

Synergistic effects of ladder and cage structured phosphorus-containing POSS with tetrabutyl titanate on flame retardancy of vinyl epoxy resins

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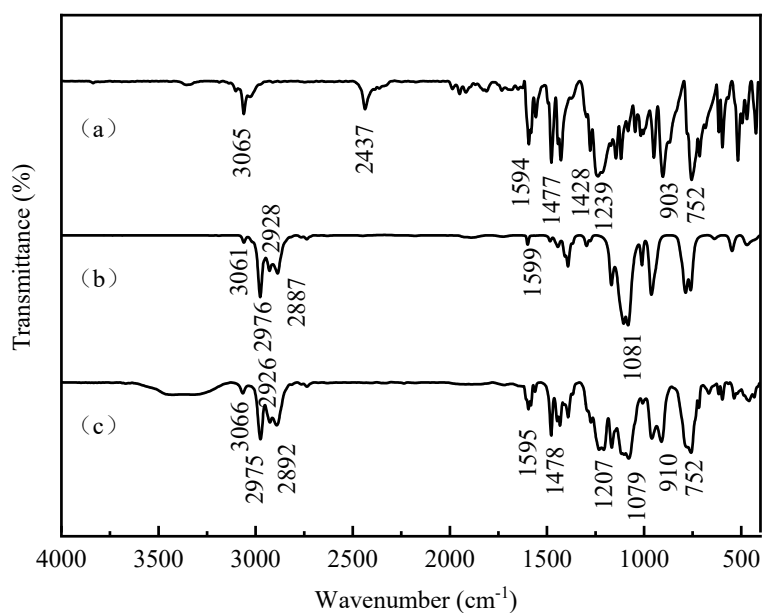


FIGURE S1 FTIR spectra of DOPO (a), VTES (b) and DOPO-VTES (c)

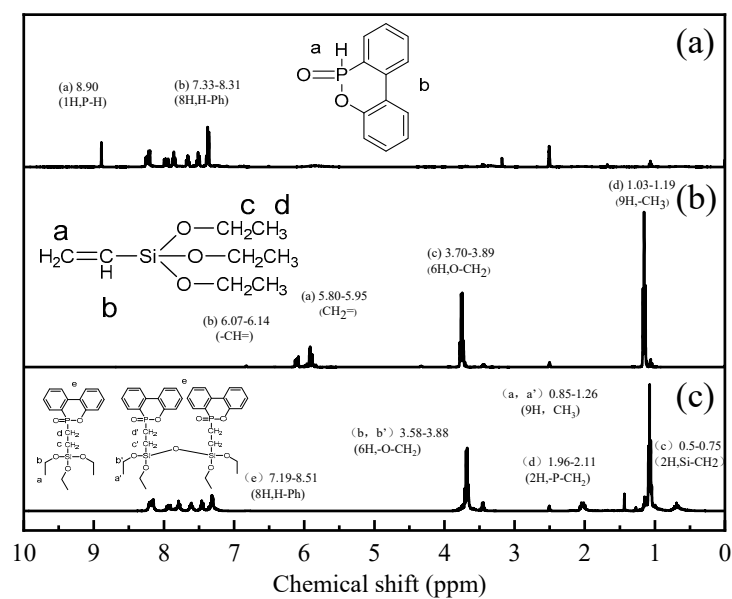


FIGURE S2 The ^1H -NMR spectra of DOPO (a), VTES (b), DOPO-VTES (c)

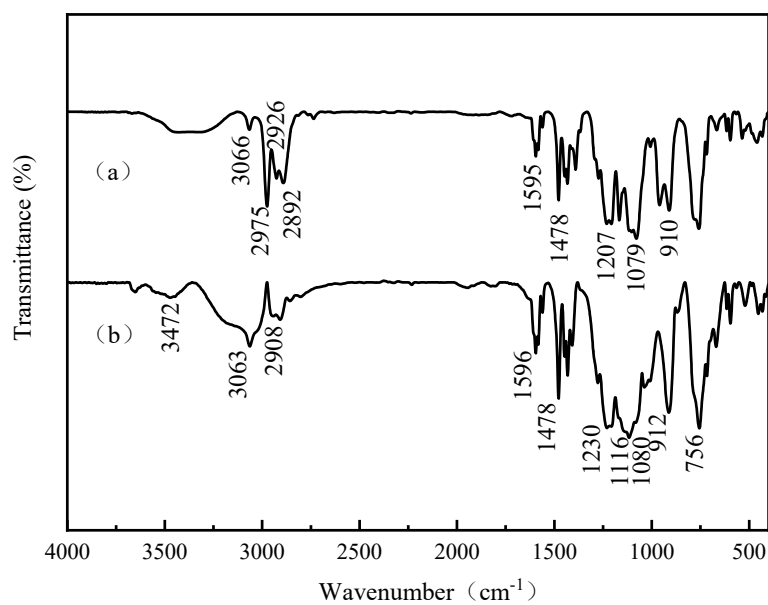


FIGURE S3 FTIR spectra of DOPO -VTES (a), DOPO-POSS (b)

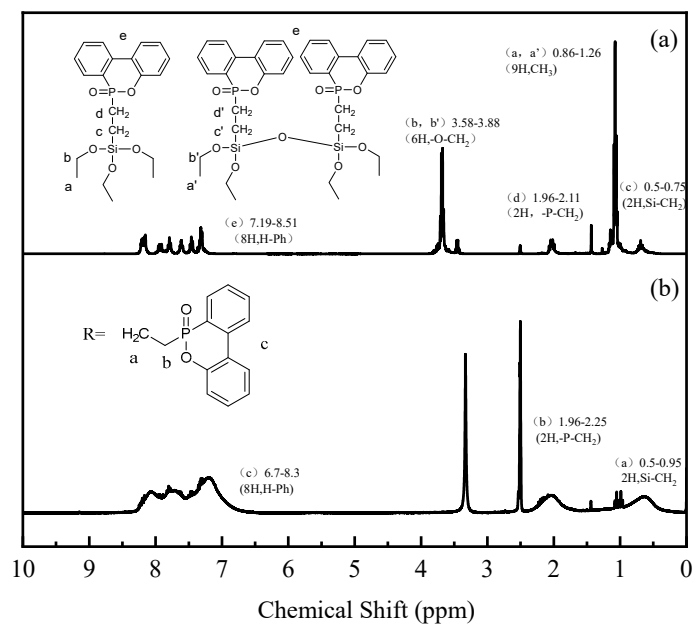


FIGURE S4 ^1H -NMR spectra of DOPO -VTES (a) and DOPO-POSS (b)

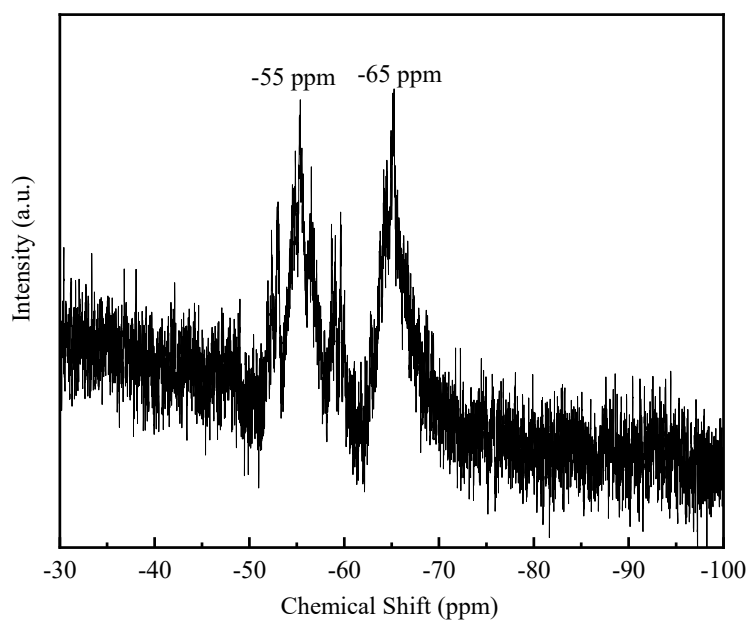


FIGURE S5 ^{29}Si -NMR spectra of DOPO-POSS

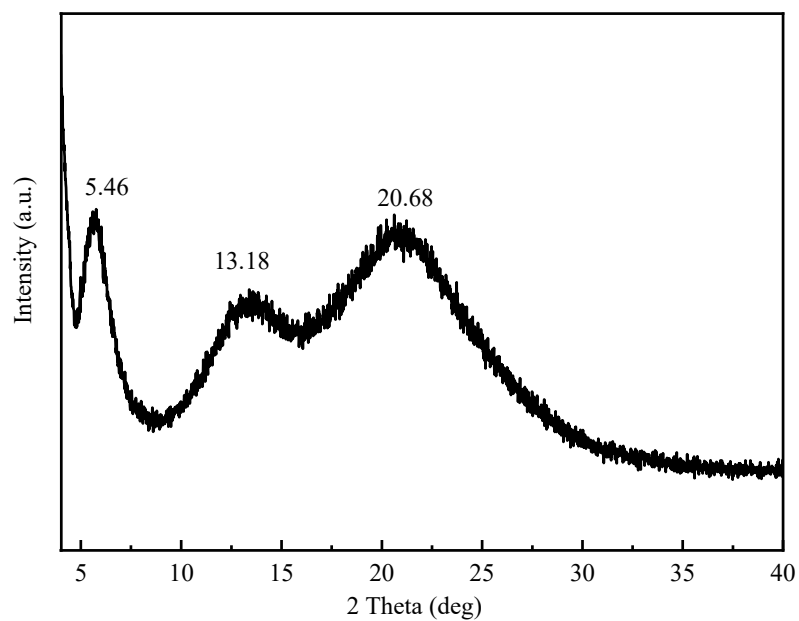


FIGURE S6 XRD pattern of DOPO-POSS

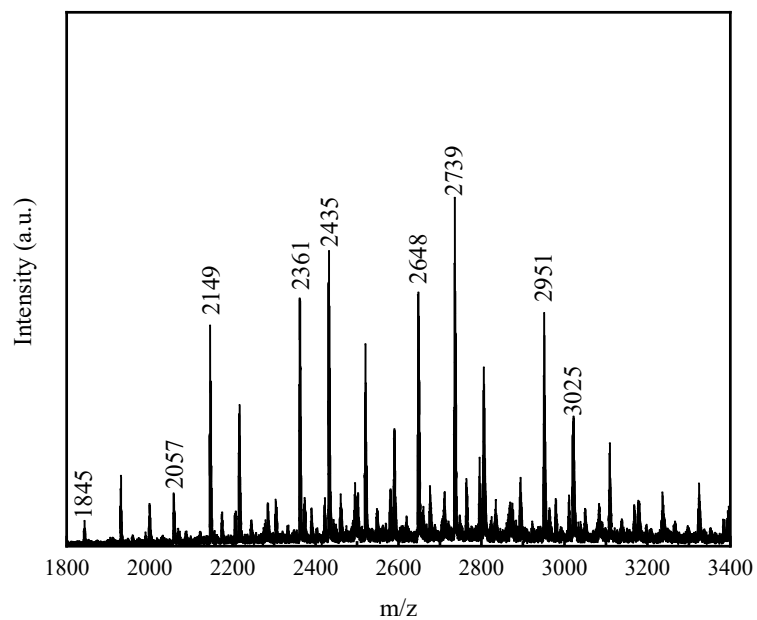


FIGURE S7 MALDI-TOF MS spectrum of DOPO-POSS

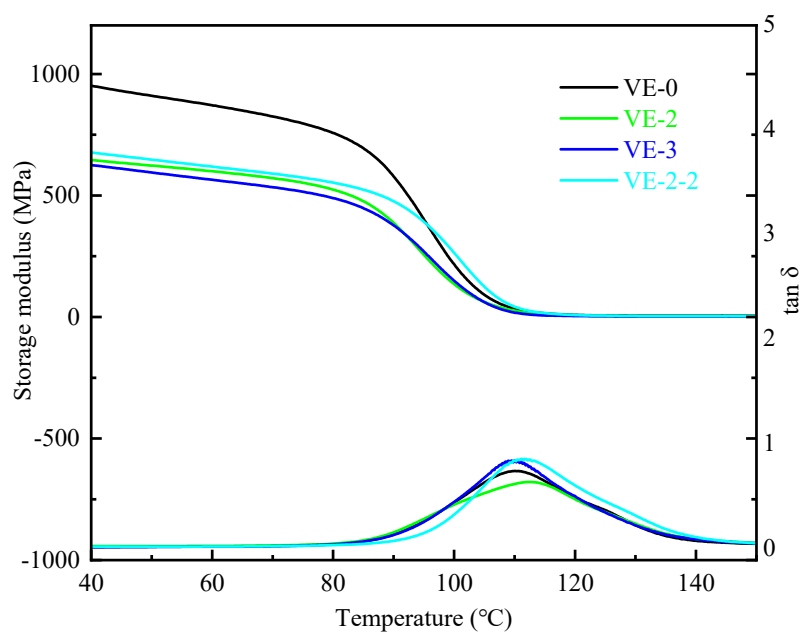
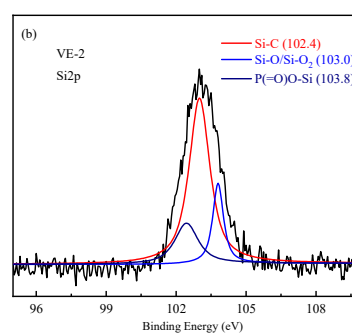
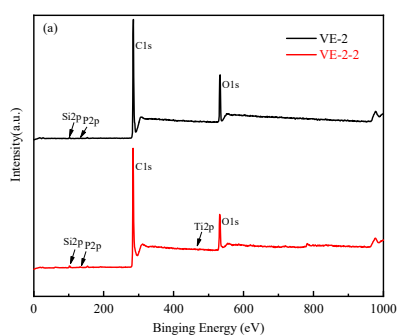


FIGURE S8 The curves of storage modulus and $\tan \delta$ versus temperature of the VE composites

TABLE S1 DMA data of the VE composites

Samples	$E'_{40^\circ\text{C}}$ (MPa)	$E'_{150^\circ\text{C}}$ (MPa)	T_g ($^\circ\text{C}$)
VE-0	951.11	4.97	110.06
VE-2	646.10	3.07	112.81
VE-3	625.11	2.60	109.85
VE-2-2	675.69	3.66	111.43



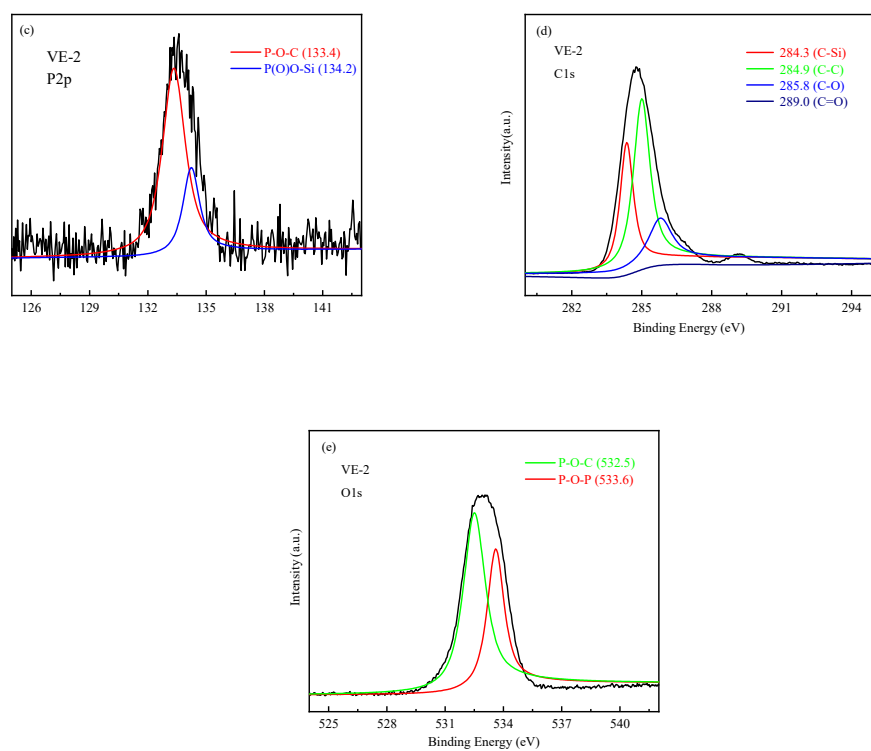


Figure S9 XPS spectra of Si2p (b), P2p (c), C1s (d), O1s (e) spectra for VE-2