

SUPPORTING INFORMATION

Tailoring the dielectric and mechanical properties of polybutadiene nanocomposites by using designed ladder-like polysilsesquioxanes

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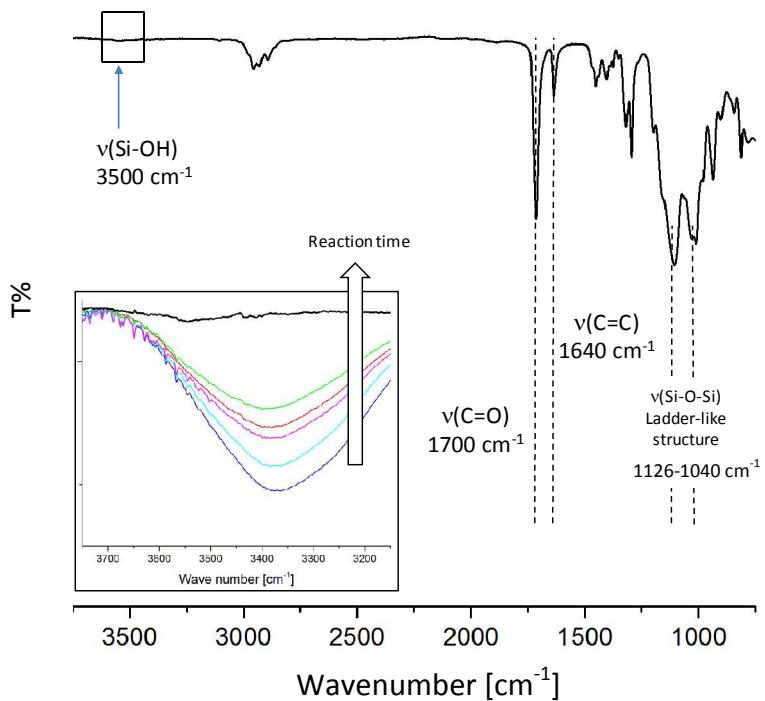


Figure S1. FT-IR spectrum of pure LPMASQ.

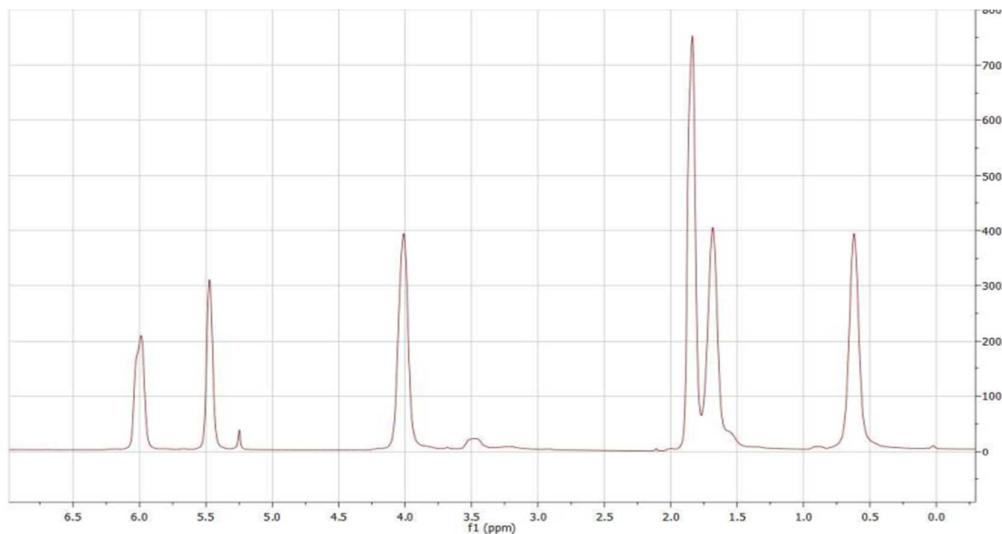


Figure S2. ^1H NMR spectrum of pure LPMASQ in CDCl_3 .

^1H NMR analyses were carried out with a Bruker 400WB spectrometer operating at a proton frequency of 400.13 MHz.

FT-IR spectrum of LPMASQ shows the following main bands (Fig. S1): the silane C–H stretching at 2940 and 2830 cm^{-1} ; the intense absorption bands at 1730 cm^{-1} and 1640 cm^{-1} deriving from C=O and C=C stretching of the methacryl groups, the methylene C–H bending at 1454 cm^{-1} ; the –C–CO–O– skeletal vibration from the methacryloxy groups at 1320 and 1210 cm^{-1} ; finally, the relative intensity of the peaks at 1028 and 1112 cm^{-1} (Si-O asymmetric stretching) confirms the ladder-like silsesquioxane structure, according to the literature ¹⁻³. No peaks associated to residual silanol groups can be detected in the spectrum. ¹H NMR (Fig. S2) spectrum of the obtained sample appears superimposable to that reported in literature ⁴⁻⁵, showing the typical signals due to the protons of methacryloxypropyl groups and the absence of unreacted methoxy or silanol groups. Therefore, both FTIR and NMR spectra confirm the complete hydrolysis-condensation of TMMS alkoxyde groups.

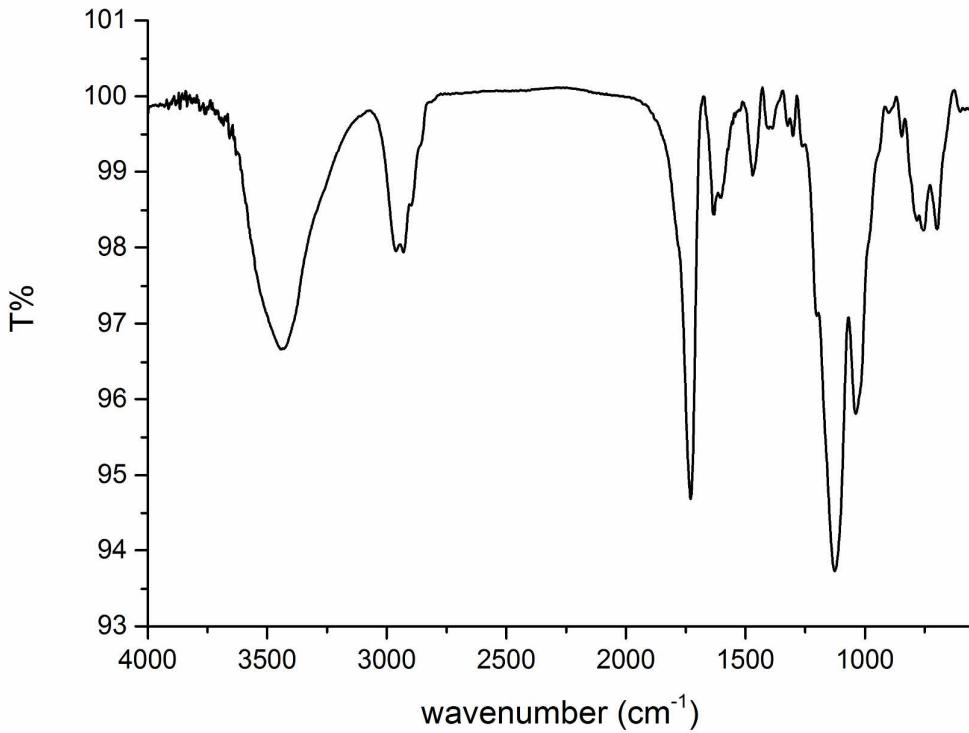


Figure S3. FT-IR spectrum of LPMASQ polymerized with AIBN.

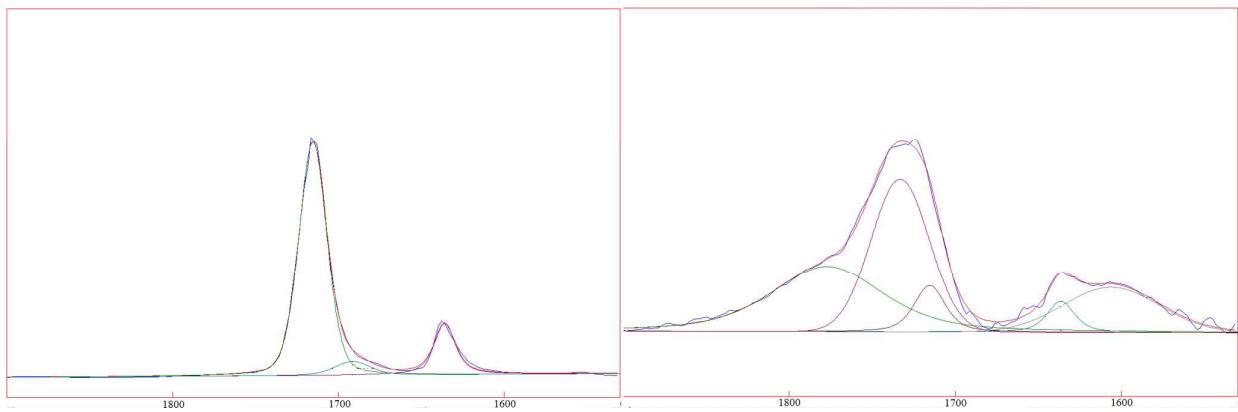


Figure S4. Magnification of C=O and C=C stretching region of FT-IR spectrum of pure LPMASQ (left) and polymerized LPMASQ (right).

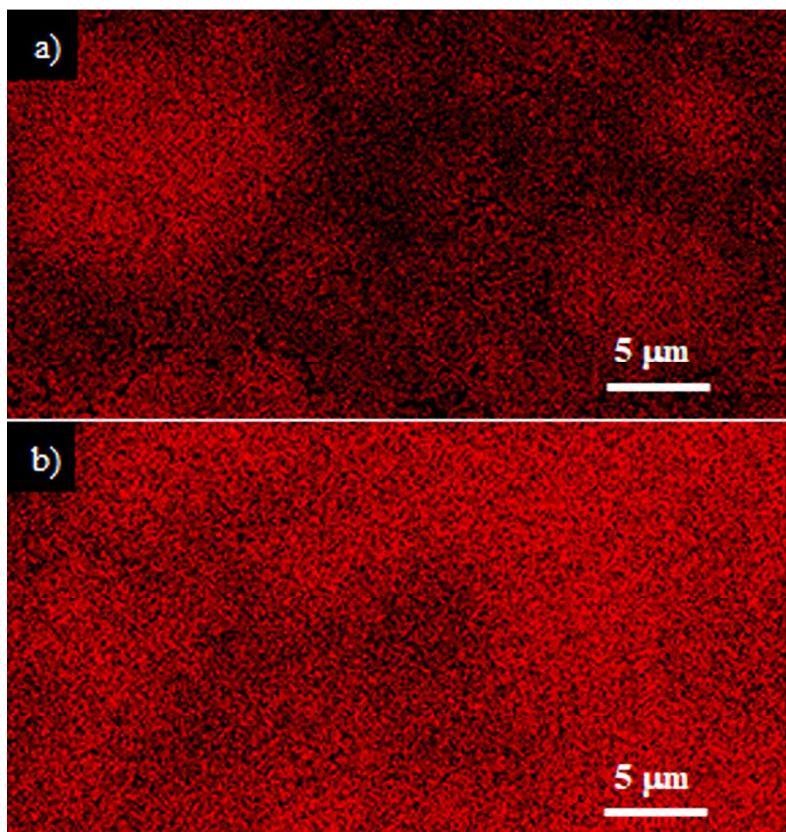


Figure S5. Representative Si elemental mapping for a) PB/25%LPMASQ_2h and b) PB25%/LPMASQ_24h

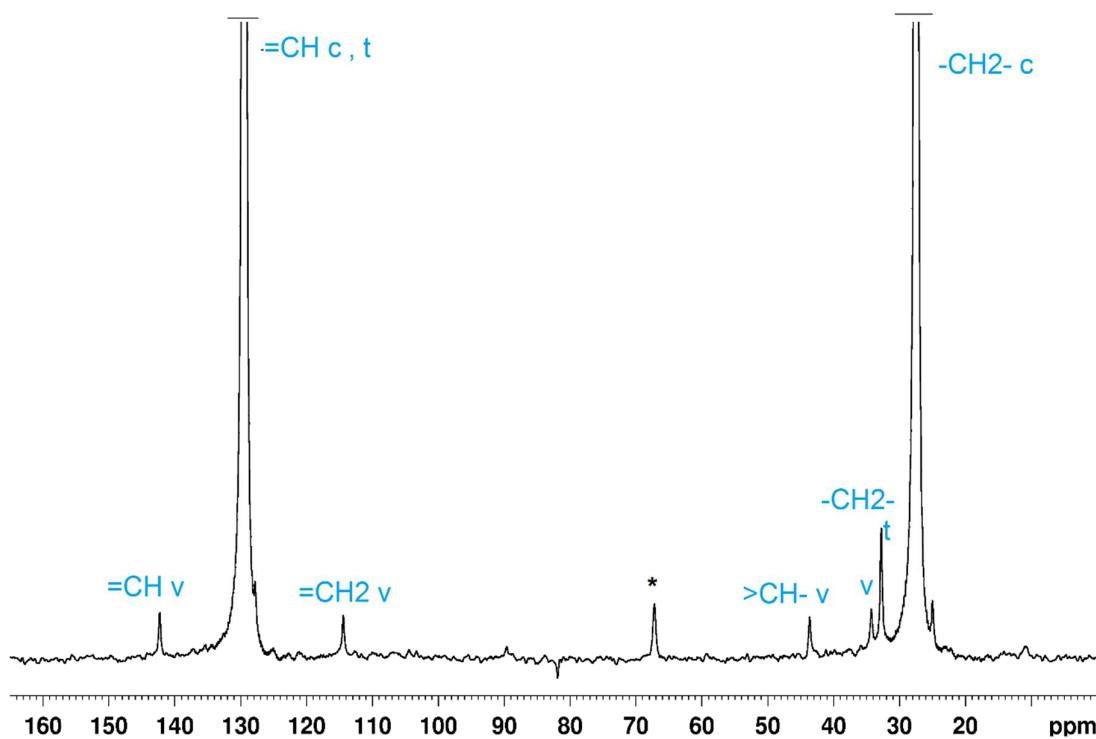


Figure S6. ^{13}C MAS NMR spectrum of pure 1,4 cis Polybutadiene ($v = 1,2$ polymerized units, $c = 1,4$ cis, $t = 1,4$ trans). Peaks marked with * are spinning sidebands.

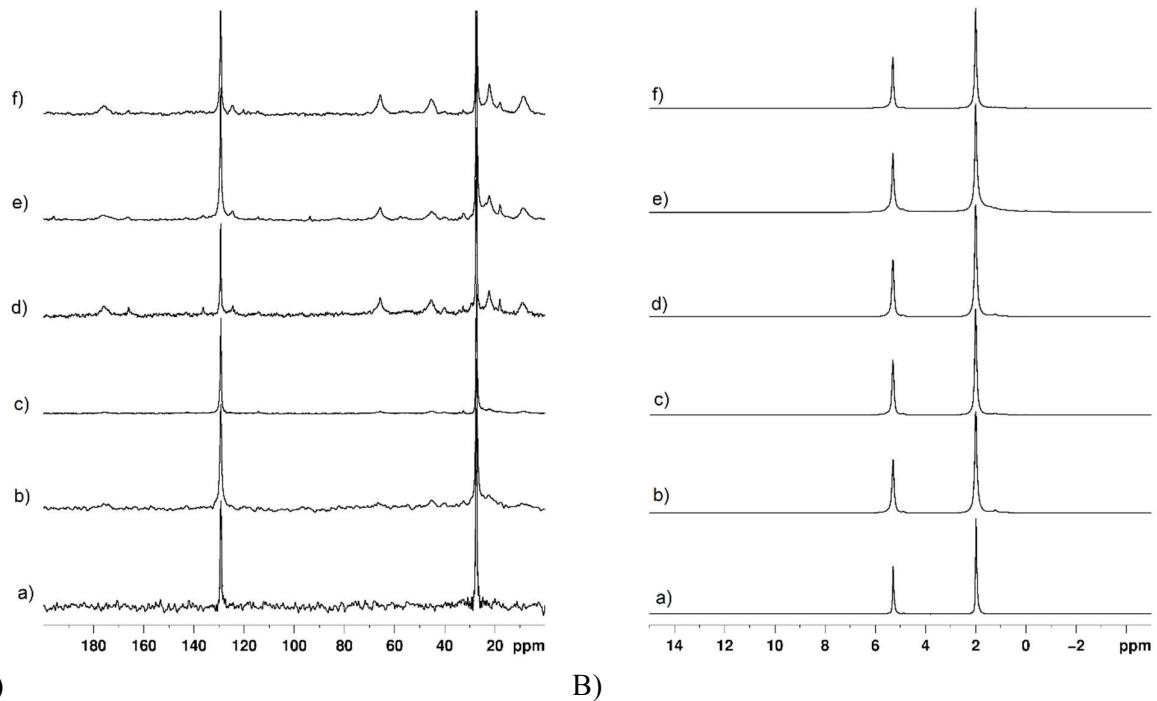


Figure S7. A) ¹³C CP MAS and B) ¹H MAS spectra of a) pristine PB, b) PB/3%LPMASQ_24h. c) PB/5%LPMASQ_24h, d) PB/10%LPMASQ_24h, e) PB/15%LPMASQ_24h, and f) PB/25%LPMASQ_24h.

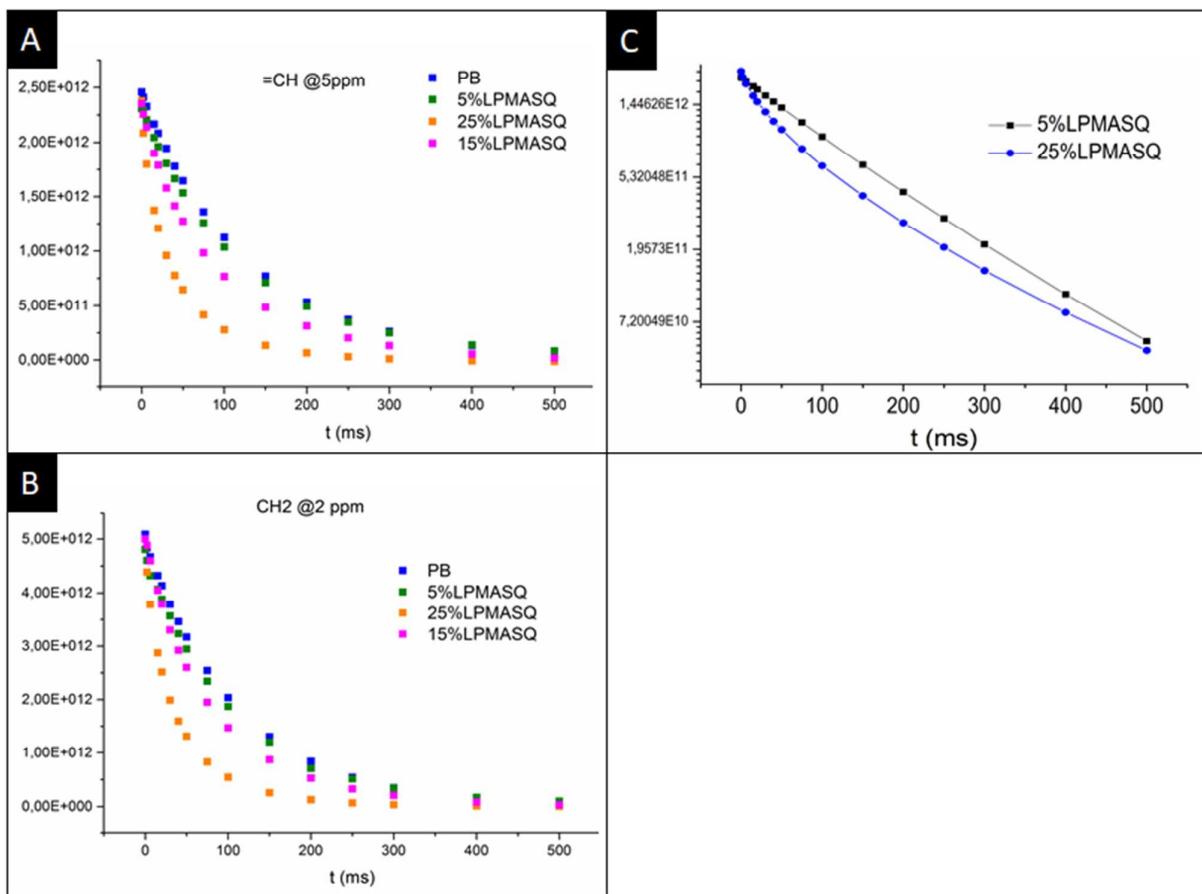


Figure S8. Plots of Magnetization of polybutadiene A) CH and B) CH₂ curves in ¹H T_{1ρH} experiments for pristine PB, PB/5%LPMASQ_24h, PB/15%LPMASQ_24h, and PB/25%LPMASQ_24h representative samples, and C) CH logarithmic plots for PB/5%LPMASQ_24h and PB/25%LPMASQ_24h.

Table S1. Dissipation factor ($\tan \delta$) for PB/Y%LPMASQ_24h nanocomposites

Sample	Tan δ
PB/3%LPMASQ_24h	0.026
PB/5%LPMASQ_24h	0.033
PB/7.5%LPMASQ_24h	0.051
PB/10%LPMASQ_24h	0.166
PB/15%LPMASQ_24h	0.039
PB/25%LPMASQ_24h	0.071
PB/40%LPMASQ_24h	0.030

References

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