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Highly thermostable and durably flame-retardant unsaturated polyester modified by a novel polymeric flame retardant containing Schiff base and spirocyclic structures

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ABSTRACT

To expand the use of unsaturated polyester (UP), its flame retardation, thermostability, and glass transition temperature (T_g) must be improved. To achieve this purpose, a novel organophosphorus polymeric flame retardant, poly(hydroxyphenyl imino methyl phenol spirocyclic pentaerythritol diphosphonate) (PPISP), containing both Schiff base and spirocyclic diphosphate structures, has been designed and synthesized. When PPISP is incorporated into the UP matrix, the cured UP thermoset containing 20 wt% PPISP exhibits a much higher initial decomposition temperature ($T_{5\%}$) and T_g than pure UP. Simultaneously, the thermoset composite possesses a limiting oxygen index (LOI) value of 28.2% and achieves a UL-94 V-0 rating as well as sharply decreases the peak heat release rate by 60%. These results demonstrate that PPISP dramatically enhances the flame retardancy of UP. Additionally, the flame-retardant UP (FRUP) exhibits outstanding durable flame-retardance and water resistance. The catalytic charring effect