

Summary

For some materials requiring visible surface such as wood and paper, using biomass-based intumescent flame-retardant coatings (IFRCs) with excellent transparency is one of the most effective ways to improve their thermal insulation performance without affecting their original structure and natural appearance^[1-4]. Here, Phytate flame retardant PAPEG was successfully synthesized through the esterification reaction between phytic acid (PA) and polyethylene glycol (PEG). IFRCs were prepared by blending PAPEG with gelatin as matrix resin and carbon source, and urea as gas source in different proportions. The obtained biomass-based IFRCs exhibited superior flame retardancy and transparency, which offers a novel strategy for the preparation and applications of highly efficient and environmentally friendly biomass-based transparent IFRCs.

Method

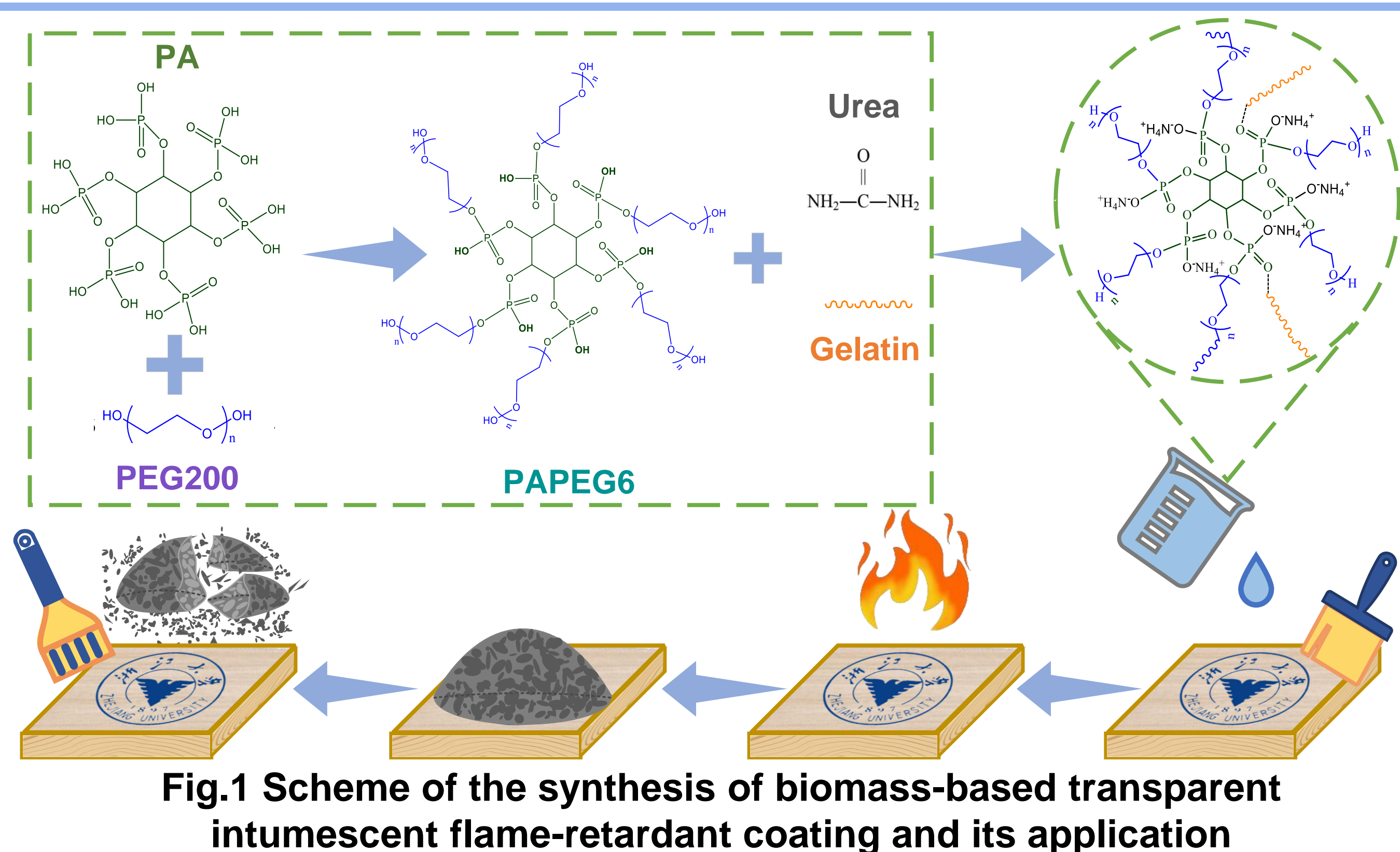


Fig.1 Scheme of the synthesis of biomass-based transparent intumescent flame-retardant coating and its application

Morphology of the carbon layer after combustion

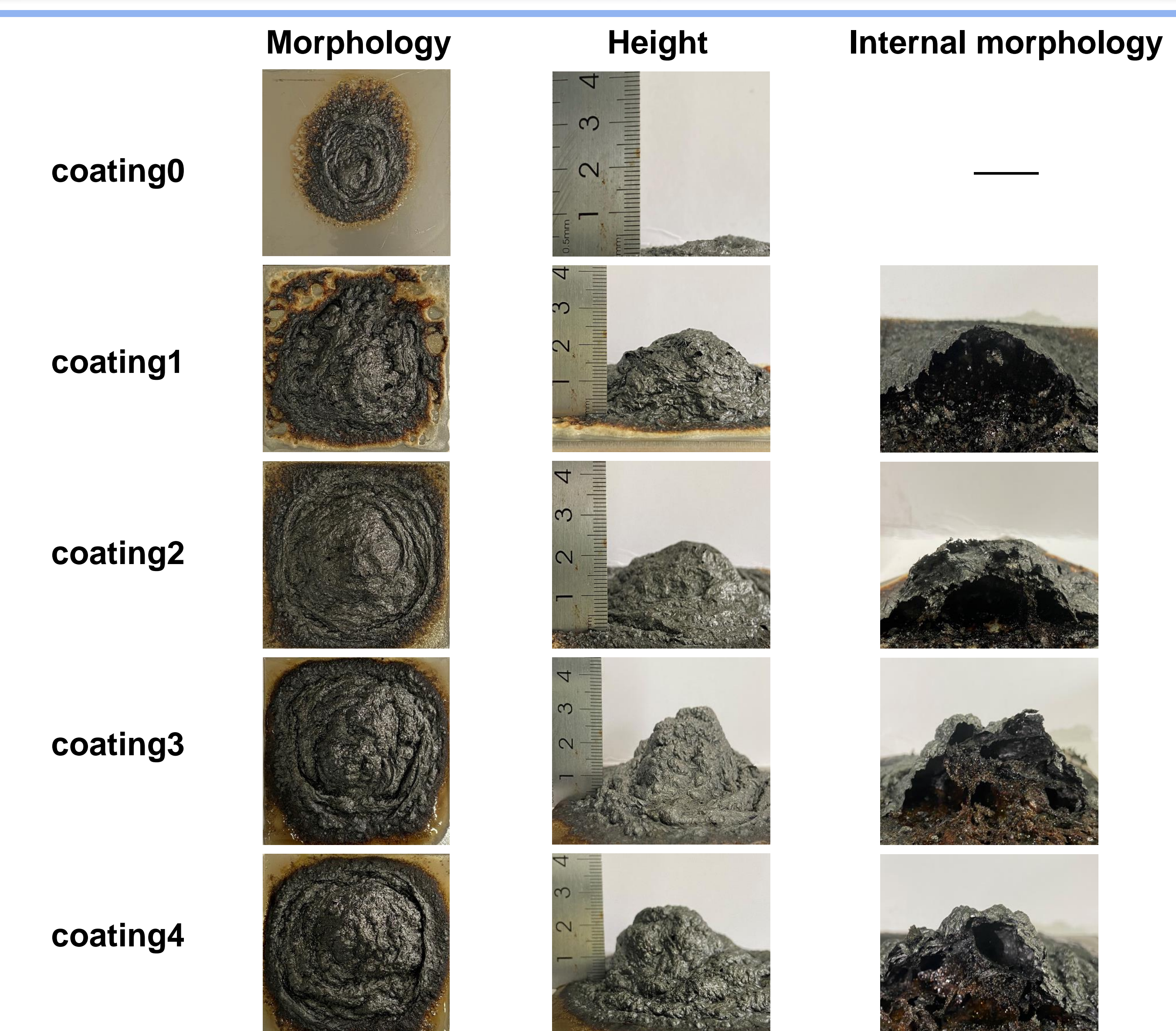


Fig. 2 Digital photos of the intumescent carbon layers at maximum expansion ratio

Flame retardancy

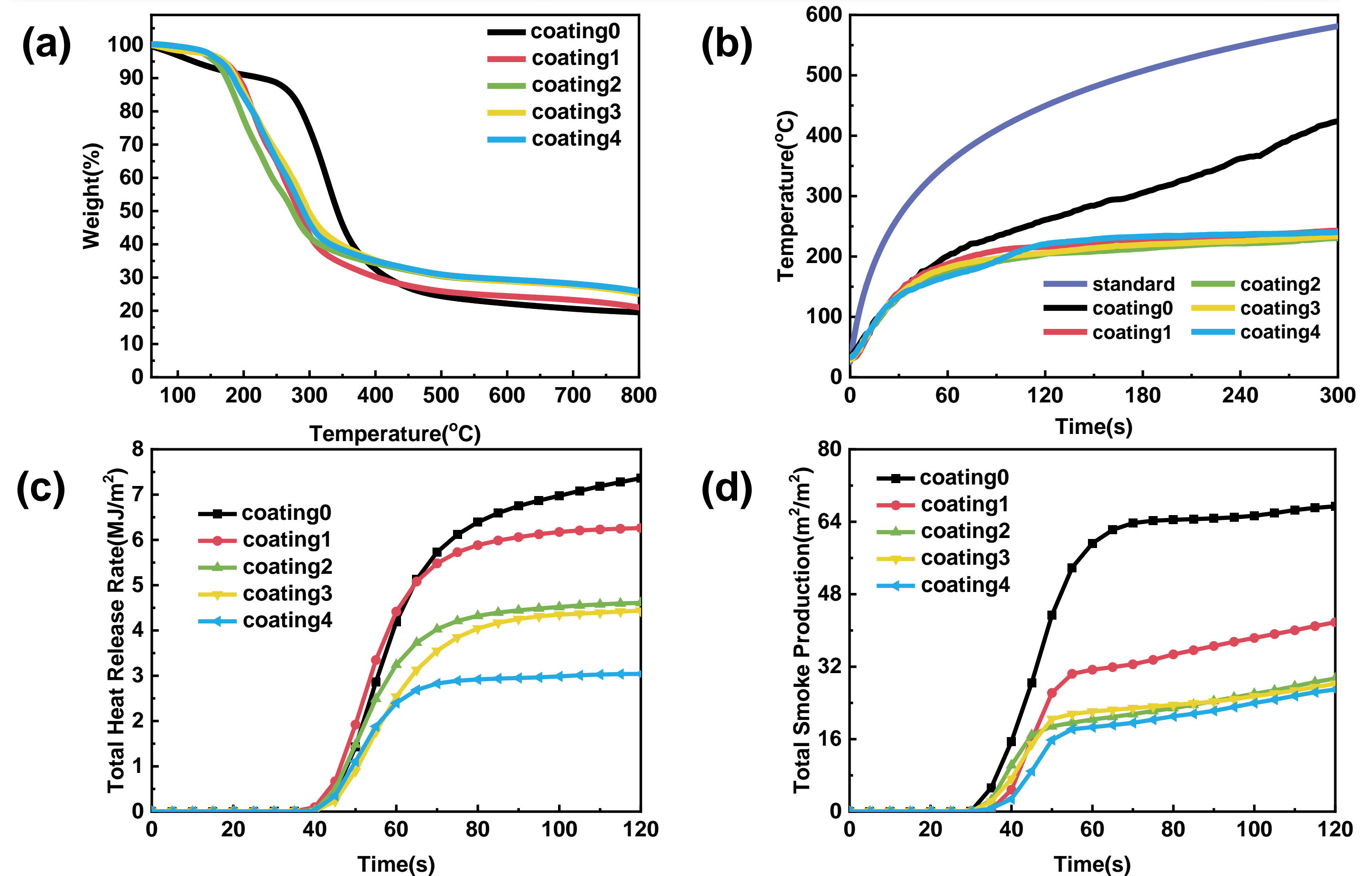


Fig. 3 Flame retardancy: (a) TG curves, (b) backside temperature curves, (c) total heat release curves, (d) total smoke production curves

Transparency



Fig.4 Transparency: (a) digital photos of the obtained coatings, (b) transmittance of the obtained coatings, (c) haze of the obtained coatings

Self-healing properties

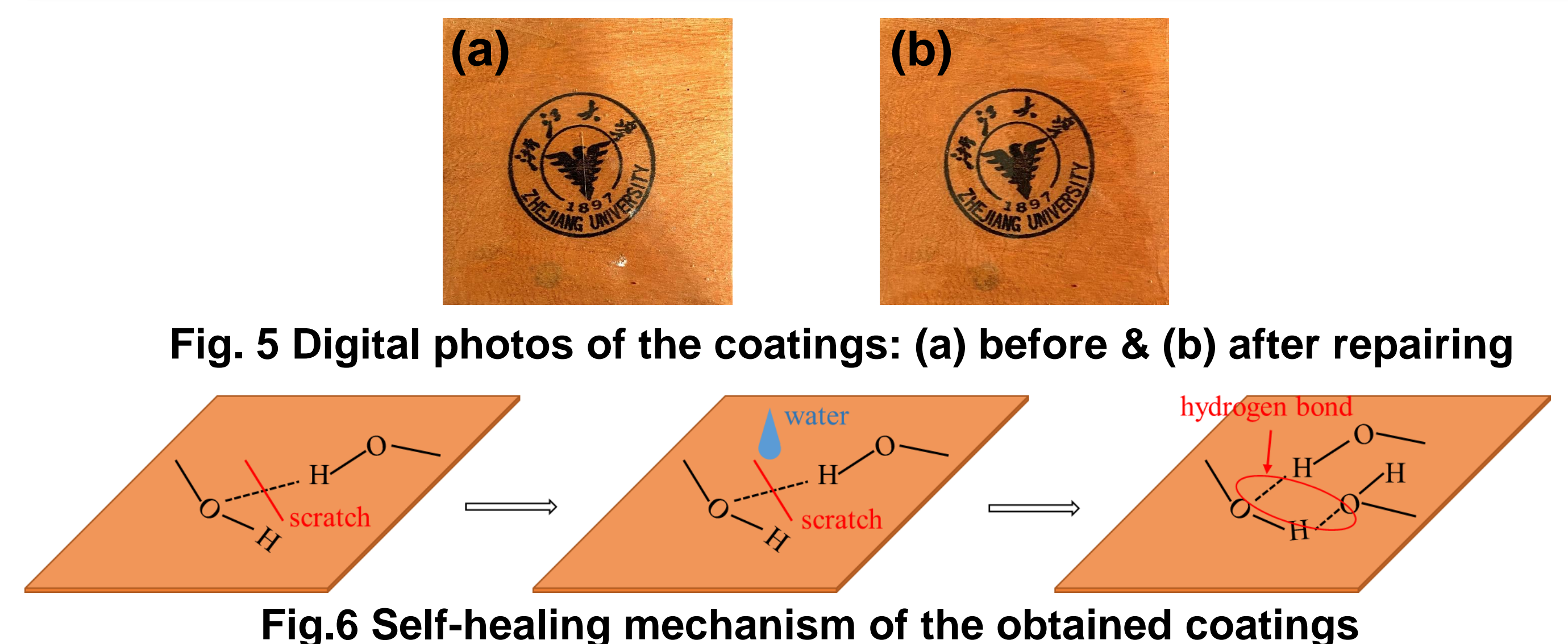


Fig. 5 Digital photos of the coatings: (a) before & (b) after repairing

Fig.6 Self-healing mechanism of the obtained coatings

Conclusions

- ◆ Biomass-based feedstocks
- ◆ Outstanding flame retardancy and transparency
- ◆ Effective heat reduction and smoke suppression
- ◆ Excellent self-healing properties

Reference

- [1] Tian, Y.; Wang, C.; Ai, Y.; Tang, L.; Cao, K., *Materials Chemistry and Physics* 2023, 294, 127000.
- [2] Yan, L.; Tang, X.; Xu, Z.; Xie, X., *Polymer Degradation and Stability* 2022, 203, 110074.
- [3] Liang, Y.; Jian, H.; Deng, C.; Liu, Y.; Park, H.; Wen, M.; Sun, Y., *Polymers* 2023, 15(4), 950.
- [4] Song, F.; Liu, T.; Fan, Q.; Li, D.; Ou, R.; Liu, Z.; Wang, Q., *Progress in Organic Coatings* 2022, 162, 106597.