Construction of bimetallic metal-organic frameworks/ graphitic carbon nitride hybrids as flame retardant for unsaturated polyester resin

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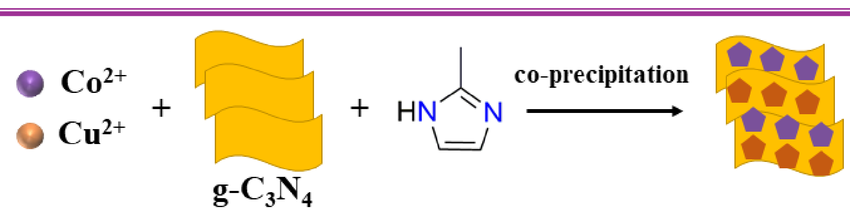
1、Introduction

- **Unsaturated polyester resin (UPR)** is commonly utilized in the **aerospace, automotive, and marine industries** as high-performance components [1]. However, the **high flammability** of UPR restricts its use in these locations.
- **Metal-organic frameworks (MOFs)** are utilized to construct composite materials and improve the fire resistance of polymers as a result of their **minimal addition of FRs, good thermal stability, and catalytic characteristics** [2].
- As a **two-dimensional layered structure**, **g-C_3N_4** can effectively exert a physical barrier effect to **reduce the composites' thermal degradation rate** and **increase the quantity of char layer**.

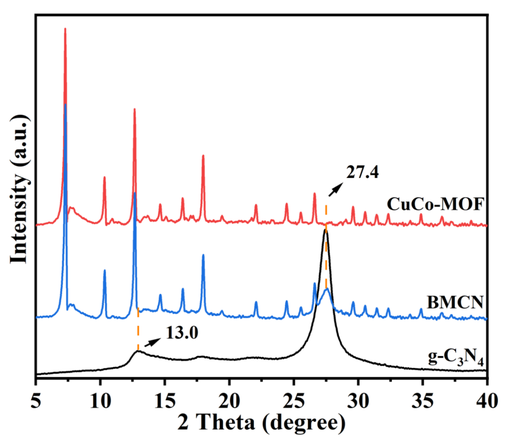
2、Methods

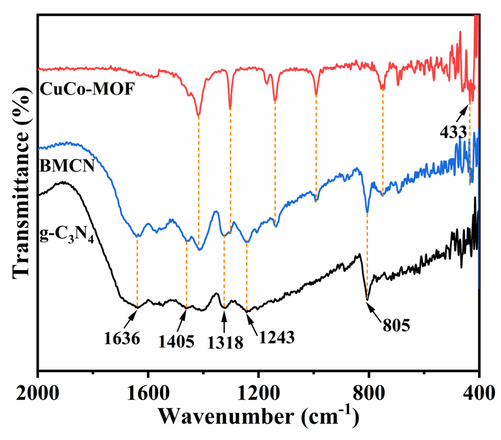


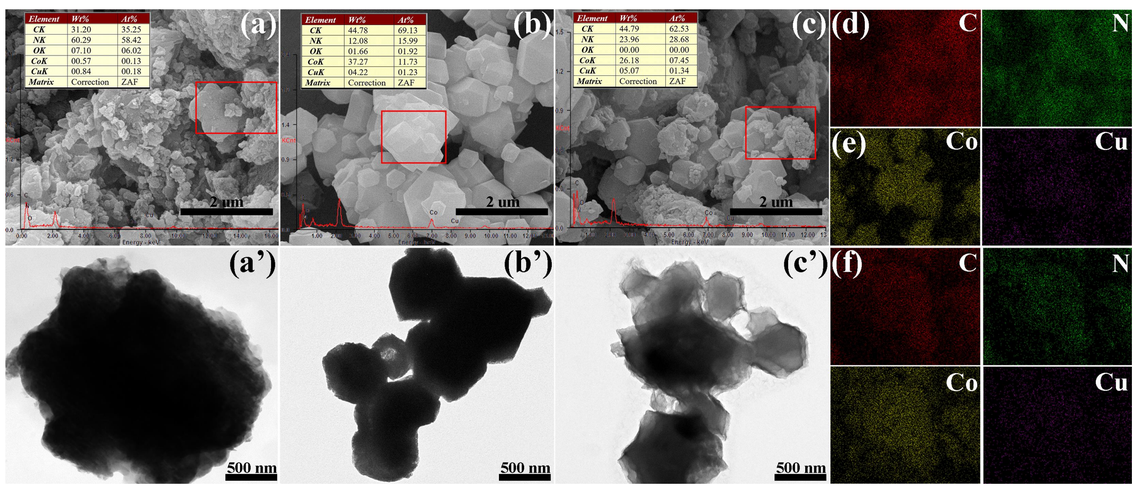
- **Structure:** Fourier transform infrared (FTIR) spectroscopy and X-ray diffraction (XRD) spectra.
- **Morphology:** Transmission electron microscopy (TEM) and Scanning electron microscopy (SEM).
- **Flame retardancy:** Conical calorimeter test (CCT).

3、Results and discussion

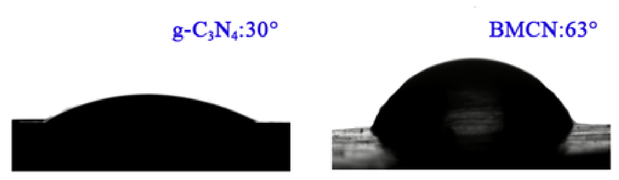
1、Structure of BMCN

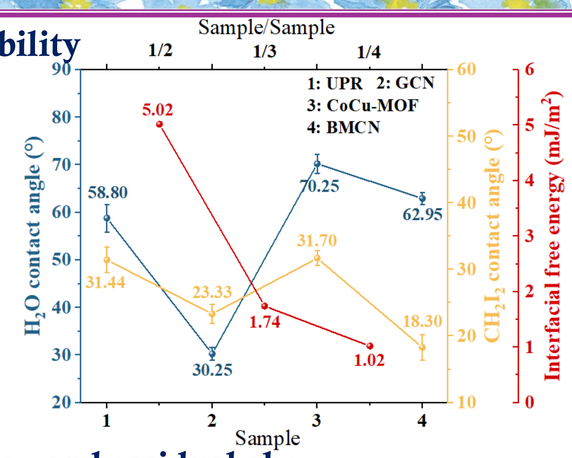




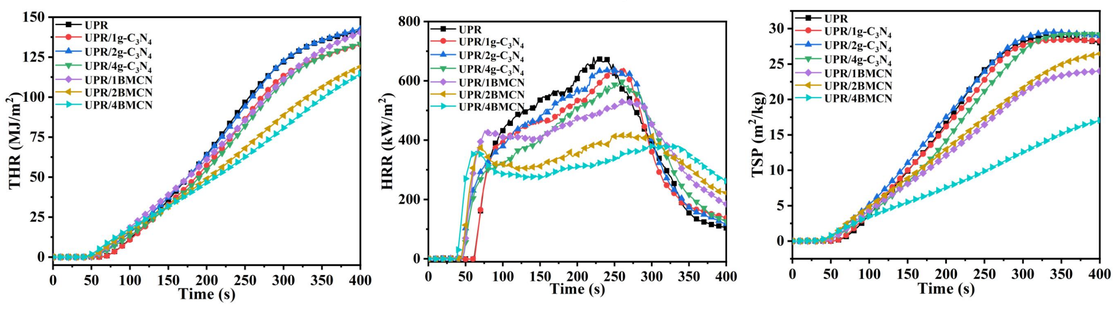


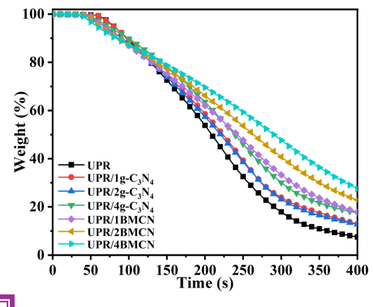
2、Compatibility

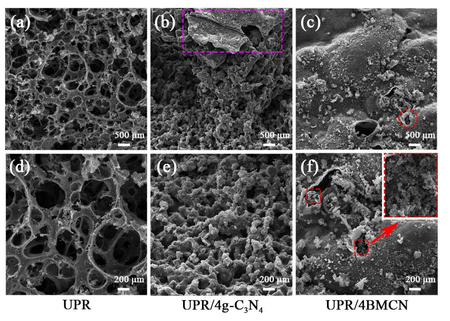




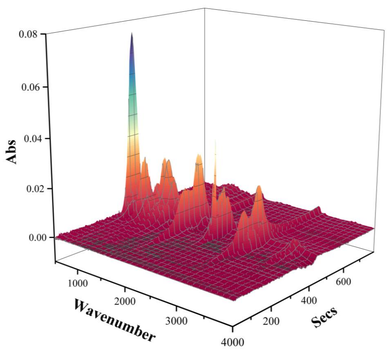
3、Flame retardancy and residual char

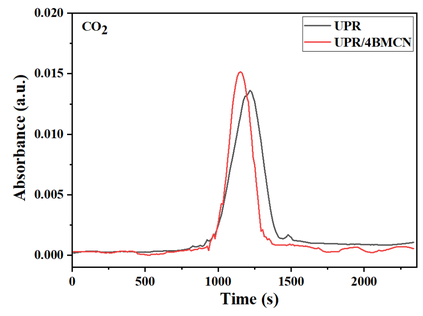


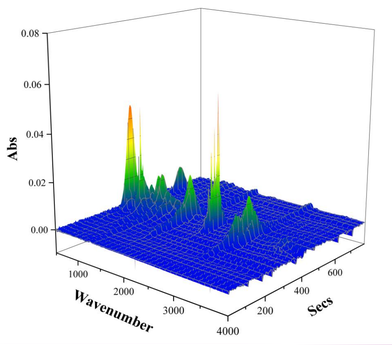


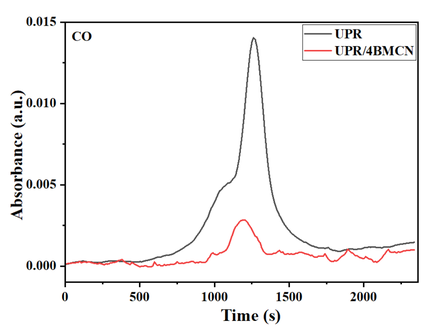


4、Gaseous and condensed product

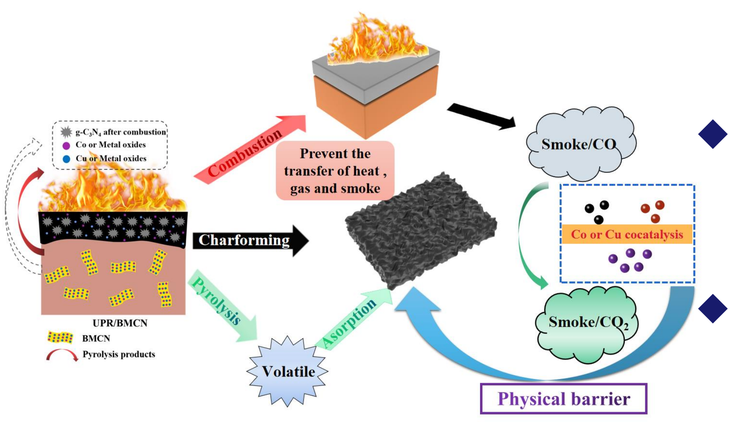








4、Conclusion



- Only 4 wt% of BMCN was added, the pSPR, pHRR, TSP and pCOP were reduced by 50.0%, 43.4%, 32.5% and 79.6%, respectively.
- The thermal barrier effect of the dense char layer and the catalytic impact of the metal oxides prevented the release of harmful gases.
- This work contributes to the development of bimetallic organic frameworks/g-C_3N_4 hybrid composites by proposing suggestions to overcome the inadequacies of MOFs and g-C_3N_4 in the field of flame retardancy and to enhance the fire safety of UPR.

5、Acknowledgements

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6、Referances

[1] F. Chu, S. Qiu, S. Zhang, Z. Xu, Y. Zhou, X. Luo, X. Jiang, L. Song, W. Hu, Y. Hu, Exploration on structural rules of highly efficient flame retardant unsaturated polyester resins, J. COLLOID. INTERF. SCI., 608 (2022), pp. 142-157.

[2] N. Al Amery, H.R. Abid, S. Al-Saadi, S. Wang, S. Liu, Facile directions for synthesis, modification and activation of MOFs, MATER. TODAY. CHEM., 17 (2020), p. 100343.