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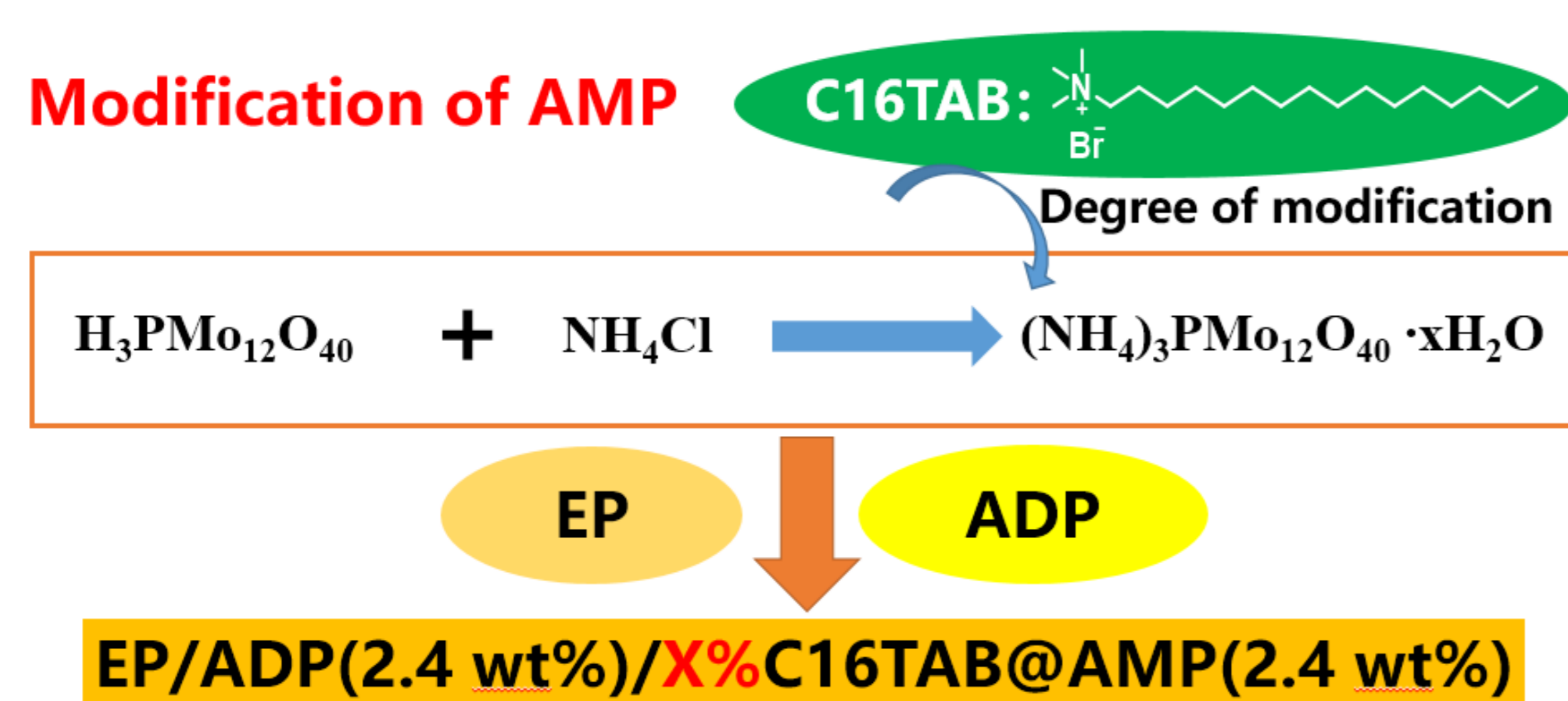
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Background

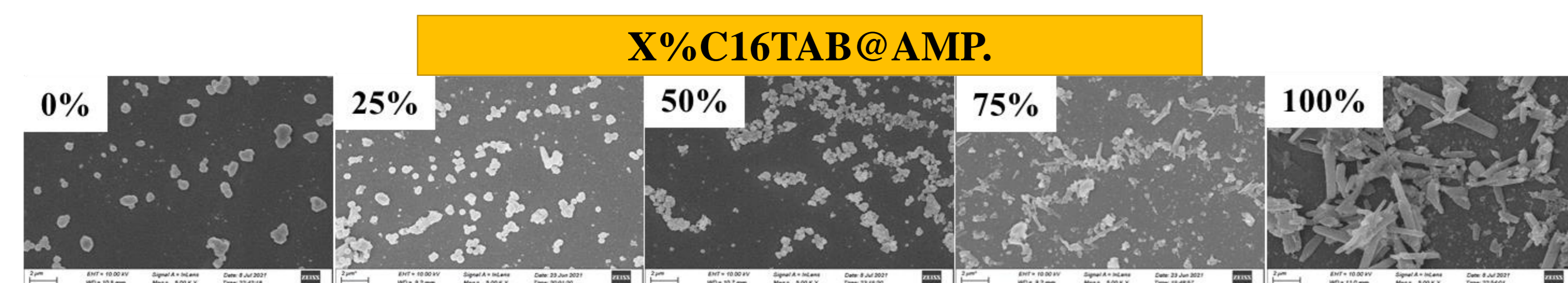
- ◆ In previous work, it was found that ammonium phosphomolybdate (AMP) had excellent catalytic charring effect in epoxy resin (EP), and its synergistic effect with aluminum diethylphosphinate (ADP) could improve the flame retardancy of EP, but AMP had little effect in the onset degradation step of EP and easy to absorb water.
- ◆ In this work, a series of quaternary ammonium salt (C16TAB) modified AMP with different molar content were synthesized. The organic modification of AMP by C16TAB not only changes the surface properties and morphology of the particles, but also eliminates the hygroscopicity of AMP, and it can effectively reduce the agglomeration caused by the high surface activity of particles and improve the mechanical properties of EP/AMP/ADP. In addition, the modification of C16TAB enhances the catalytic activity of AMP.

Results and Discussion

Research strategy

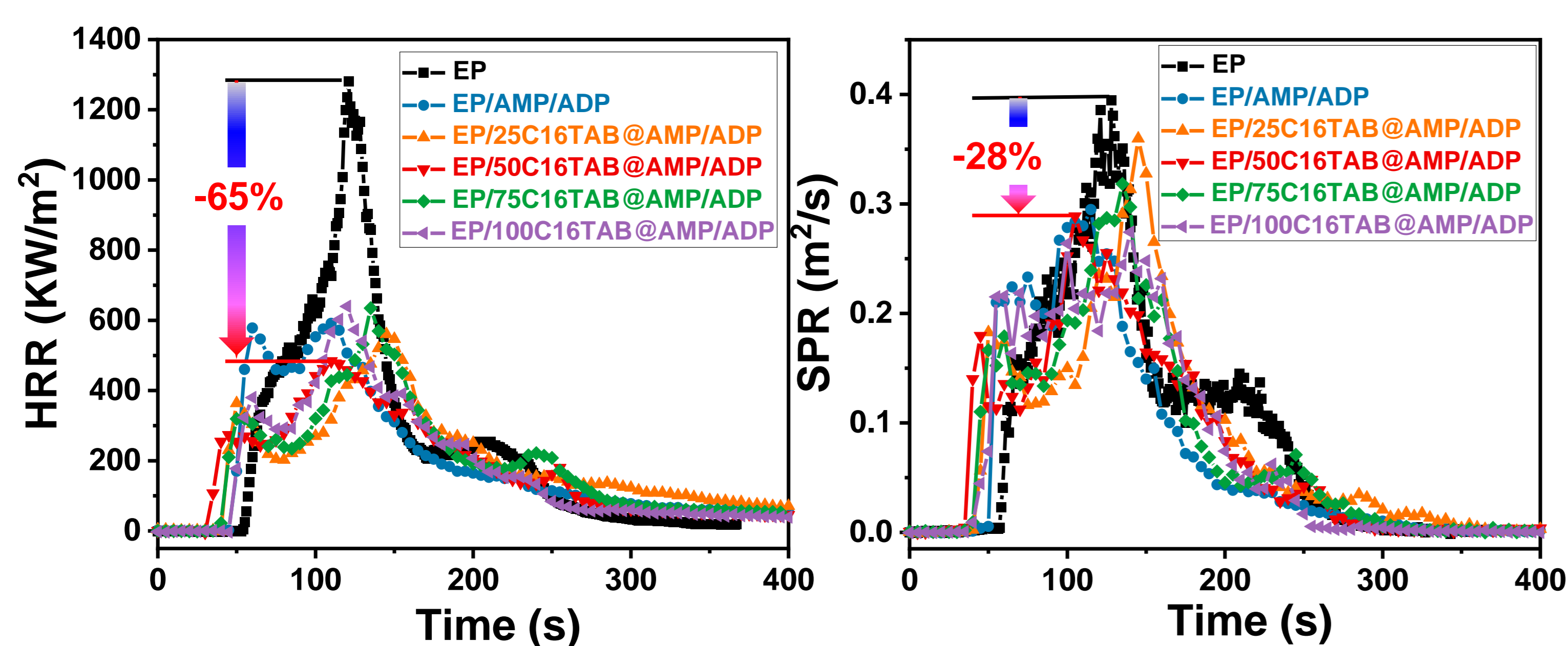


- Further improving flame retardancy and mechanical properties.

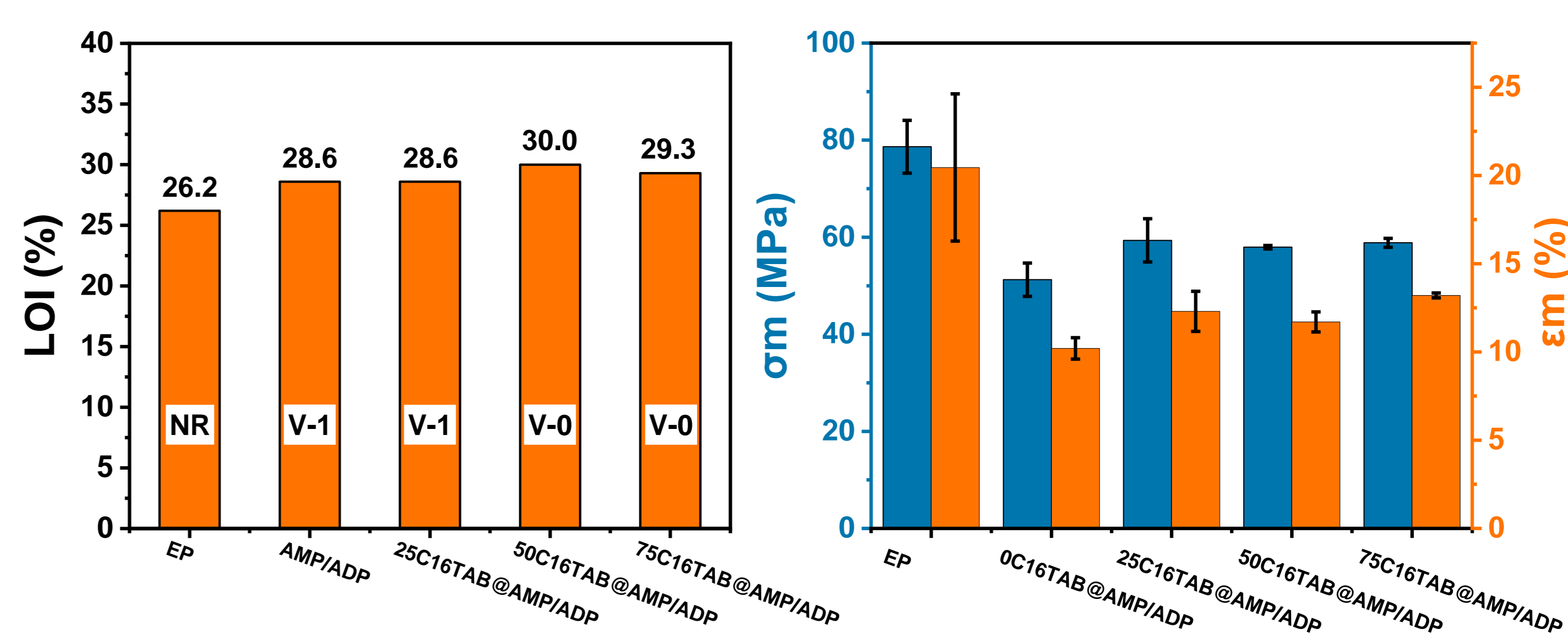


- The morphology of X%C16TAB@AMP changed from one-dimensional granular to two-dimensional flake with the increase of C16TAB molar content.

Flame retardancy and mechanical properties

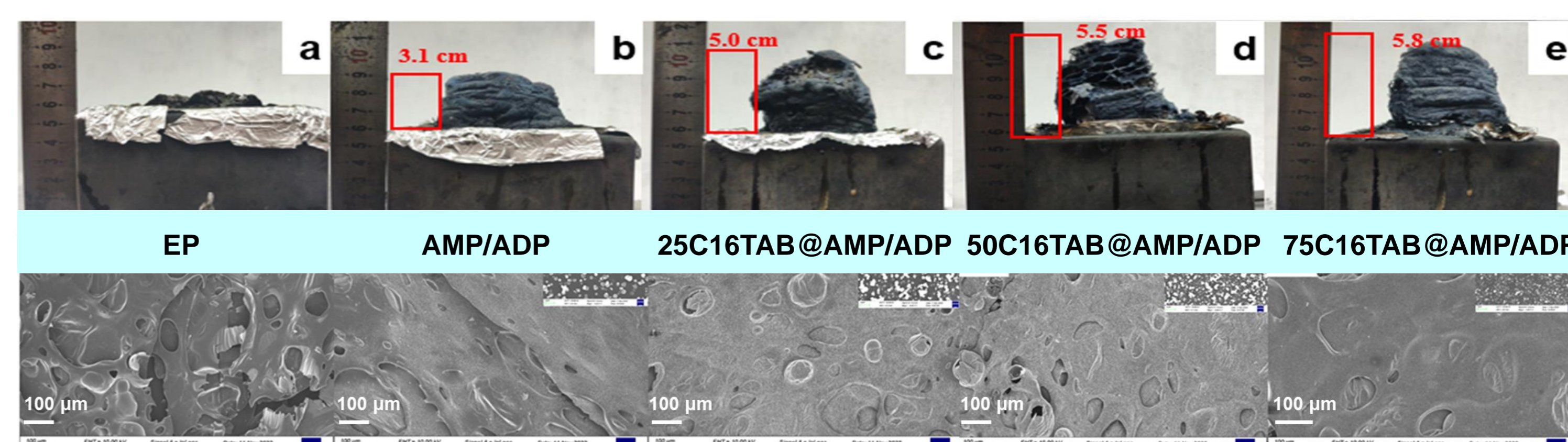


- EP/X%C16TAB@AMP/ADP displayed much better flame retardancy effect than EP.



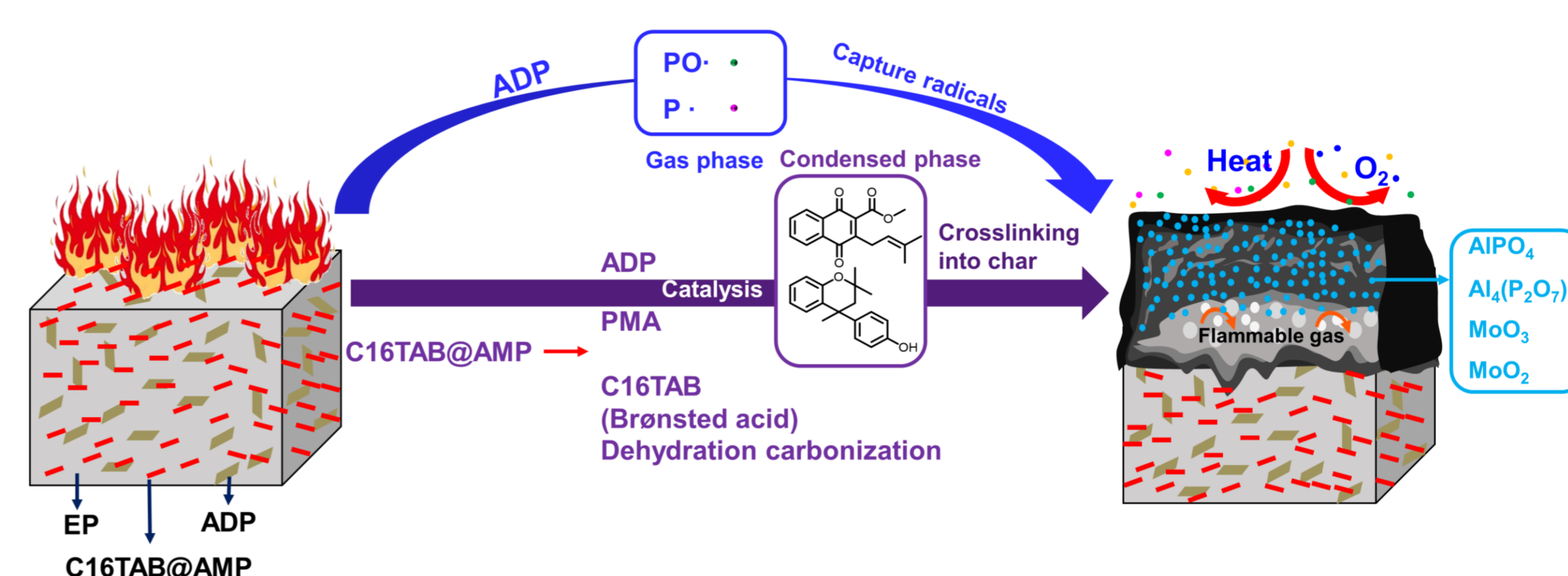
- Improving the mechanical properties of EP/AMP/ADP.

The morphology of char layer



- EP/X%C16TAB@AMP/ADP composites formed a complete and dense intumescent char layer with excellent barrier effect during combustion.

Flame-retardant mechanism



- C16TAB@AMP exhibited outstanding catalytic carbonization and oxidation activity.
- ADP presented good flame retardancy in both gas phase and condensed phase.
- EP/X%C16TAB@AMP/ADP composites easily generated a complete and intumescent char layer over the surface of EP composites during the combustion.

Conclusion

- ◆ We successfully synthesized a series of AMP modified by C16TAB with different molar contents, and combined them with ADP to greatly improve the flame retardancy and mechanical properties of EP.
- ◆ The best flame-retardant performance of EP was obtained at an 50C16TAB@AMP/ADP weight ratio of 1:1 in the total added amount of 4.8 wt% the EP composite reached the UL-94 V-0 grade, the PHRR decreased to 480 kW m⁻² (65% reduction).
- ◆ The presence of combined X%C16TAB@AMP and ADP in the EP matrix easily generated a complete and intumescent char layer over the surface of EP composites during the combustion.