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Supporting Materials for

Low Loading of Grafted Thermoplastic Polystyrene Strengthened and Toughened Transparent Epoxy Composites

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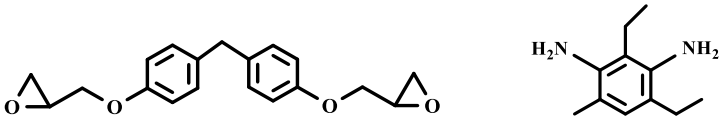
S1. Chemical Structures of Epon 862 and EK3402



Epon 862 EK3402

Scheme S1 Molecular structures of Epon 862 and EK3402 curing agent.

S2. SEM and XPS of *g*-PS

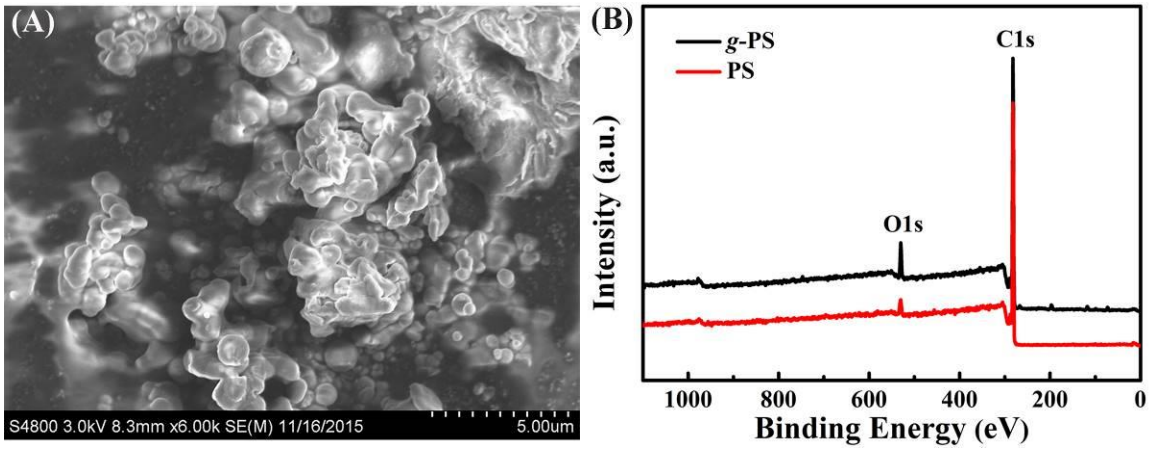


Figure S1. (a) SEM image and (b) XPS wide-scan survey spectra of *g*-PS.

S3. Interaction Exploration between *g*-PS and Epoxy Resin: DSC measurement

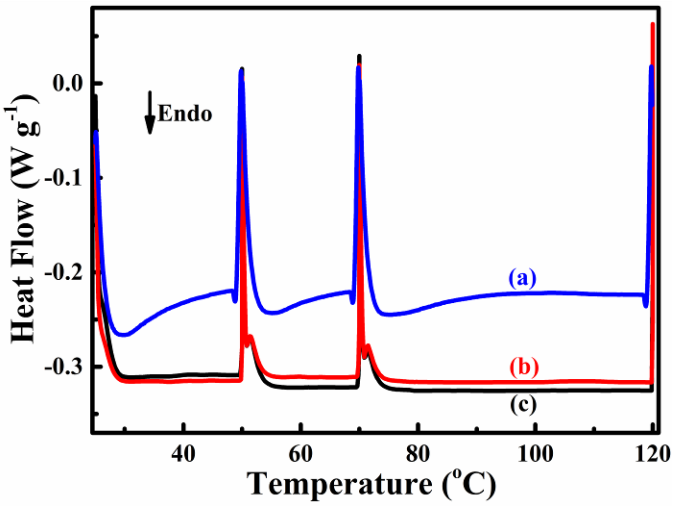


Figure S2. DSC curves of epoxy monomer suspensions with (a) *g*-PS, (b) pure PS; and (c) pure epoxy monomer.

S4. Thermal Stability of Cured Pure Epoxy and PS/epoxy Composites

Figure S3 shows the effect of *g*-PS loading on the thermal stability of cured epoxy composites. The main degradation of these materials takes place in two stages in their decomposition profiles. The first weight loss at around 300 - 400 ^{o}C is from the breakdown of epoxy network. The second weight loss at about 480 - 600 ^{o}C is due to the degradation of benzene rings of the cured epoxy composites. The cured pure epoxy, the first decomposition temperature (T_{d1}, 5 wt% weight loss) is 379 ^{o}C and the second decomposition temperature (T_{d2}, 40 wt% weight loss) is 409 ^{o}C. There is no obvious difference between pure PS and g-PS/epoxy composites in their first decomposition stage. However, the thermal stability for these composites is distinct in the second decomposition stage.

Normally, the $T_{\text{heat-resistance index}}$ (T_{HRI}) is expressed as eqn S1.[1, 2]

$$T_{\text{Heat-resistance index}} = 0.49 \times \left[T_{d1} + 0.6\left(T_{d2} - T_{d1} \right) \right] \quad (1)$$

The calculated T_{HRI} is also listed in Table S1. It's seen that there is not too much difference for the T_{HRI} of cured epoxy and epoxy composites.

Table S1. Thermal parameters of cured pure epoxy and PS/epoxy composites.

Samples	Weight loss temperature (^{o}C)		$T_{\text{heat-resistance index}}$ (^{o}C)
	T_{d1}	T_{d2}	
Pure epoxy	379	409	194.5
0.5 wt% *g*-PS	382	413	196.3
1.0 wt% *g*-PS	380	419	197.7
1.5 wt% *g*-PS	384	421	199.0
2.0 wt% *g*-PS	377	410	194.4
2.5 wt% *g*-PS	381	419	197.9
0.5 wt% pure PS	380	413	195.9

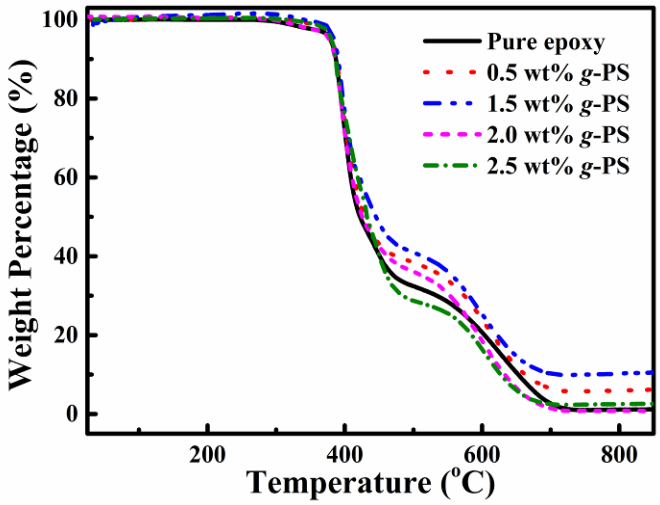


Figure S3. TGA curves of cured epoxy composites with different *g*-PS loadings.

References:

1. J. Gu, W. Dong, S. Xu, Y. Tang, L. Ye and J. Kong, *Compos. Sci. Technol.*, 2017, **144**, 185-192.

2. Junwei Gu, Shuang Xu, Qiang Zhuang, Y. Tang and J. Kong, *IEEE Trans. Dielectr. Electr. Insul.*, 2017, **24**, 784-790.