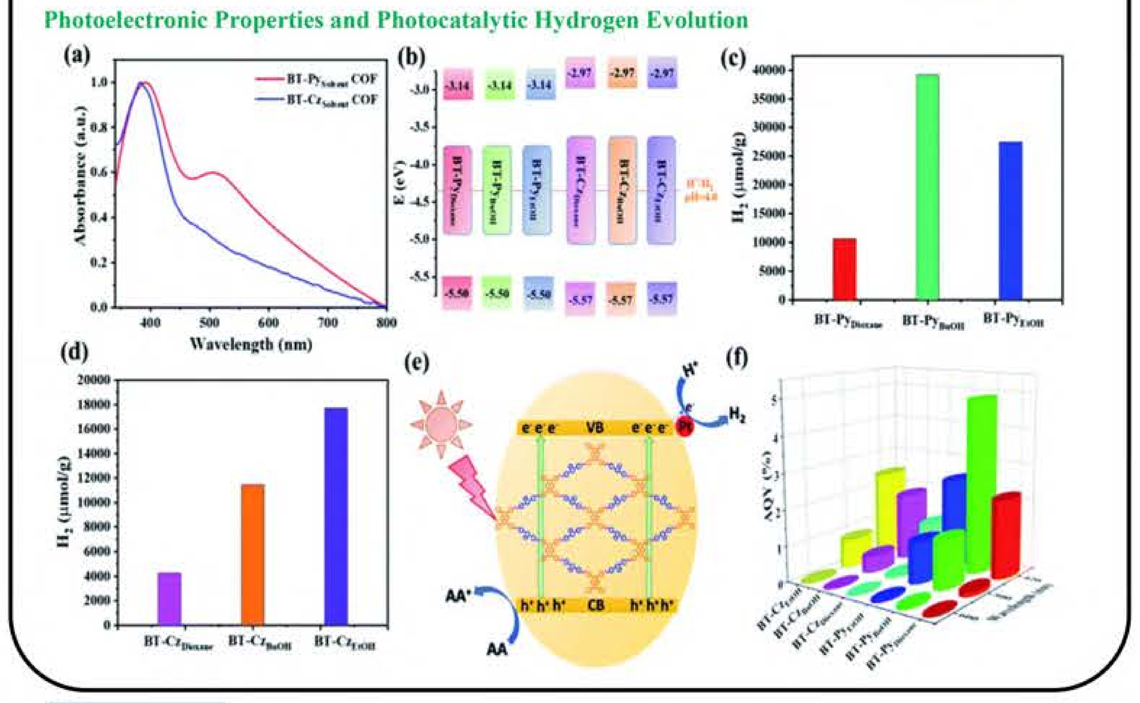
Research Focus

Tuning the Crystallinity of COFs using Solvent Polarity for enhancing the Photocatalytic Activity

Design Strategy



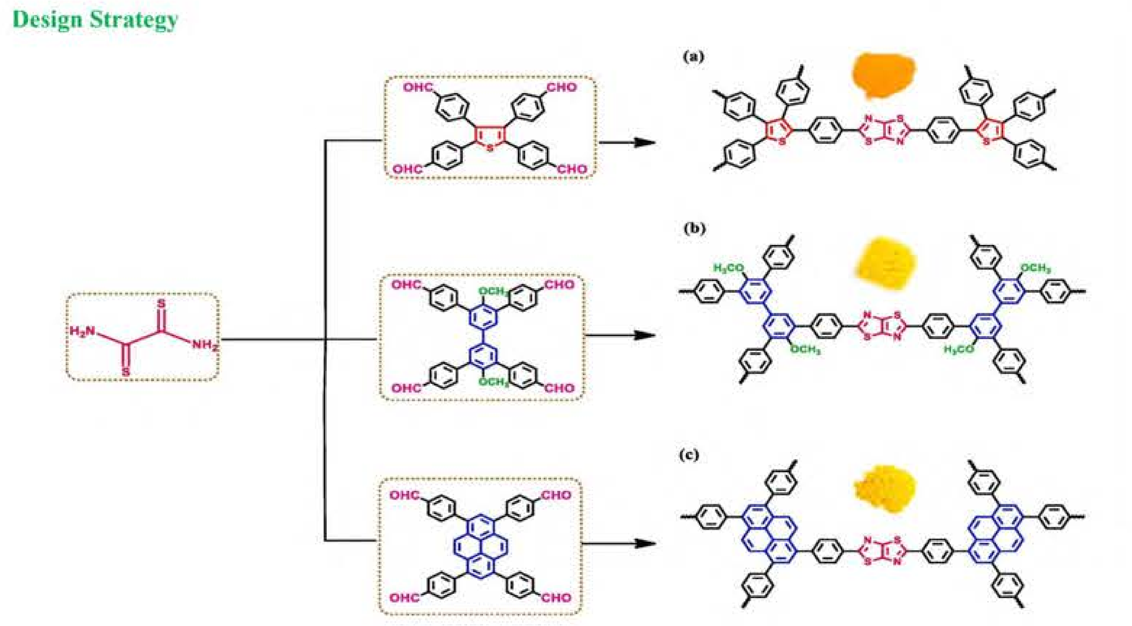
Photoelectronic Properties and Photocatalytic Hydrogen Evolution



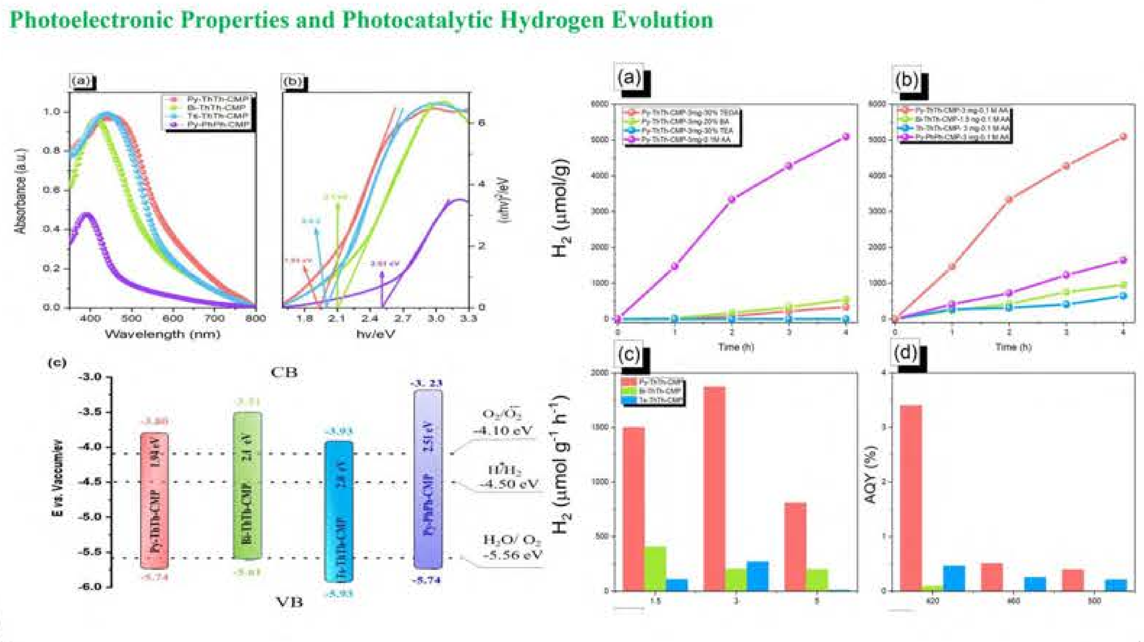
Research Focus

Thiazolo[5,4-d]thiazole moieties Increase the Photocatalytic Activity

Design Strategy



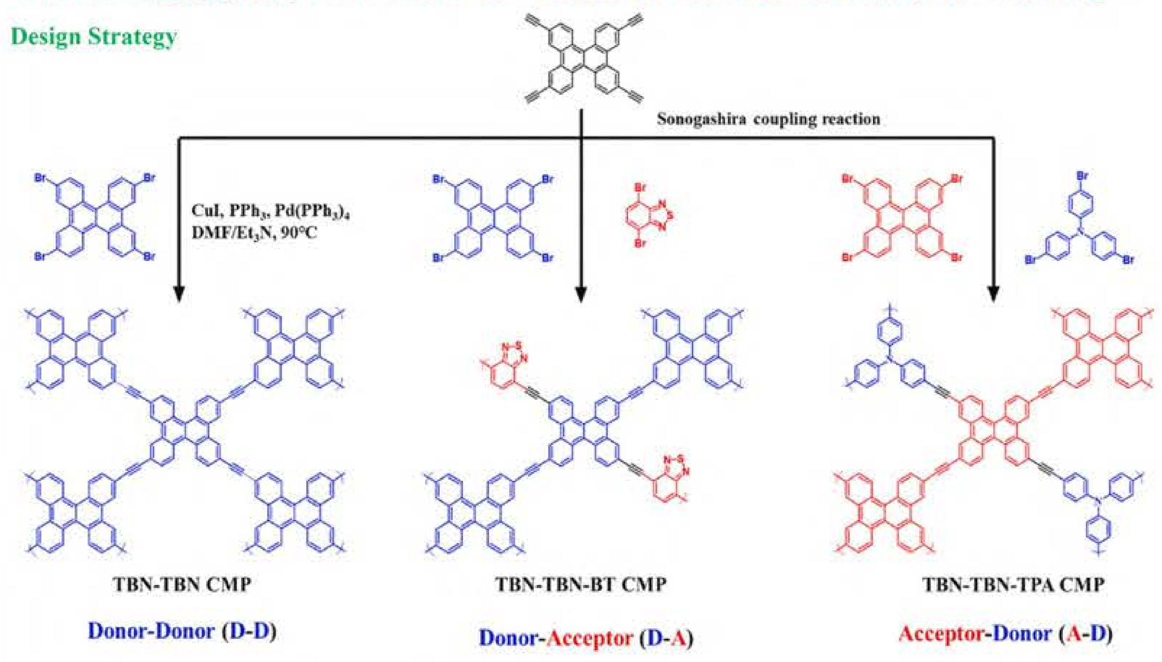
Photoelectronic Properties and Photocatalytic Hydrogen Evolution



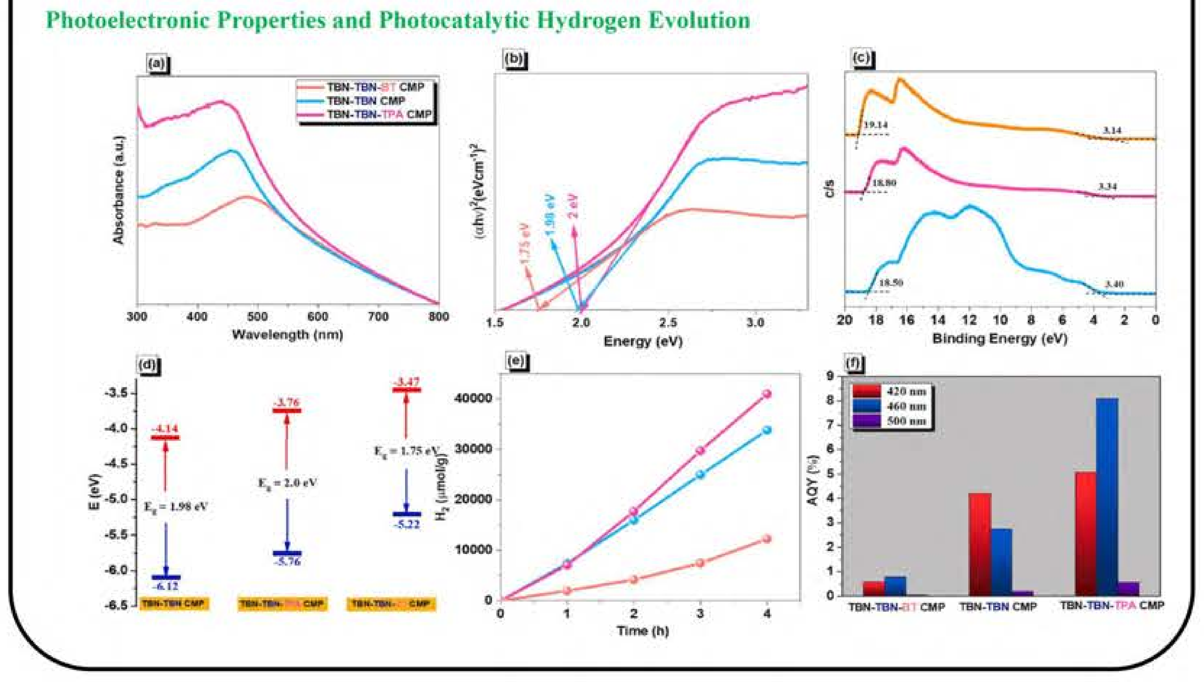
Research Focus

Dibenzo[g,p]chrysene moieties enhance the Photocatalytic Activity

Design Strategy



Photoelectronic Properties and Photocatalytic Hydrogen Evolution



Conclusion

In conclusion, Covalent Organic Frameworks (COFs) emerge as highly promising materials with significant potential across diverse domains, including gas storage, separation, adsorption, and catalysis. Their appeal lies in their substantial surface area, robust stability, customizable structures, and active binding sites. The regularity and interconnectivity of organic units within COFs position them as strong contenders for applications reliant on charge transfer, such as photocatalytic reactions. As a result, various methods for processing COFs, linked by imine, amine, and benzoin bonds, have been devised, particularly in the realm of applications involving solar energy generation. The effect of solvent polarity on COF crystallization and photocatalytic performance for hydrogen evolution under visible light irradiation were investigated. The new integration of Thiazolo[5,4-d]thiazole and Dibenzo[g,p]chrysene moieties enhances photocatalytic hydrogen production.

Acknowledgment

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Selected Publication

1- Islam M. A. Mekhemer, et al, Chem.Eng. J. 137158 (2022). (IF = 16.744)
2- Islam M. A. Mekhemer, et al, Coordination Chemistry Reviews, 2023, 483: 215066. (IF= 24.833)
3- Islam M. A. Mekhemer, et al, Macromolecules, 2022, 56.4: 1352-1361. (IF = 6.057)
4- Islam M. A. Mekhemer, et al, Journal of Materials Chemistry A, 2022, 10.23: 12378-12390. (IF= 14.511)
5- Islam M. A. Mekhemer, et al, Materials Today Chemistry, 2023, 33: 101680. (IF=7.613)

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