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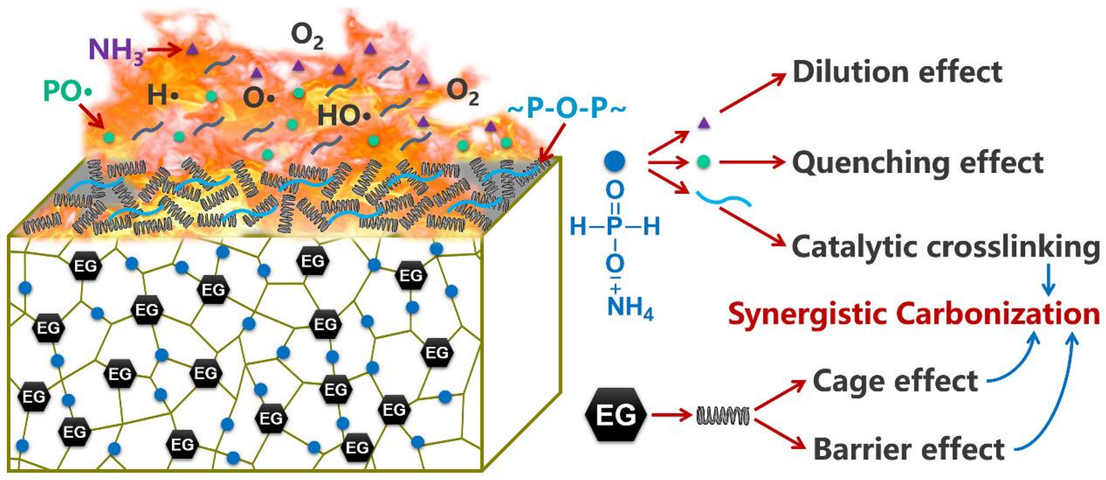
Carbonization-dominated synergistic behaviors of ammonium hypophosphite/EG composite in improving fire safety of flexible polyurethane foam

Baoan Xi[1,2,3],Yong Qiu[1,2,3,*], Lijun Qian[1,2,3,*], Anqi Liu[1,2,3], Lun-Bagen Gao[1,2,3]

1. Beijing Technology and Business University, Beijing 100048; 2. China Light Industry Engineering Technology Research Center of Advanced Flame Retardants, Beijing 100048; 3. Petroleum and Chemical Industry Engineering Laboratory of Non-halogen Flame Retardants for Polymers, Beijing 100048.

* Corresponding author email：yongqiu@btbu.edu.cn (Yong Qiu); qianlj@th.btbu.edu.cn (LiJun Qian)

Highlight：Synergy between NHP and EG significantly improves the anti-ignition and self-extinguishing performance of FPUF, via a carbonization-dominated comprehensive combustion inhibition mechanism.



Synergy of NHP and EG effectively endowed FPUF with extremely high LOI value and significantly reduced t_e, L_d, and v. 11NHP/7EG achieved a terrific LOI value of 30.3%, and passed the HF-1 level.

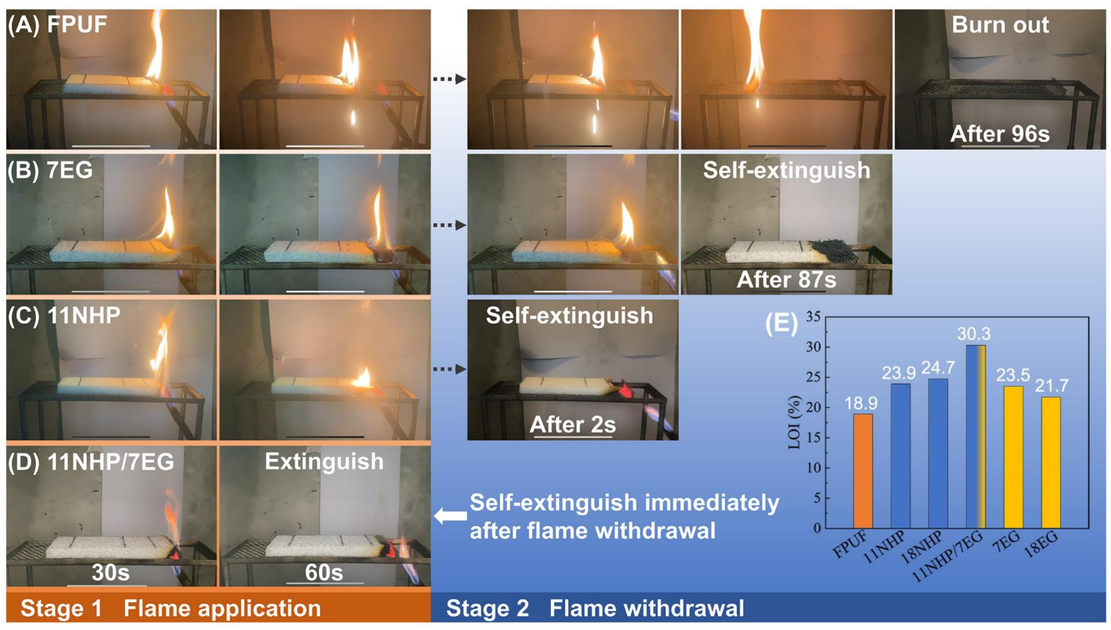


Fig.1 Limited oxygen index and horizontal burning tests.

NHP induced FPUF matrix to decompose in advance, releasing massive inert gas with dilution effect. Subsequently, caging effect from EG and charring enhancement implemented by NHP play a leading role, resulting in less volatile release, including toxic gas.

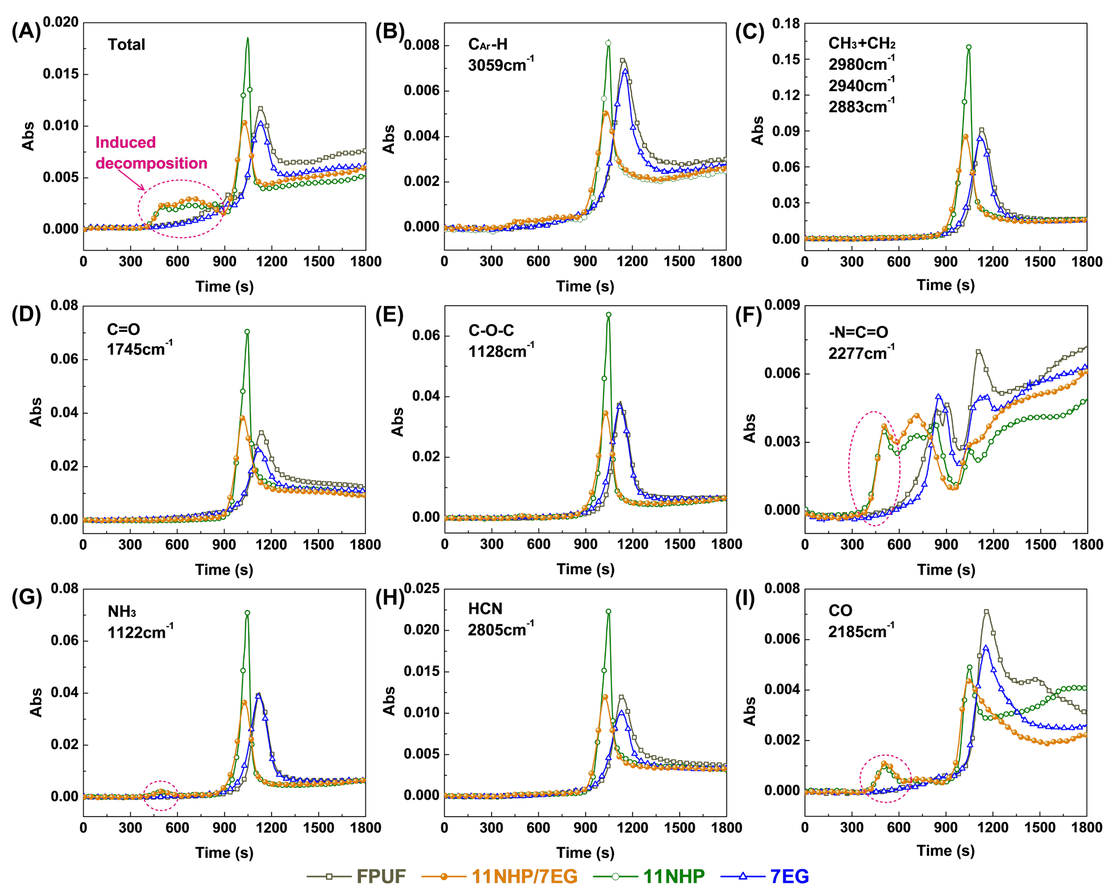


Fig.2 Real-time tracing curves of thermal-decomposition volatiles.

NHP/EG system significantly reduced the peak combustion intensity, mainly by promoting matrix carbonization to convert combustible components into charring residue as much as possible.

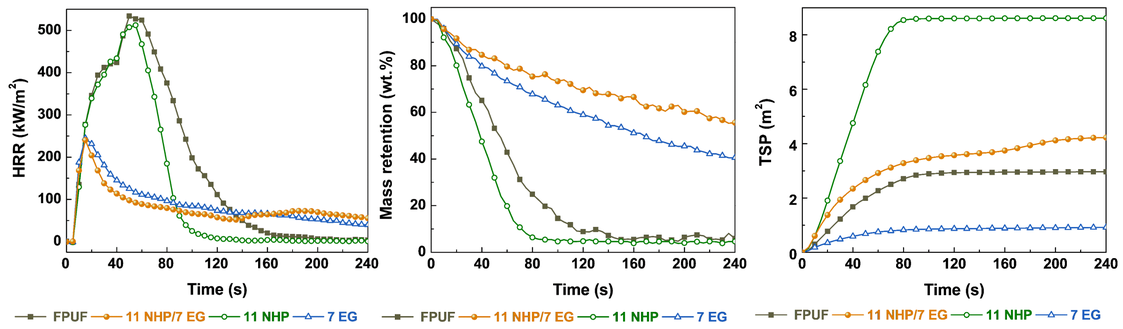


Fig.3 Heat release rate, mass loss, and total smoke production curves.

Expanded graphite with complex grooves provides the necessary structural basis for caging matrix fragments. Residual phosphorus oxides (FTIR: P=O, P-O-P, P-O-C) conducive to further promote carbonization and improve charring layer quality.

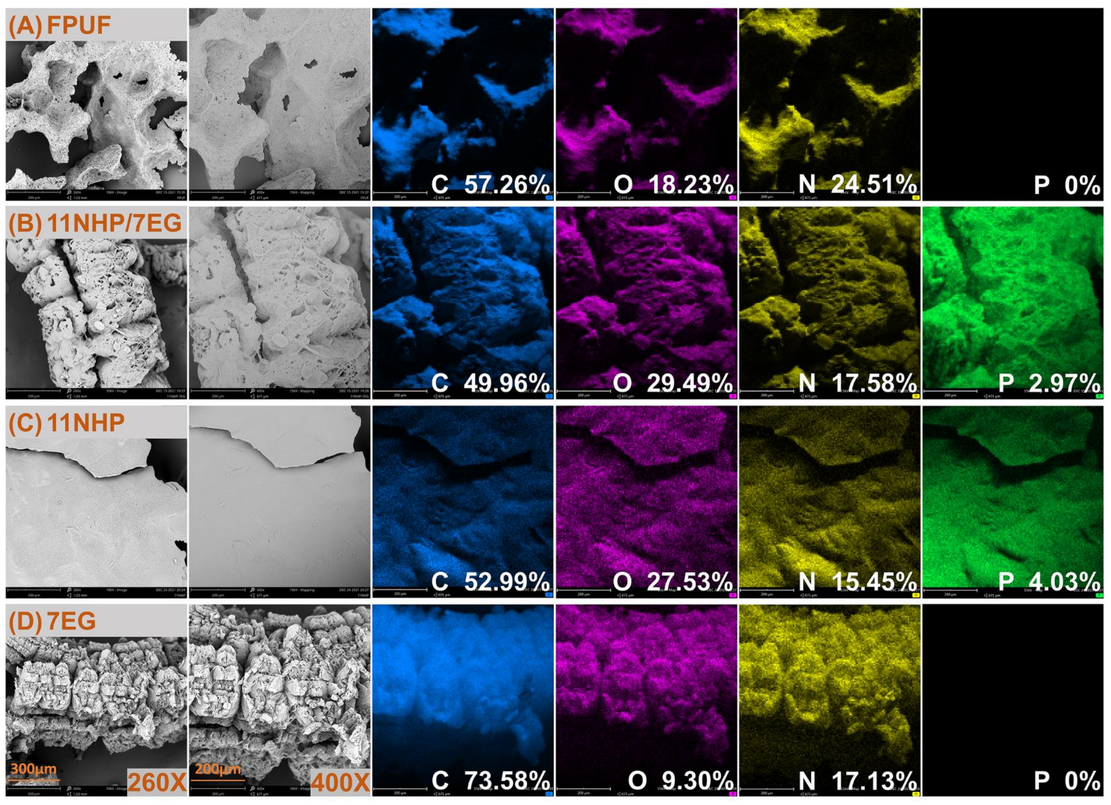


Fig.4 Micromorphology and element retention of charring residue.

NHP/EG system conduct carbonization-dominated bi-phase synergistic flame retardant effect to suppress the flammability and combustion behavior of FPUF, which provides an effective method for high-performance flame retardant FPUF manufacturing.

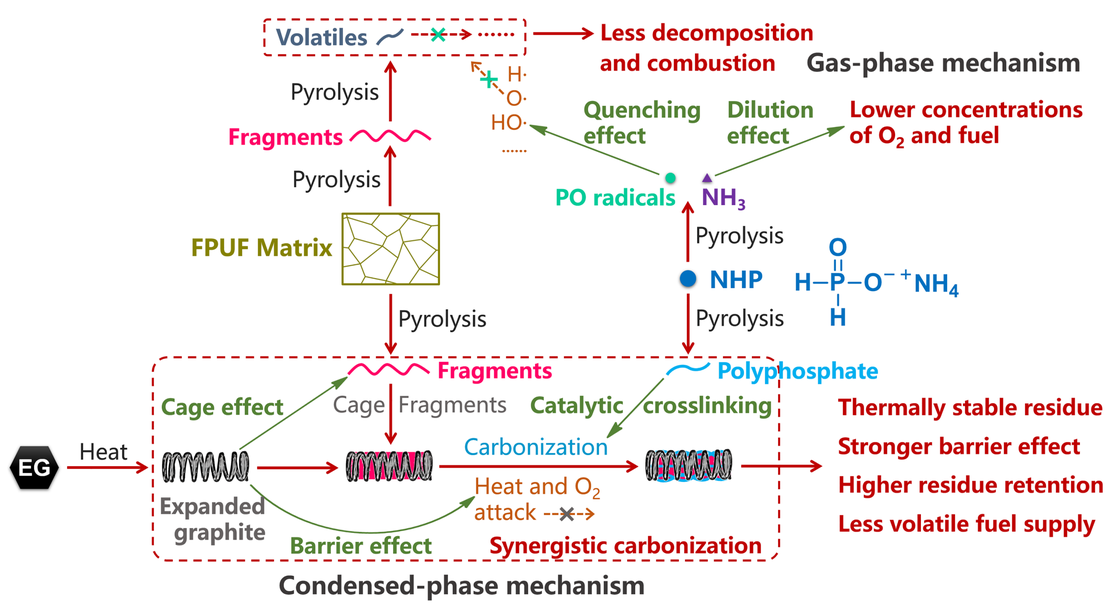


Fig.5 Flame-retardant mechanism of NHP/EG composite.

Acknowledgments

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