

Promotion of charring and improving flame-retardant properties of PC by controlling the substituent group on the side chain of imine-functionalized polysiloxane

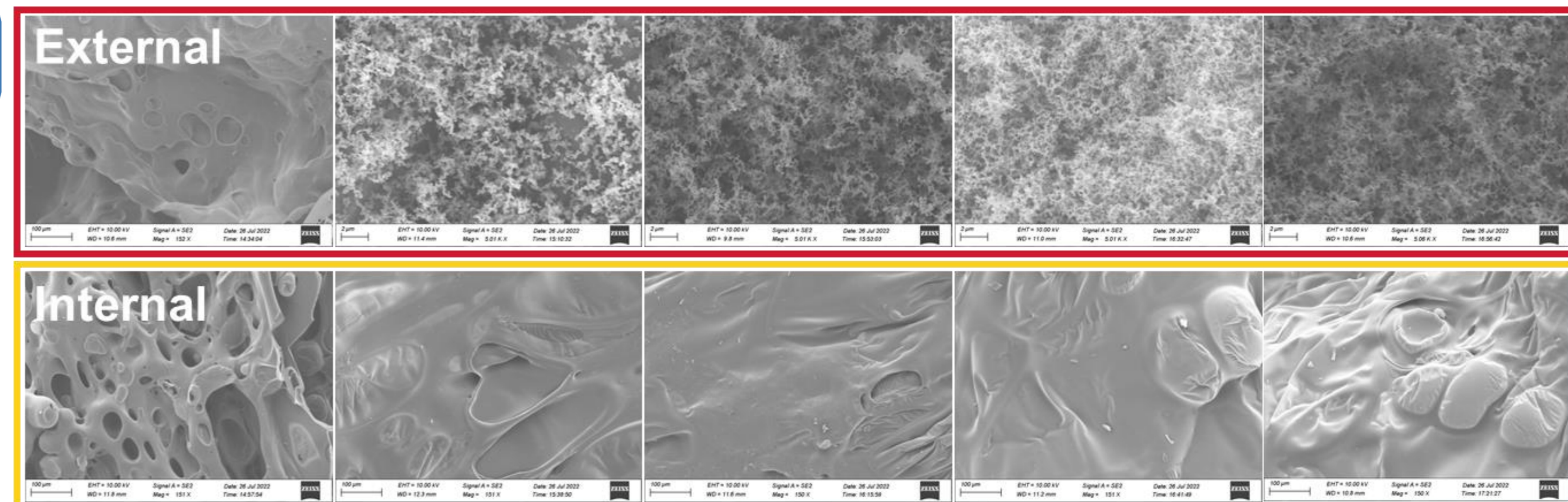
Yue Zhu, Senhao Lei, Ronghua Yu, Jie Liu *, Tao Tang*

Key Laboratory of Polymer Physics and Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun 130022, China

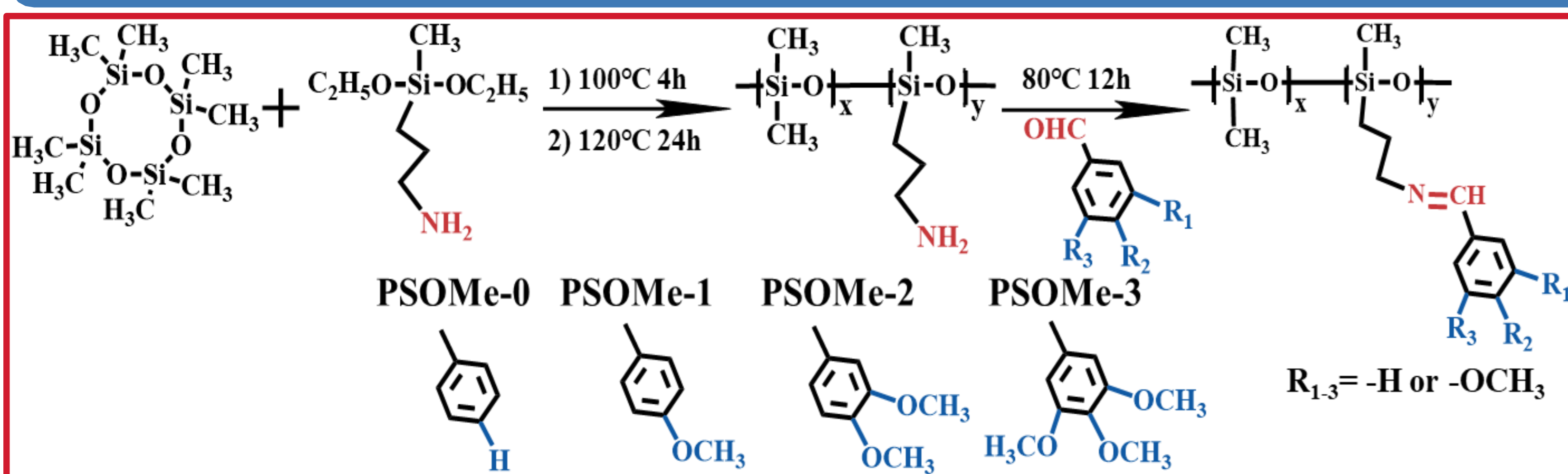
E-mail: ttang@ciac.ac.cn; liujie@ciac.ac.cn

Background

Based on the charring characteristics of polycarbonate (PC), fire safety performance of PC can be improved by combining the regulation of the char layer structure and the promotion of charring. Therefore, the polysiloxane named PSOMe-X, which modulated the charring behavior of PC and contained groups to capture phenolic degradation products, was designed.

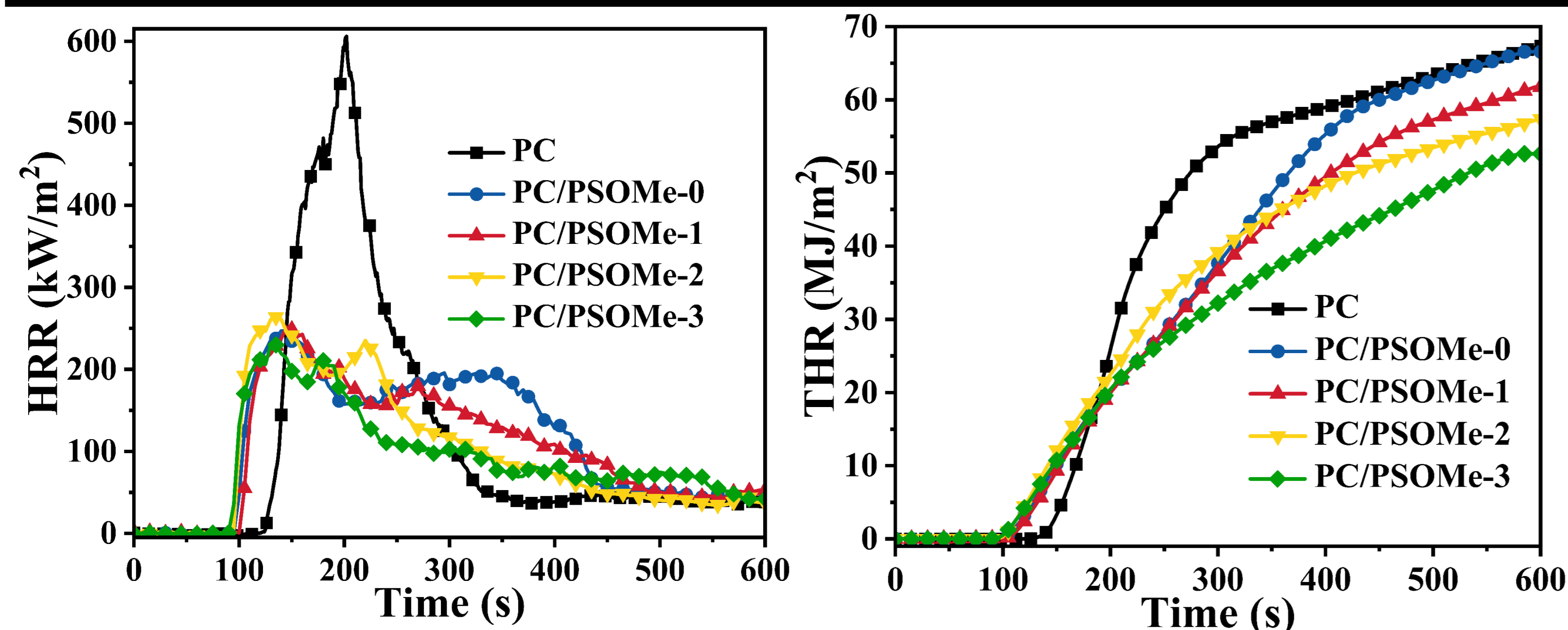


Synthesis route for PSOMe-X



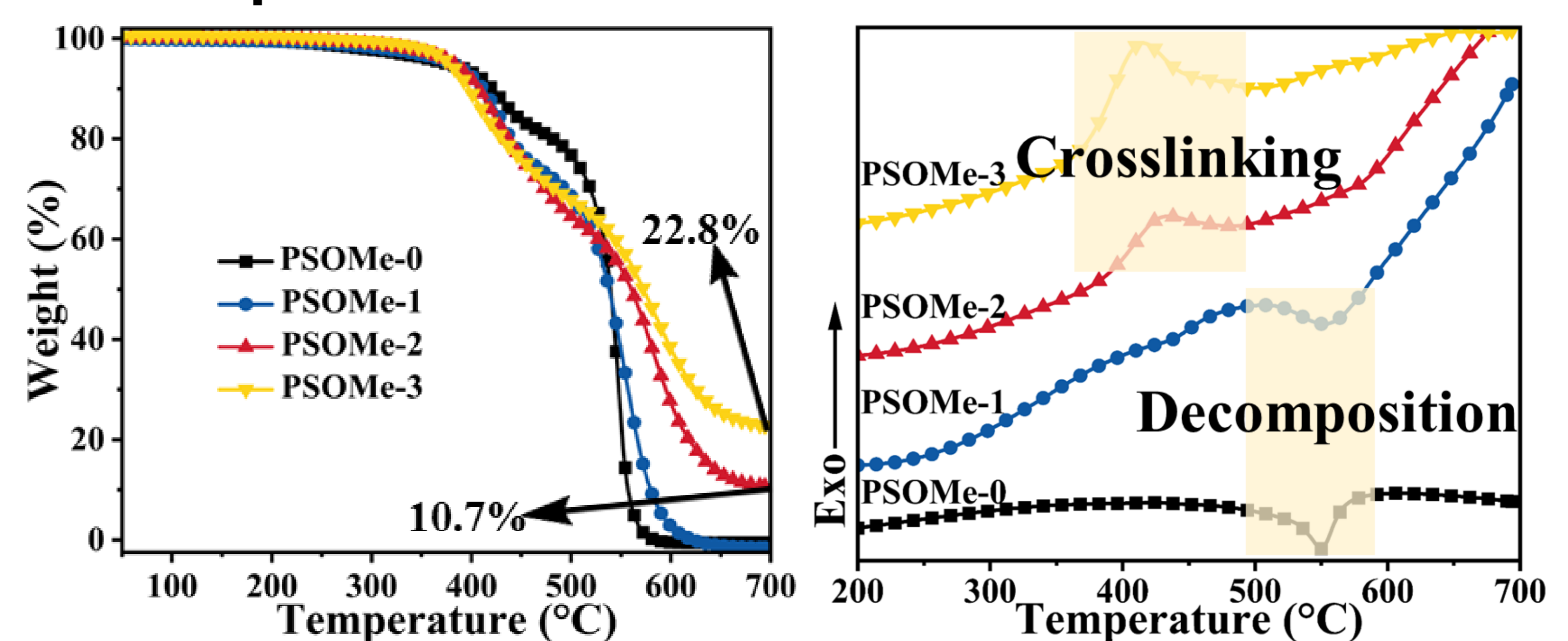
Fire safety performance

Sample	PHRR (kW/m ²)	THR (MJ/m ²)	PSPR (m ² /s)	TSP (m ²)	LOI (%)	UL-94
PC	598	66.3	0.219	17.0	27.2	V-2
PC/PSOMe-0	252	62.3	0.090	13.5	28.1	V-2
PC/PSOMe-1	262	58.9	0.096	14.0	27.9	V-1
PC/PSOMe-2	240	57.1	0.097	13.2	29.0	V-1
PC/PSOMe-3	224 (-63%)	53.4 (-19.5%)	0.119	13.9	29.9	V-0

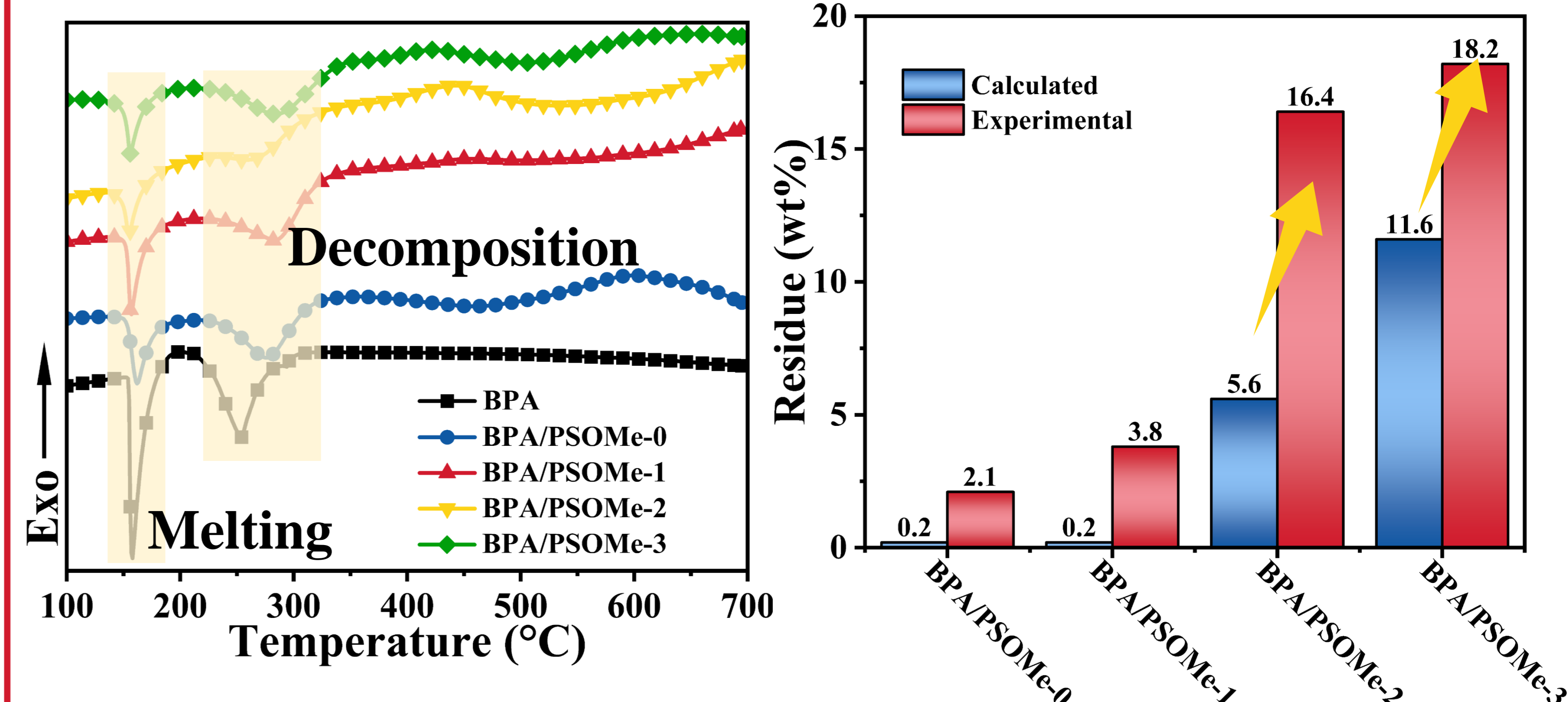


Charring behavior

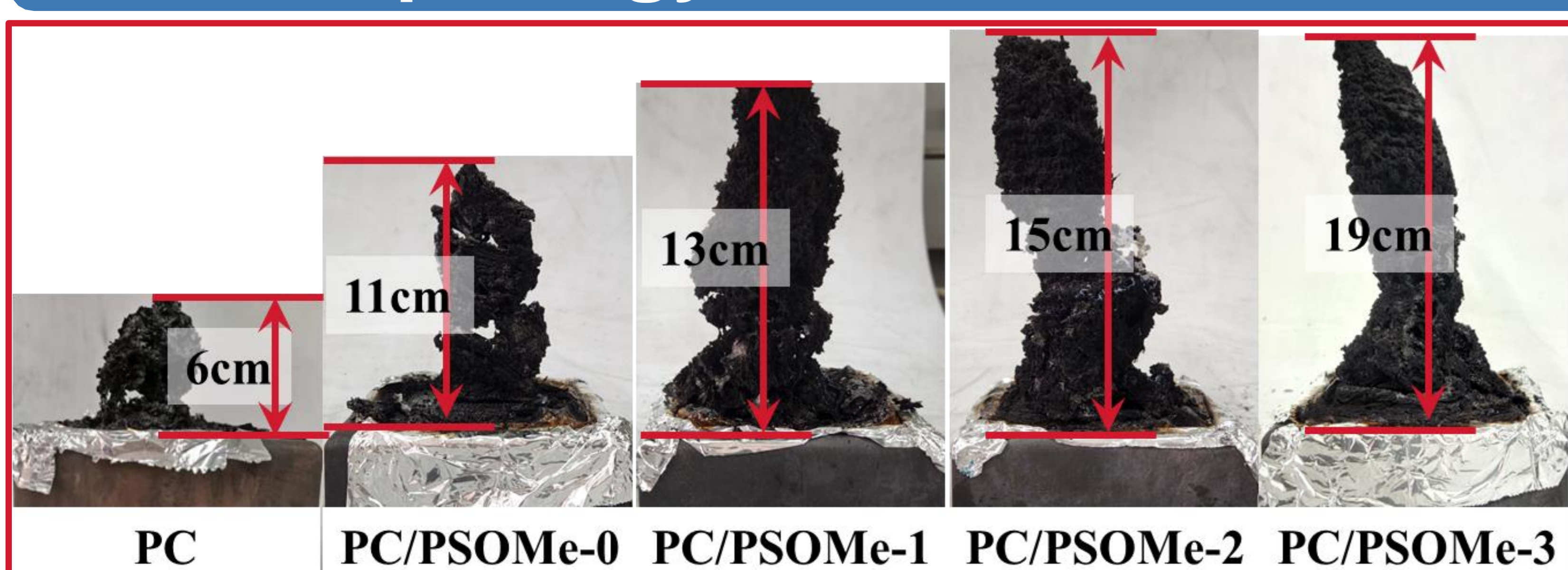
Decomposition behavior of PSOMe-X



PSOMe-X : BPA=1:1



Morphology of residual char



Conclusion

- ◆ The PC/PSOMe-3 composite exhibited a high LOI of 29.9 % at 2 wt% addition and passed the V-0 rating of UL-94, while reducing PHRR by 63 % and THR by 19.5 % compared with pure PC.
- ◆ The flame-retardant mechanism of PSOMe-X on PC included modulating the charring behavior to form protective char layer while simultaneously promoting charring by capturing degradation products.
- ◆ With the increasing of -OMe group content, the promotion charring of PC by PSOMe-X was correspondingly enhanced.