Electronic Supplementary Material (ESI) for Soft Matter.

SUPPORTING INFORMATION

Filler-Rubber Interface in Styrene Butadiene Nanocomposites with Anisotropic Silica Particles. Morphology and Dynamic Properties.

*L. Tadiello,[a] M. D'Arienzo,[a] B. Di Credico, [a] T. Hanel, [b] L. Matejka,[c] M. Mauri,[a] F.Morazzoni,[a] R. Simonutti,[a] M. Spirkova,[c] R. Scotti[a]**

[a] Dip. Scienze dei Materiali, INSTM, University of Milano-Bicocca, Via R. Cozzi, 55, 20125 Milano, Italy; [b] Pirelli Tyre SpA, Viale Sarca 222, 20126 Milano, Italy; [c]Institute of Macromolecular Chemistry, Academy of Science of the Czech Republic, Heyrovskeho Nam. 2, Prague, Czech Republic.

	V-SBR-S1-35	V-SBR-S2-35	V-SBR-S5-35	V-SBR-REF-0
Rq	10.5 nm	10.0 nm	9.5 nm	8.2 nm
Ra	7.6 nm	7.8 nm	7.3 nm	6.5 nm
ΔR	2.9 nm	2.2 nm	2.2 nm	1.7 nm

Table S1: Roughness analysis of V-SBR-SX-35 nanocomposites and V-SBR-REF-0

Rq (Rms): the standard deviation of the Z values within the given area
Ra (mean roughness): the mean value of the surface relative to the center place
ΔR: difference Rq - Ra

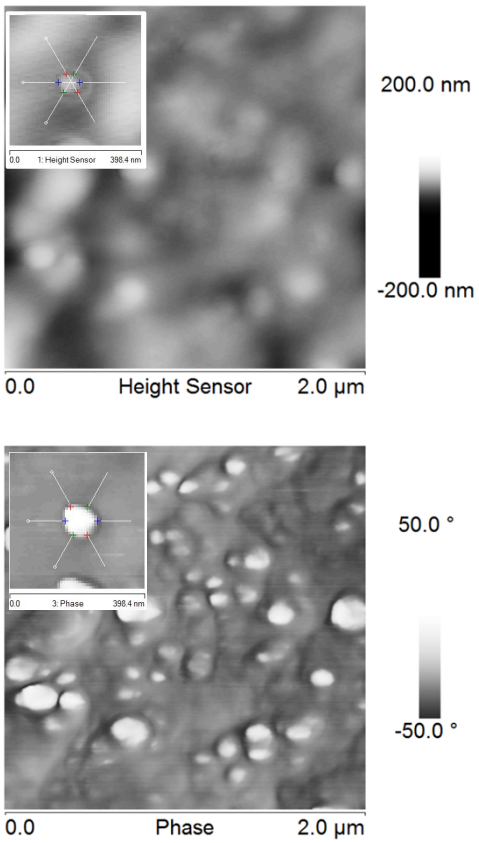


Figure S1: Height and phase images of V-SBR-S2-35 . The insets represent the image analysis of isolated NPs

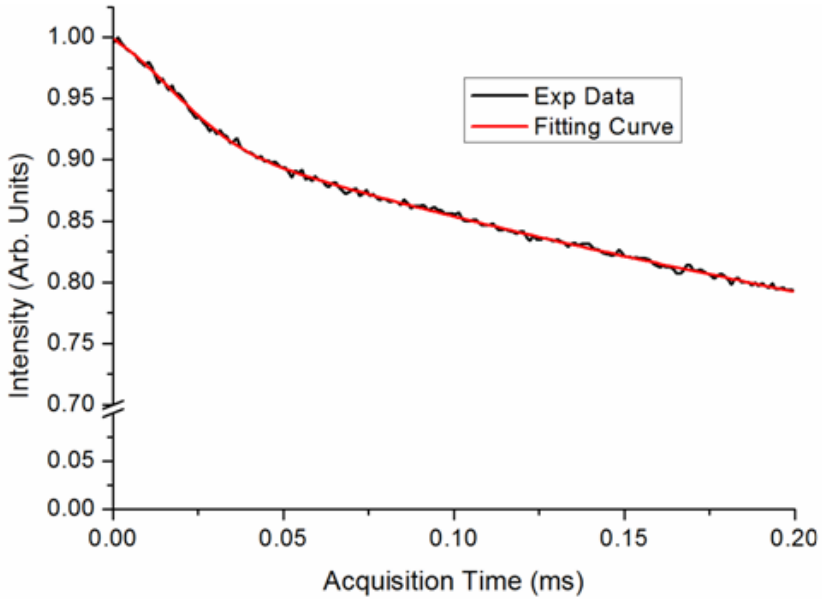


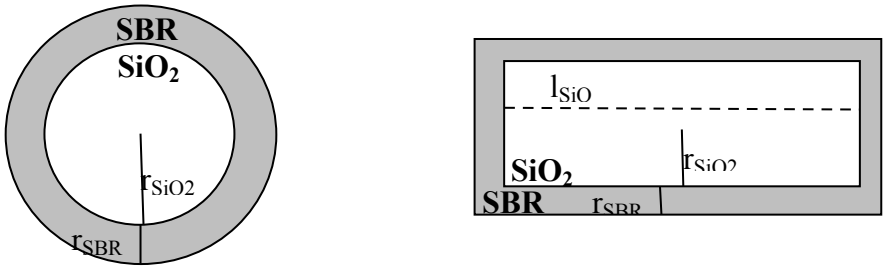
Figure S2: MSE fitting relative to sample SBR-S5-35

Table S2: Values of integrals obtained from plots of tanδ *vs*.temperature of V-SBR-SX-W

	V-SBR-S1-12	V-SBR-S2-12	V-SBR-S5-12	V-SBR-S1-25	V-SBR-S2-25	V-SBR-S5-25	V-SBR-S1-35	V-SBR-S2-35	V-SBR-S5-35
Area of experimental curve	39,19	37,91	34,46	32,10	32,82	29,03	30,11	29,43	29,41
Area of sum curve	36,46	39,60	32,26	34,34	32,04	30,72	28,52	29,76	30,46
Area peak 1	34,57	32,76	29,95	29,17	29,04	25,67	23,44	22,55	22,50
Area peak 2	1,92	2,20	2,32	2,23	3,00	3,37	5,08	7,88	8,32
R_i %	5,2	6,3	7,2	7,1	9,3	11,6	17,8	25,9	27,0

Estimation of the thickness of rigid rubber (SBR) from MSE-NMR measurements

The thickness of the rigid rubber was calculated by modeling the shapes of SiO_2-X particles as perfect spheres or cylinders surrounded by a homogeneous layer of rigid rubber:



a) Total SiO_2 volume (V_{SiO2}):

$$V_{SiO_2} = \frac{m_{SiO_2}}{d_{SiO_2}(1 - p_{SiO_2})}$$

m_{SiO2} SiO_2 mass
d_{SiO2} SiO_2 density d_{SiO2}= 0.74 gcm^{-3} (from picnometer)
p_{SiO2} SiO_2 pore volume p_{SiO2}= 1.5, 1.2, 2.5 cm^{3}g^{-1} for S1, S2, S5 (from BET)

b) Number of SiO_2 particles (n_{SiO2}):

$$n_{SiO_2} = \frac{V_{SiO_2}}{v_{SiO_2}} = \frac{V_{SiO_2}}{\frac{4}{3}\pi r_{SiO_2}^3}$$ for shperical particles (S1)

$$n_{SiO_2} = \frac{V_{SiO_2}}{v_{SiO_2}} = \frac{V_{SiO_2}}{r_{SiO_2}^2 \pi l_{SiO_2}}$$ for rod-like particles (S2, S5)

v_{SiO2} SiO_2 particle volume
r_{SiO2} SiO_2 particle radius (S1) or half cross-section (S2, S5) from TEM
l_{SiO2} SiO_2 particle lenght (S2, S5)

c) Total SBR volume (V_{SBR}) and total rigid SBR volume (V'_{SBR}):

$$V_{SBR} = \frac{m_{SBR}}{d_{SBR}} \qquad V'_{SBR} = V_{SBR} f_r^*$$

m_{SBR} SBR mass
d_{SBR} SBR density
f_r^* rigid SBR fraction (from MSE-NMR measurements)

d) Rigid SBR volume for single SiO_2 nanoparticles (v'_{SBR}):

$$v'_{SBR} = \frac{V'_{SBR}}{n_{SiO_2}}$$

e) Thickness of the rigid SBR layer (r_{SBR})

$$v = v'_{SBR} + v_{SiO_2}$$

v total volume of SiO_2 nanoparticles with a layer of rigid SBR

The thickness of the rigid SBR layer (r_{SBR}) can be calculated by the equations:

$$v = \frac{4}{3}\pi(r_{SBR} + r_{SiO_2})^3$$ for shperical particles (S1)

$$v = (r_{SBR} + r_{SiO_2})^2(l_{SiO_2} + 2r_{SBR})$$ for rod-like particles (S2, S5)