

Supporting Information:

Hybrid SiO₂@POSS nanofiller: a promising reinforcing system for rubber nanocomposites

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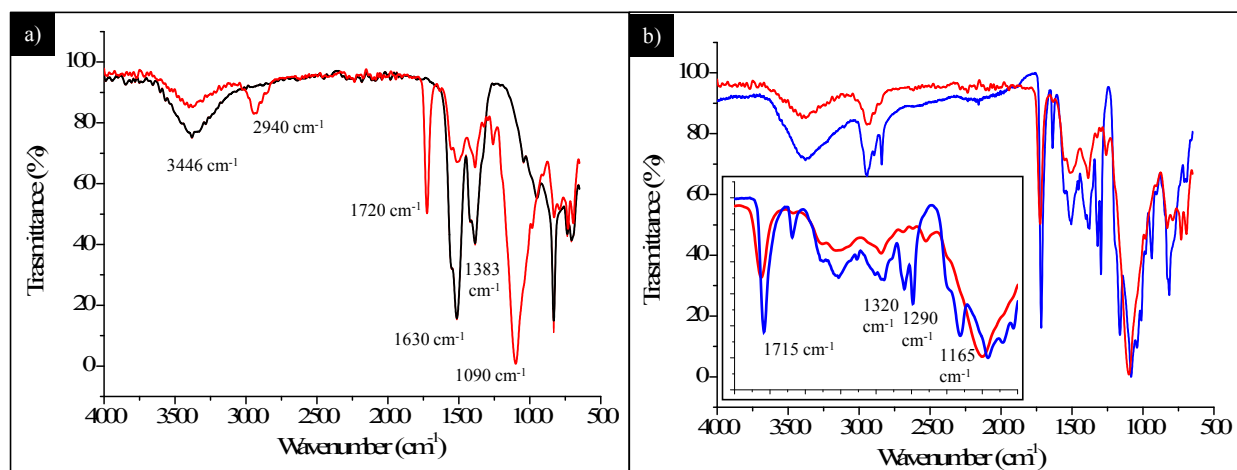


Figure S1. FT-IR spectra of: a) pristine ZnO (black line) and ZnO functionalized with TMMS (ZnO-TMMS, red line); b) ZnO-TMMS (red line) and ZnO@POSS-10 (blue line).

Pristine ZnO (Fig. S1a, black line) showed broad absorption bands at 3380 cm^{-1} and 1550 cm^{-1} assigned to the stretching and bending vibration modes of water most likely adsorbed by H-bonding to OH groups on the surface of ZnO nanoparticles. The other band at 1383 cm^{-1} in the ZnO sample was considered an impurity. After reacting ZnO with TMMS, the spectrum (Fig. S1a, red line) revealed the characteristic absorption bands of the silane. In detail, the weak band at 2940 cm^{-1} was assigned to the stretching of C–H vibration, while those at 1725 and at 1085 cm^{-1} were associated to the vibration of C=O and Si–O–C bonds of TMMS ⁽ⁱ⁾.

In Figure S1b the spectra of ZnO-TMMS (red line) and ZnO@POSS-10 (blue line) are compared. ZnO@POSS-10 NPs show the bands at 2950 and 2890 cm^{-1} attributable to the C–H stretching vibrations of methyl and methylene groups of POSS terminations. The vibrations typical of methacryloxy groups ($\nu\text{ C=O}$, $\nu\text{ C=C}$, $\nu\text{ -C-CO-O-}$) and the Si–O–C stretching increase in intensity if compared to those observed in ZnO-TMMS (see inset Fig. S1b).

(i) C. G. Allen, D. J. Baker, J. M. Albin, H. E. Oertli, D. T. Gillaspie, D. C. Olson, T. E. Furtak, R. T. Collins *Langmuir* **2008**, *24*, 13393–13398

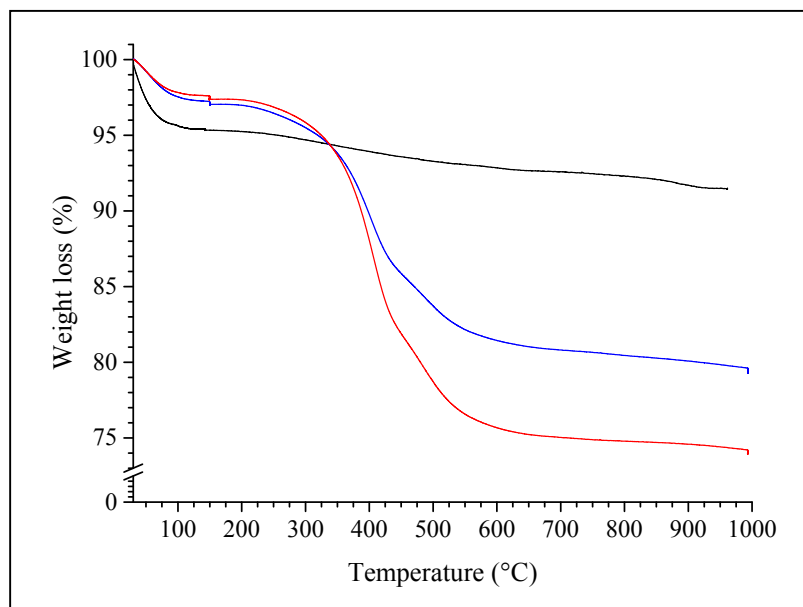


Figure S2. TGA curves of pristine SiO₂ Rhodia (black line), SiO₂-TMMS (blue line) and SiO₂@POSS-10 (red line) nanoparticles.

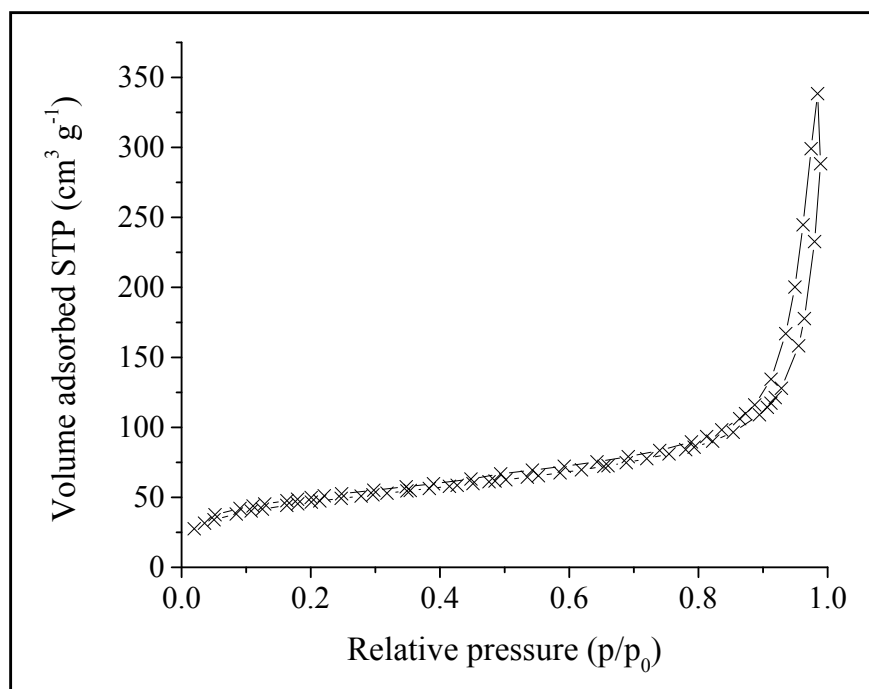


Figure S3. Adsorption/desorption isotherms at liquid nitrogen temperature for pristine SiO₂ Rhodia NPs. The curve corresponds to a type IV isotherm with capillary condensation in the mesopores.

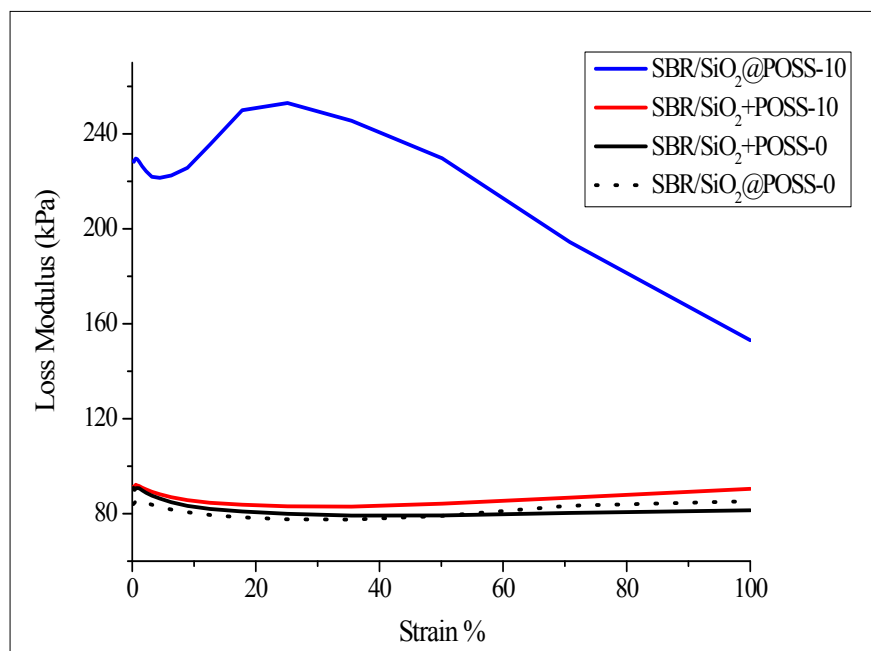


Figure S4. Loss modulus (G'') vs. strain for the uncured composites.