Supporting Information

Particle-size Dependent Melt Viscosity Behavior and Properties of Three-arm Star Polystyrene/Fe_3O_4 Composites

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Table S1. The cross frequency (ω_{cross}) and apparent viscosity (η_a) for pure S3PS and their composites with Fe_3O_4 nanoparticles

Sample	ω_{cross} [a] (rad/s)	η_a [b] (Pa·s)
S3PS-18k	--	--
S3PS-18k-Fe(3)	--	--
S3PS-18k-Fe(44)	176.799	--
S3PS-48k	22.136	10086
S3PS-48k-Fe(3)	23.250	92880
S3PS-48k-Fe(44)	13.595	11608
S3PS-75k	4.134	41374
S3PS-75k-Fe(3)	4.916	38877
S3PS-75k-Fe(44)	2.745	53561
S3PS-150k	0.802	185030
S3PS-150k-Fe(3)	0.323	414442
S3PS-150k-Fe(44)	0.274	441989

[a] Angular frequency where the storage modulus equals to loss modulus. [b] Apparent viscosity determined from the relationship: $\eta_a = \tau * G_N^0$.

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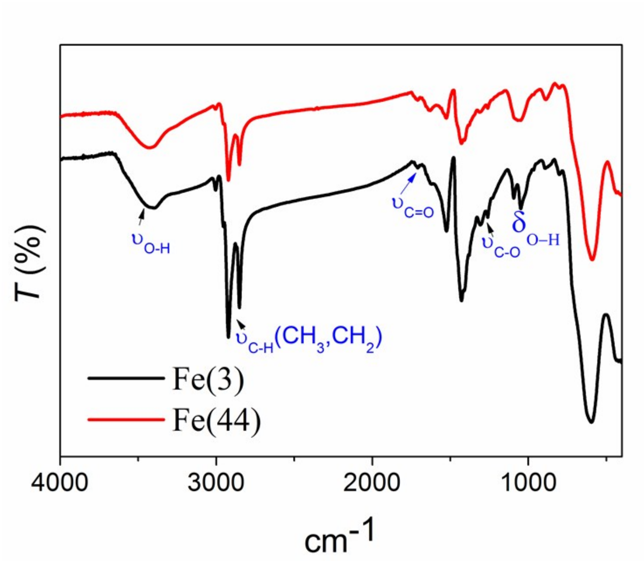

Fig. S1. FT-IR of the prepared Fe(3) and Fe(44).

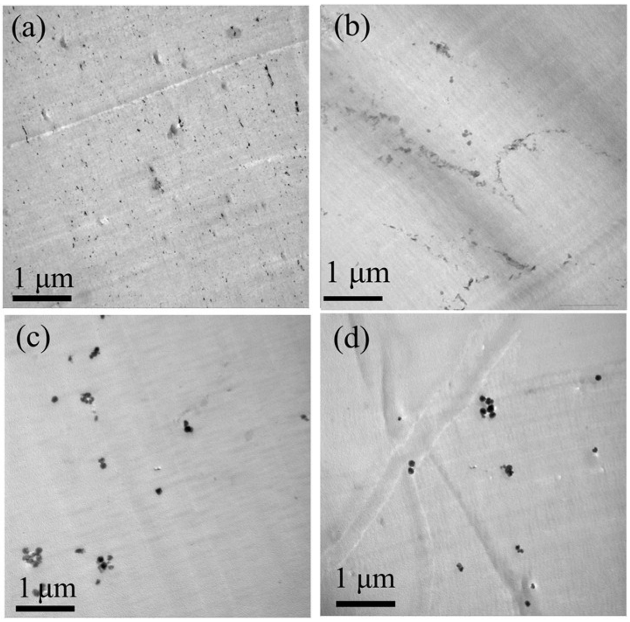

Fig. S2. TEM images of (a) S3PS-48k-Fe(3)-1, (b) S3PS-150k-Fe(3)-1, (c) S3PS-48k-Fe(44)-1 and (d) S3PS-150k-Fe(44)-1

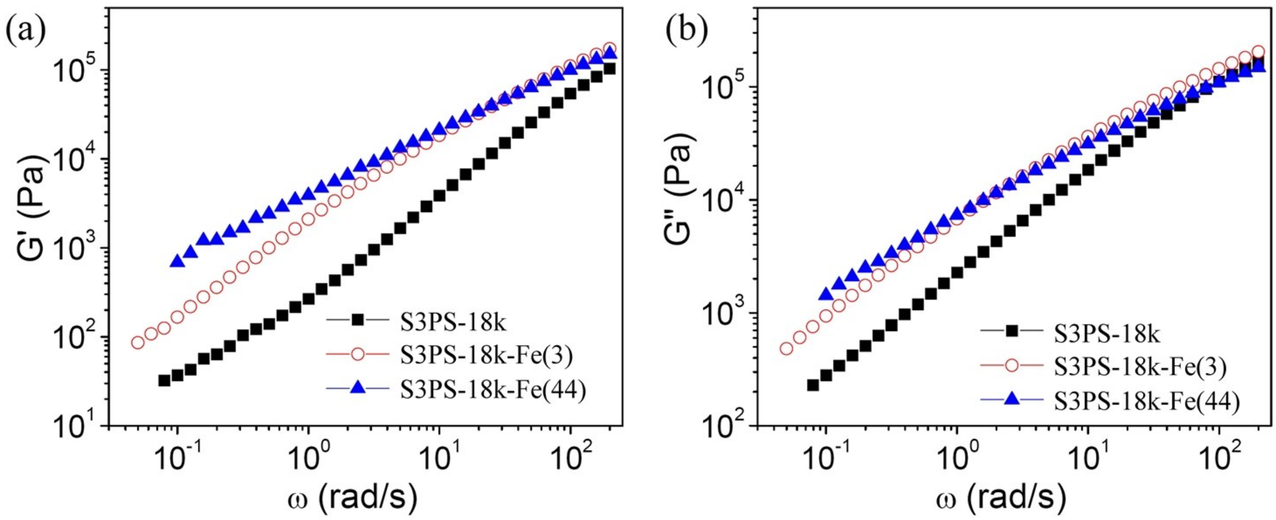

Fig. S3. Storage modulus (G') and loss modulus (G") vs angular frequency (ω) for S3PS-18k and their composites with two different sizes of Fe_3O_4 at 150 °C.

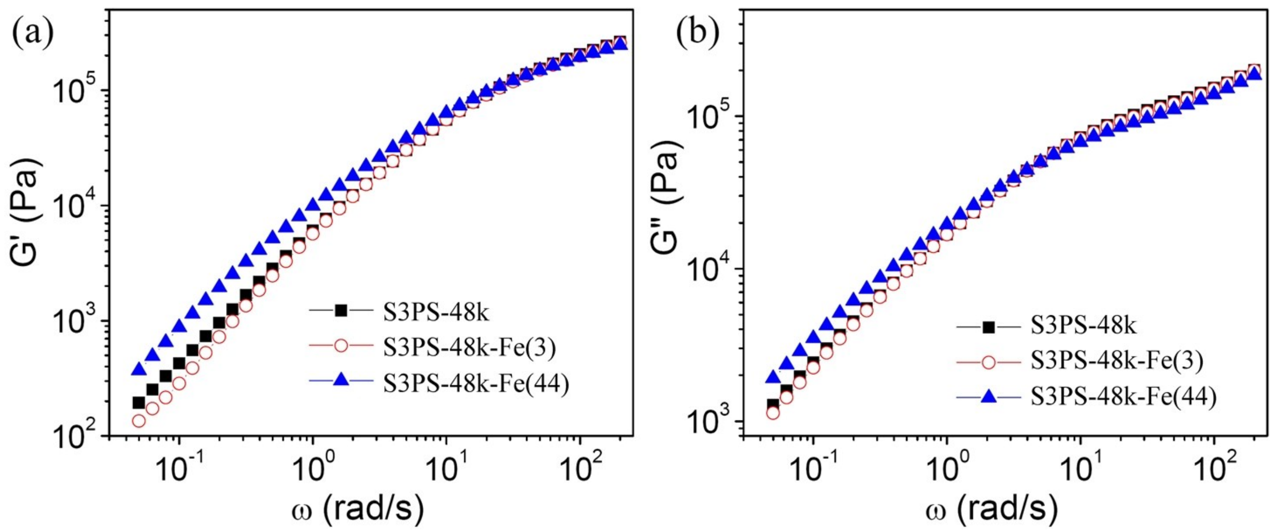

Fig. S4. Storage modulus (G') and loss modulus (G") vs angular frequency (ω) for S3PS-48k and their composites with two different sizes of Fe_3O_4 at 150 °C.

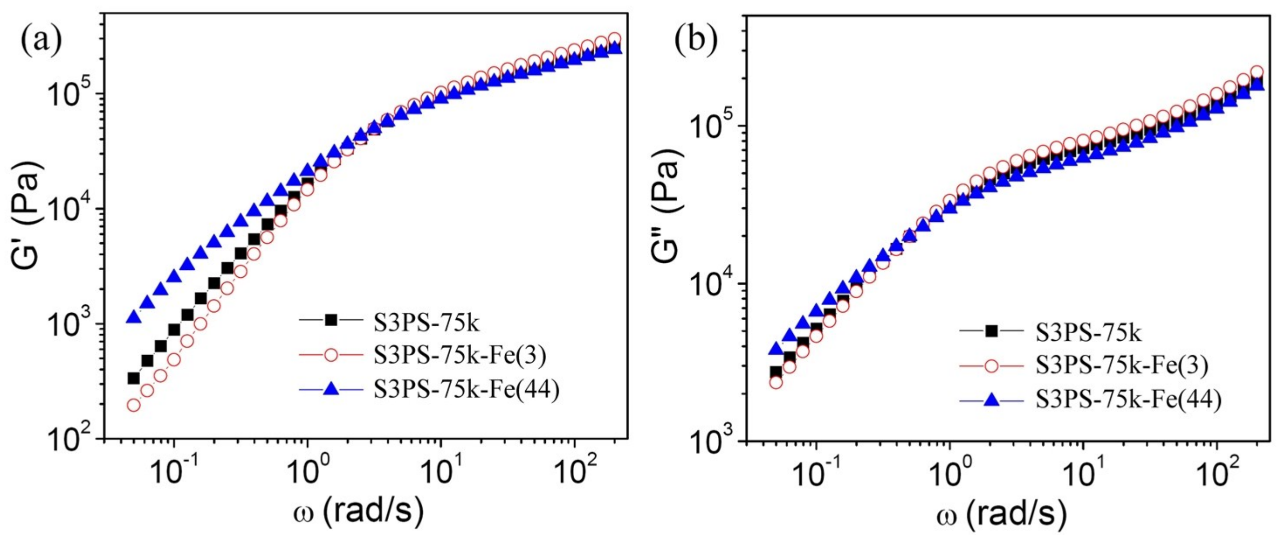

Fig. S5. Storage modulus (G') and loss modulus (G") vs angular frequency (ω) for S3PS-75k and their composites with two different sizes of Fe_3O_4 at 150 °C.

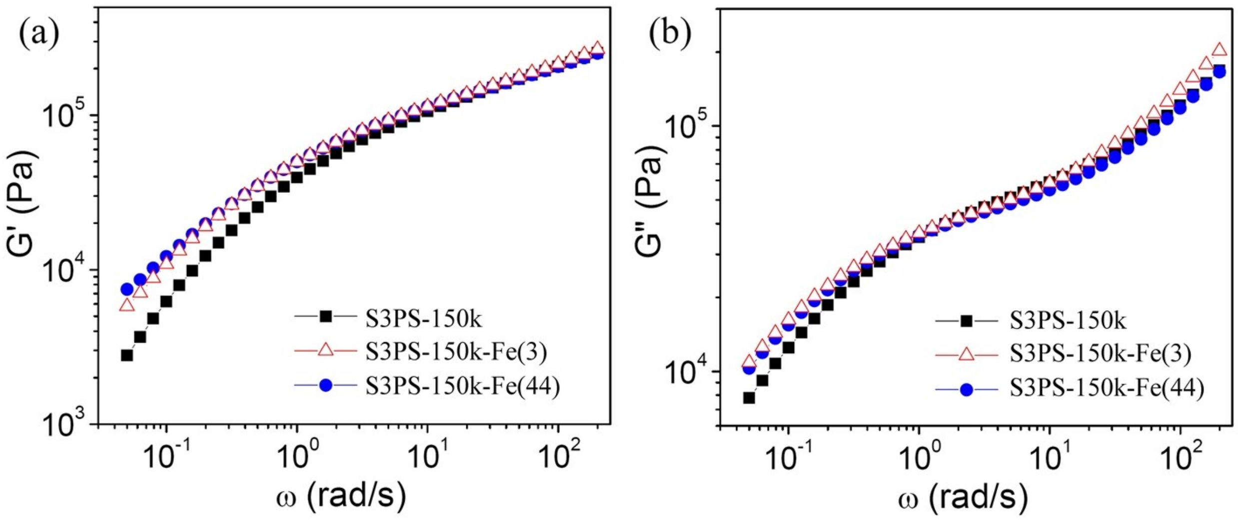

Fig. S6. Storage modulus (G') and loss modulus (G") vs angular frequency (*ω*) for S3PS-150k with their composites with two different sizes of Fe_3O_4 at 150 °C.

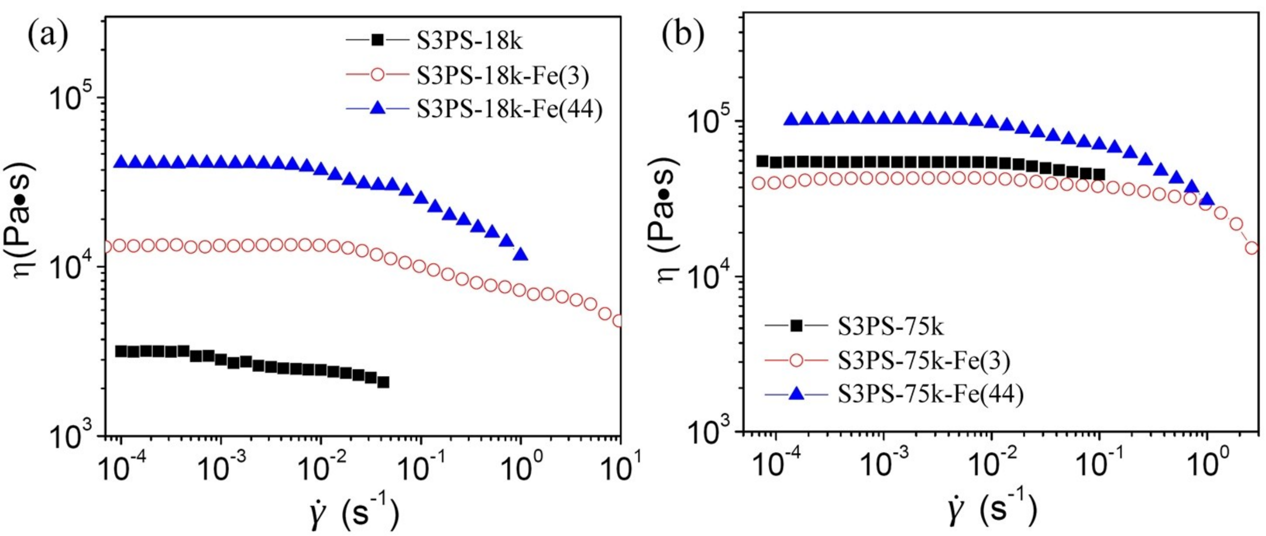

Fig. S7. Steady state shear viscosity as a function of shear rate for (a) S3PS-18k，(b) S3PS-75k and their composites with two different sizes of Fe_3O_4 at 150 °C.

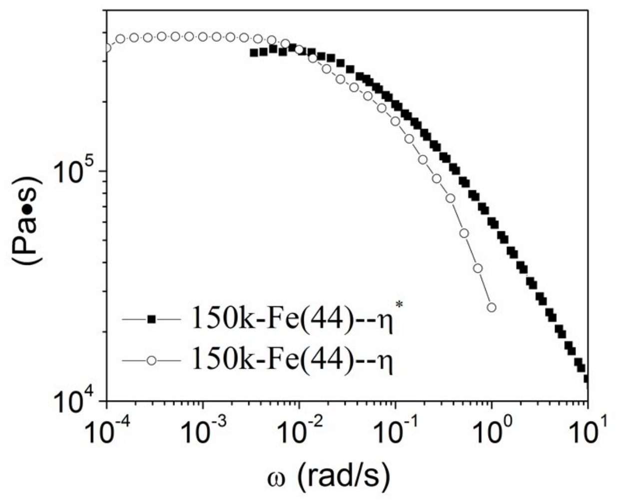

Fig. S8. Complex viscosity and steady shear viscosity plotted on the same graph for S3PS-150k-Fe(44) at 150 °C.

Continuous Relaxation Spectra.

The TRIOS software available with the ARES-G2 rheometer was used to evaluate the continuous relaxation spectra, using both the G' (storage modulus) and G" (loss modulus) data. The continuous relaxation time spectrum can be extracted by fitting following model with n terms to either oscillation (G'(w), G"(w)) or Relaxation (G(t)) data.

$$d\ln\tau = \frac{d\tau}{\tau}, g(\tau)\tau = H(\ln\tau)$$

$$G(t) = G_e + \int_{-\infty}^{+\infty} H(\ln\tau) e^{-t/x} d\ln\tau$$

$$G' = \int_{-\infty}^{+\infty} H(\ln\tau) \frac{\omega^2\tau^2}{1+\omega^2\tau^2} d\ln\tau$$

$$G'' = \int_{-\infty}^{+\infty} H(\ln\tau) \frac{\omega\tau}{1+\omega^2\tau^2} d\ln\tau$$

For the numerical computation the spectrum H(lnτ) is discretized (typical in the order of 100 steps). The spectrum represents all the pairs of fitted {Hi, τi} parameters and can be extracted into a new file if desired.