

Supporting Information

Hybrid acrylic/CeO₂ nanocomposites using hydrophilic spherical and high aspect ratio CeO₂ nanoparticles

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Morphology of the CeO₂ NP/NR dispersion

In Figure S.1 the dimensions of 500 nanorods and nanoparticles measured from the TEM images to compute the particle size distributions (PSDs) of each population are presented.

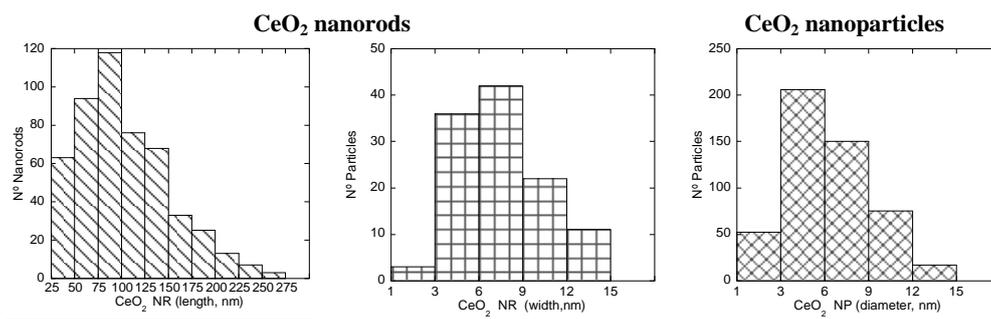


Figure S.1. CeO₂ nanorods and CeO₂ nanoparticles size distributions.

X-ray Photoelectron Spectroscopy (XPS)

XPS composition data and spectra were acquired on SPECS (Berlin, Germany) instrument equipped with Phoibos 150 1D-DLD analyzer and a monochromatic Al K α X-ray source. Compositional survey and detail scans were acquired using pass energy of 80 eV. High resolution spectra were acquired using pass energy of 30 eV. The above data were taken at 90° takeoff angle. Data analysis was performed with Casa XPS 2.3.16 Software to fit the signals to Gauss-Lorentzian curves, after removing the background (Shirley). The curves were treated to smooth the noise in Kaleida Graph 4.02. Energy correction was performed by using the C1s peak at 284.6 eV as reference. In Figure S.2 and Table S.1 the binding energy peaks and their values for V501, original dispersion, dialyzed sample and centrifuged samples are presented.

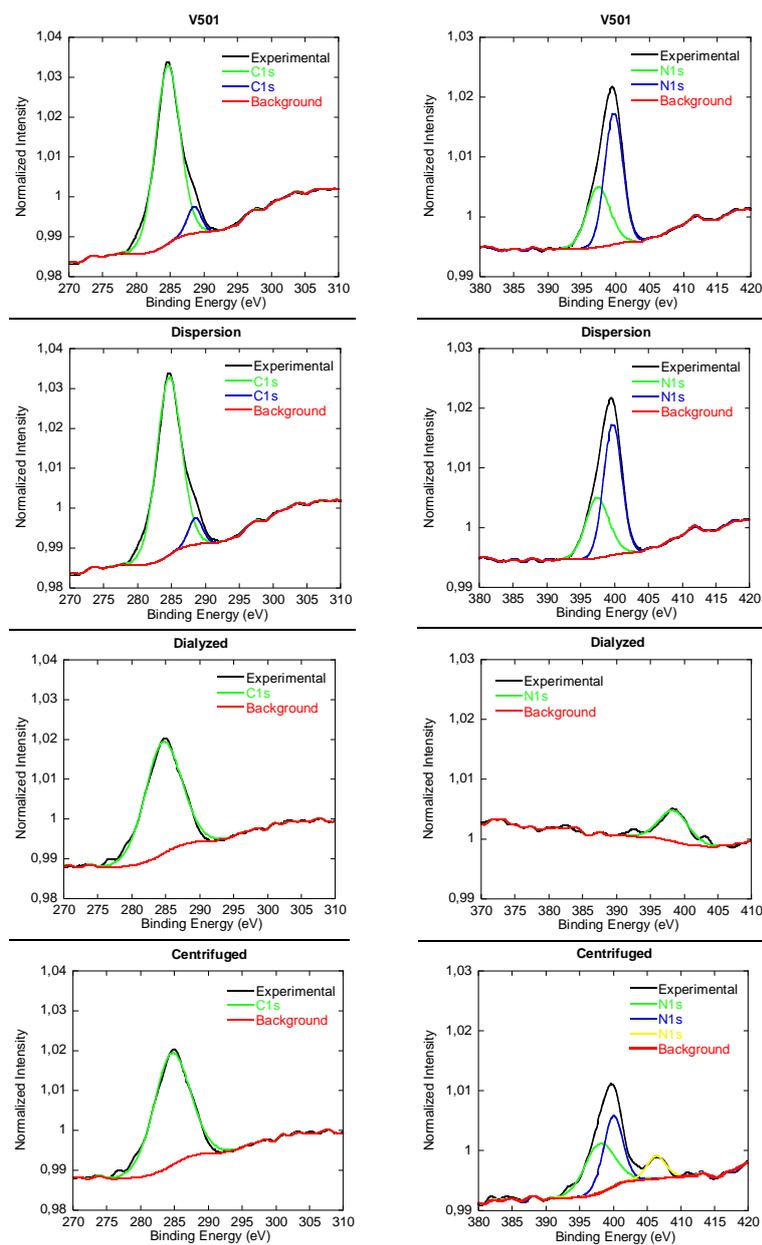


Figure S.2. X-ray spectra of the V501, original dispersion, dialyzed and centrifuged samples after the curve fitting.

The contributions for the C species were fitted and assigned according to literature values^{1,2}.

Table S. 1. Location of the Binding Energies of V501, original, dialyzed and centrifuged samples.

		V501	Original	Dialyzed	Centrifuged
C	C 1s	284.6	284.6	284.6	284.6
	C 1s	289	289	-	289
N	N 1s	397.5	397.5	-	397.9
	N 1s	399.7	399.7	398.5	399.9
	N 1s	-	405.8	-	406.3

Nuclear Magnetic Resonance (NMR)

The supernatant water of the centrifuged samples was characterized by ^{13}C -NMR spectroscopy. Both samples were dissolved in deuterated water (D_2O) and analyzed in a Bruker AVANCE-400 spectrometer 400 MHz for 9 hours.

The signals of the NMR spectra shown in the article were assigned as follows. The peaks at 180 ppm and 173 ppm were assigned to the C of the carboxylic groups of the V501 (1) and NTA (1') respectively. The two methylene groups of the V501, 2 and 3 were corresponded to the signals 32 and 34 ppm, and the methyl group (6) of the V501 appeared at 24 ppm. The signal at 58 ppm was assigned to the quaternary C (4) of the V501 while the signal at 118 ppm to the cyano group (5). The signal of the methylene group of the NTA corresponded to the peak at 56 ppm.

Polymer particle size distribution

In Figure S.3 the dimensions of 500 polymer particles from Run 2 and Run 4 measured from the TEM images to compute the particle size distributions (PSDs) of each latex are presented.

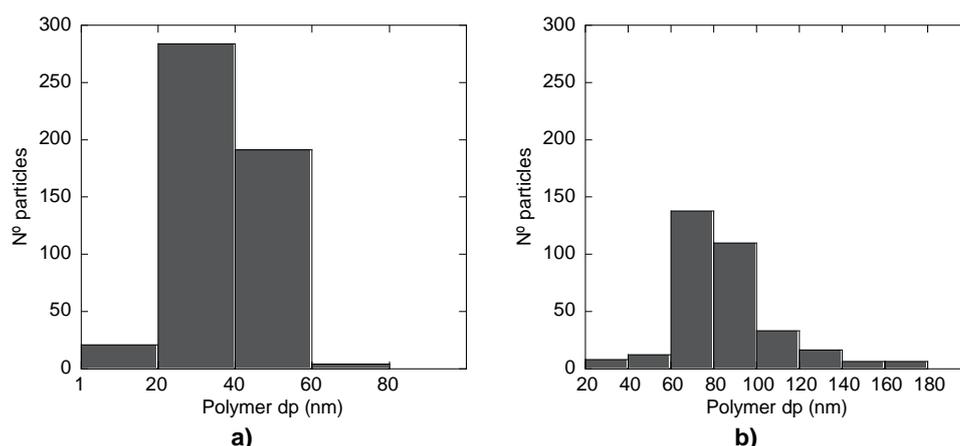


Figure S.3. Polymer particle size distributions for a) Run 2 and b) Run 4.

Latex stability measurements

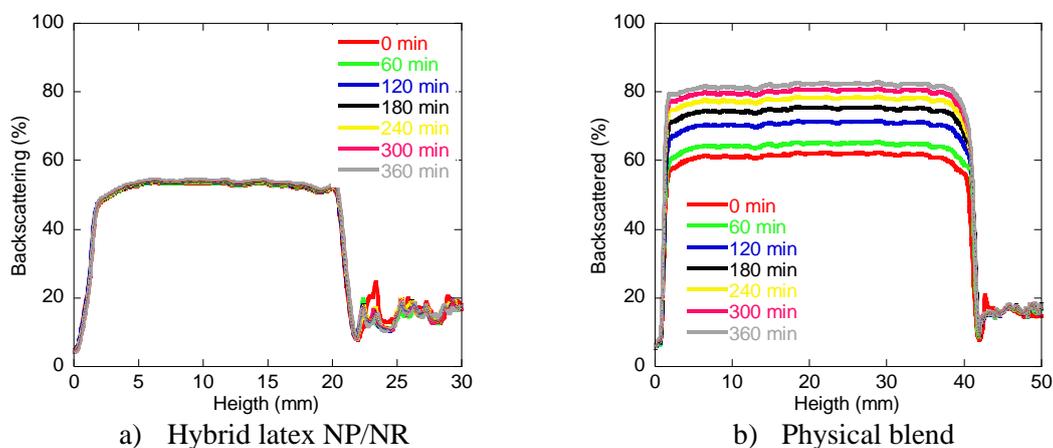


Figure S.4. Stability measured for the hybrid latex containing 3.7 wt% of CeO_2 NP/NR and a physical blend containing 3.5 wt% of CeO_2 NP/NR.

Figures in S.4 compare the stability of the hybrid latex Run 4 and that of a physical mixture of a blank latex with the dispersion of NP/NR. The study was done in the Tursbiscan lab equipment for 6 hours at 60°C.

Differential Scanning Calorimetry

Figure S.5 presents the DSC measurements for three different sample types: a blank polymer (obtained from a blank latex without CeO₂), nanocomposites obtained by in-situ polymerization with spherical CeO₂ (see Polymer 55 (2014) 752-761) and the nanocomposite from Run 4, which contains 3.7% of NP/NR.

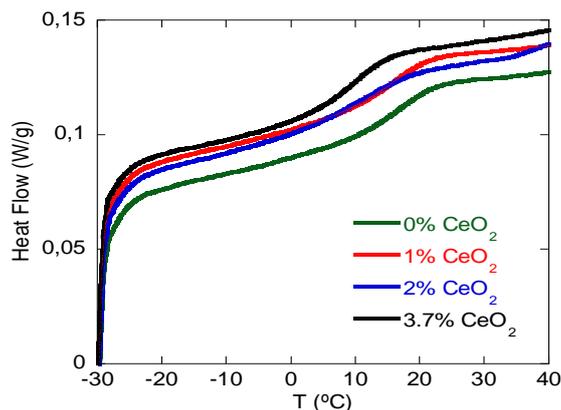


Figure S.5 DSC (Differential Scanning Calorimetry) measurements for the blank latex, hybrid latexes with 1 wt% and 2 wt% of CeO₂ NP and the hybrid latex synthesized with 3.7 wt% of CeO₂ NP/NR.

Thermogravimetric analysis (TGA)

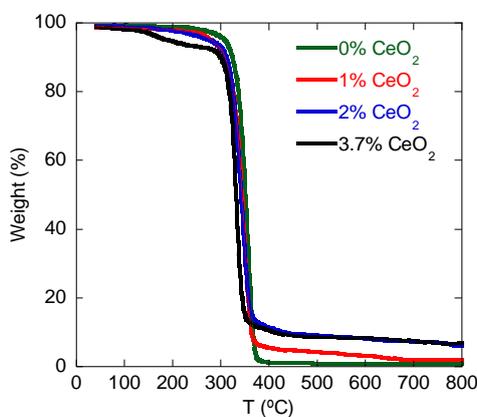


Figure S.6 Thermogravimetric analysis (TGA) for the blank latex, hybrid latexes with 1 wt% and 2 wt% of CeO₂ NP and the hybrid latex synthesized with 3.7 wt% of CeO₂ NP/NR..

Figure S.6 presents the TGA measurements for three different sample types: a blank polymer (obtained from a blank latex without CeO₂), nanocomposites obtained by in-situ polymerization with spherical CeO₂ (see Polymer 55 (2014) 752-761) and the nanocomposite from Run 4, which contains 3.7% of NP/NR.

References

1. <http://www.lasurface.com/database/elementxps.php>.
2. <http://srdata.nist.gov/xps/selectEnergyType.aspx>.