

Conjugated Polymers for Visible-Light-Driven Photocatalytic CO₂ Conversion

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The photochemical conversion of CO₂ into high-value products has attracted significant research interest in recent years. However, the development of artificial photocatalysts with superior catalytic activity and long-term stability remains a major challenge. In this study, we present a series of naphthalene diimide (NDI)-based conjugated polymers (CPs), namely PNDI-T, PNDI-TT, PNDI-2T, and PNDI-2TF. These polymers are synthesized through the copolymerization of NDI with thiophene (T), thieno-thiophene (TT), bithiophene (2T), and bifluorothiophene (2TF), respectively.

Remarkably, these CPs exhibit excellent catalytic performance in the photochemical reduction of CO₂, efficiently producing CO and CH₄ as the main products without requiring metal-based co-catalysts. The solution processability of these linear polymers enables their incorporation into porous substrates, such as molecular sieves and Ni foam, which enhance the reaction interface. Among the studied systems, the PNDI-2TF@Ni foam catalyst in an H₂O/triethylamine environment achieved the highest CO yield of 400.7 μmol·gcat⁻¹ over a 14 hour reaction period. In contrast, PNDI-T@Ni foam demonstrated the highest CH₄ yield of 125.3 μmol·gcat⁻¹, outperforming the other CP-based catalyst systems.

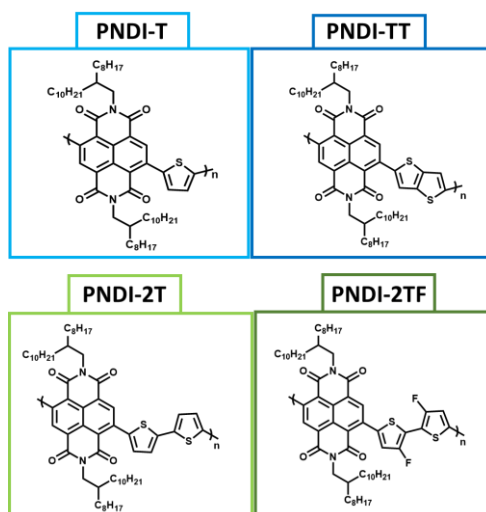


Fig.1 The conjugated polymer catalysts: PNDI-T, PNDI-TT, PNDI-2T, and PNDI-2TF.

References

- 1) S.-H. Wang, F. Khurshid, P.-Z. Chen, Y.-R. Lai, C.-W. Cai, P.-W. Chung, M. Hayashi, R.-J. Jeng, S.-P. Rwei, and L. Wang, *Chem. Mater.* **2022**, *34*, 4955.