Supplementary Materials

Conductive and Thermo-Responsive Composite Hydrogels with Poly(N-Isopropylacrylamide) and Carbon Nanotubes Fabricated by Two-Step Photopolymerization

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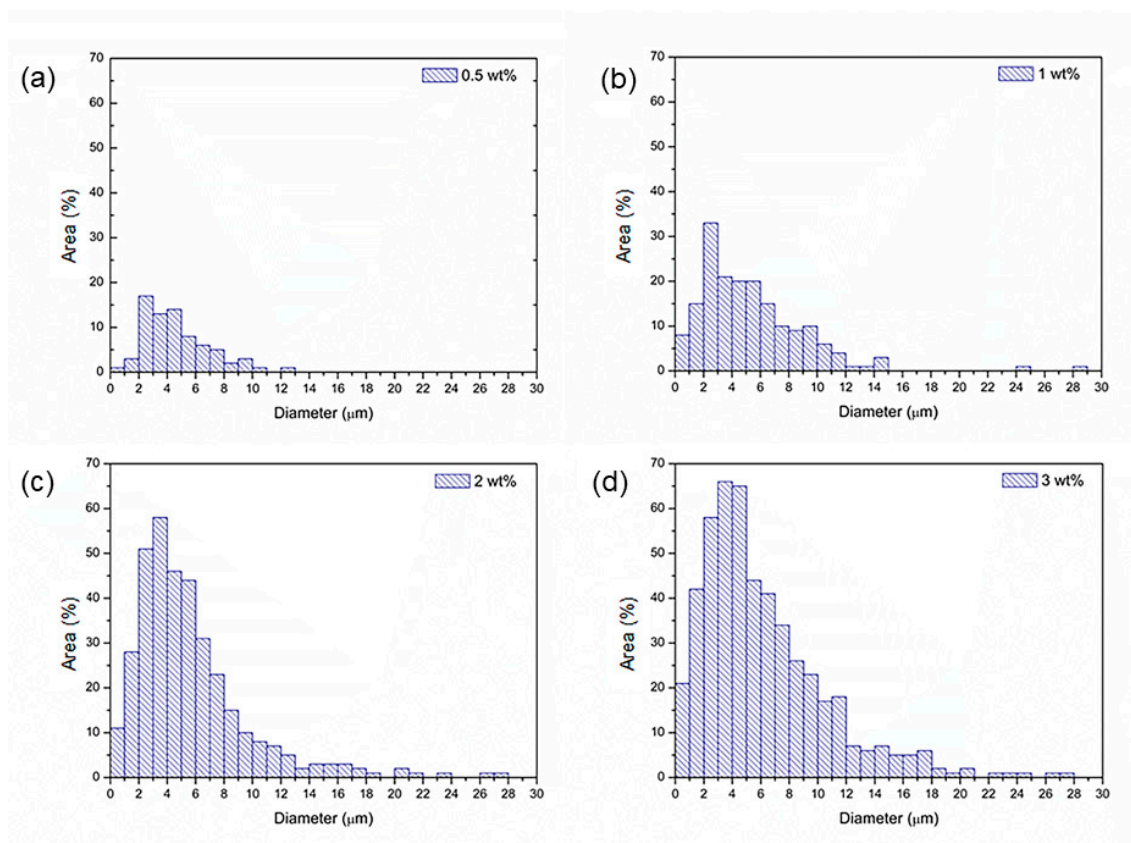*Correspondence: mariagabriella.santonicola@uniroma1.it; Tel.: +39-06-49766372

Figure S1. Particle size distribution of MWCNT-COOH aggregates after dispersion in the PNIPAM gel obtained by the first photopolymerization. Concentration of nanotubes equal to (a) 0.5 wt%, (b) 1.0 wt%, (c) 2.0 wt%, (d) 3.0 wt%.
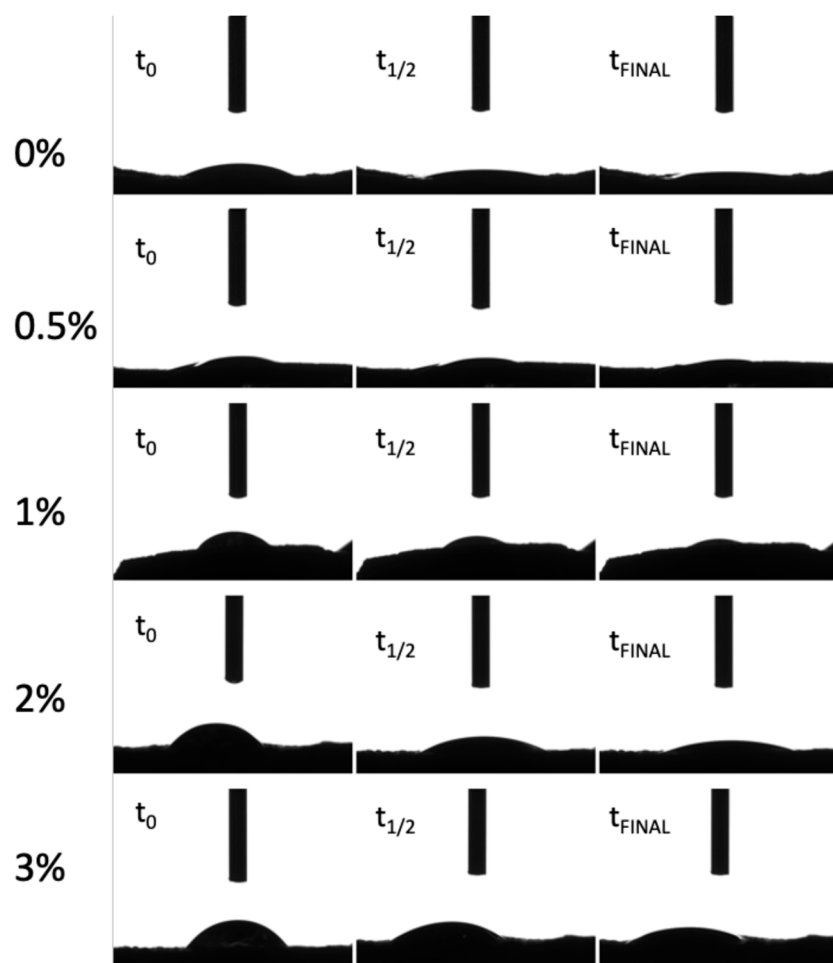
Figure S2. Contact angle analysis at 3 different time frames for pure PNIPAM hydrogel and PNIPAM/MWCNT-COOH composites with different nanotube concentrations (0.5, 1, 2, and 3 wt%).
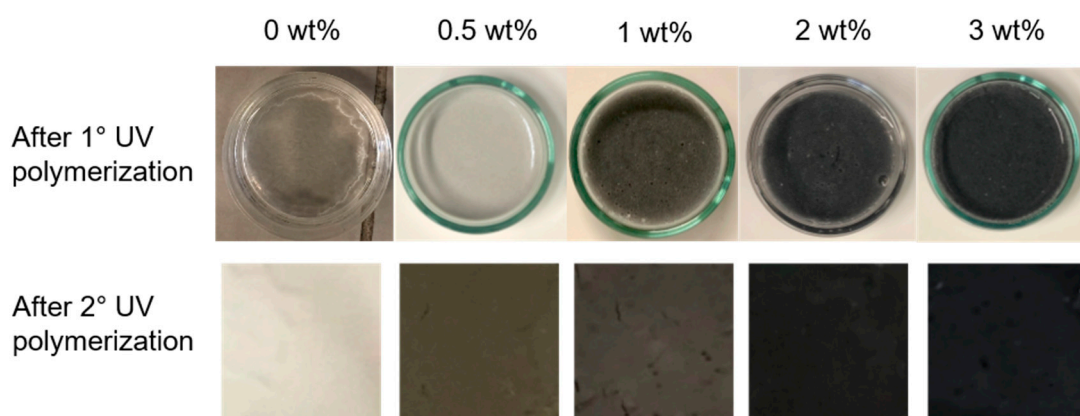

Figure S3. Images of PNIPAM and PNIPAM/MWCNT-COOH composite hydrogels during the two-step photopolymerization process. Top: PNIPAM/MWCNT-COOH gels after dispersion of the nanotubes in the PNIPAM gel. Bottom: top surface of the final hydrogels after the second step of photopolymerization and purification in water.

Table S1. Mean particle size of MWCNT-COOH aggregates after dispersion in the PNIPAM gel obtained by the first photopolymerization.

MWCNT-COOH (wt%)	Mean Particle Size (µm)
0.5	4.58 ± 2.24
1	5.15 ± 3.13
2	5.43 ± 3.62
3	5.96 ± 3.92

Table S2. Mean values of the parameters of the equivalent circuit (Figure 11a) used for fitting the electrical impedance data of hydrogels in water.

MWCNT-COOH (wt%)	R_1 [Ω]	R_2 [Ω]	Y01 [$\alpha \times \Omega^{-1} \times s^{\alpha}$]	α_{01}	Wd [$n \times \Omega^{-1} \times s^{0.5}$]	Goodness of Fit
1	$2.1 \times 10^{2} \pm 9.1$	$1.7 \times 10^{4} \pm 2.9 \times 10^{3}$	$5.0 \times 10^{-6} \pm 4.2 \times 10^{-7}$	$6.8 \times 10^{-1} \pm 7.3 \times 10^{-3}$	$5.1 \times 10^{-5} \pm 9.1 \times 10^{-6}$	$1.4 \times 10^{-2} \pm 2.4 \times 10^{-4}$
2	$1.5 \times 10^{2} \pm 3.3$	$1.4 \times 10^{4} \pm 1.5 \times 10^{3}$	$1.5 \times 10^{-5} \pm 1.4 \times 10^{-6}$	$6.0 \times 10^{-1} \pm 9.5 \times 10^{-3}$	$1.5 \times 10^{-4} \pm 1.8 \times 10^{-5}$	$1.0 \times 10^{-2} \pm 5.6 \times 10^{-4}$
3	$3.5 \times 10^{1} \pm 7.9 \ 10^{-1}$	$4.6 \times 10^{3} \pm 4.6 \times 10^{2}$	$6.1 \times 10^{-5} \pm 7.3 \times 10^{-6}$	$6.2 \times 10^{-1} \pm 9.8 \times 10^{-3}$	$4.9 \times 10^{-4} \pm 1.7 \times 10^{-4}$	$9.6 \times 10^{-3} \pm 6.8 \times 10^{-4}$

MWCNT-COOH (wt%)	Y_{01} $[\alpha \times \Omega^{-1} \times s^{\alpha}]$	α_{01}	Y_{02} $[\alpha \times \Omega^{-1} \times s^{\alpha}]$	α_{02}
1	$5.8 \times 10^{-10} \pm 1.1 \times 10^{-10}$	$8.3 \times 10^{-1} \pm 1.2 \times 10^{-1}$	$9.0 \times 10^{-7} \pm 9.1 \times 10^{-8}$	$6.9 \times 10^{-1} \pm 1.9 \times 10^{-2}$
2	$2.7 \times 10^{-7} \pm 1.3 \times 10^{-7}$	$3.2 \times 10^{-1} \pm 1.1 \times 10^{-1}$	$1.5 \times 10^{-6} \pm 4.9 \times 10^{-7}$	$5.8 \times 10^{-1} \pm 2.0 \times 10^{-1}$
3	$6.1 \times 10^{-9} \pm 5.6 \times 10^{-10}$	$6.18 \times 10^{-1} \pm 1.3 \times 10^{-1}$	$2.5 \times 10^{-6} \pm 4.9 \times 10^{-7}$	$6.7 \times 10^{-1} \pm 2.3 \times 10^{-2}$

Table S3. Mean values of the parameters of the equivalent circuit (Figure 11b) used for fitting the electrical impedance data of hydrogels in PBS.

MWCNT-COOH (wt%)	R1 $[\Omega]$	R2 $[\Omega]$	R3 $[\Omega]$	Wd $[n \times \Omega^{-1} \times s^{0.5}]$	Goodness of Fit
1	$4.9 \times 10^{3} \pm 3.2 \times 10^{3}$	$2.0 \times 10^{4} \pm 5.9 \times 10^{3}$	$8.6 \times 10^{4} \pm 3.5 \times 10^{3}$	$6.6 \times 10^{-5} \pm 1.3 \times 10^{-5}$	$5.1 \cdot 10^{-4} \pm 6.2 \times 10^{-5}$
2	$5.2 \times 10^{2} \pm 6.0 \times 10$	$1.8 \times 10^{4} \pm 5.5 \times 10^{3}$	$7.9 \times 10^{4} \pm 2.7 \times 10^{4}$	$2.8 \times 10^{-5} \pm 9.2 \times 10^{-6}$	$9.1 \cdot 10^{-3} \pm 6.2 \times 10^{-4}$
3	$6.5 \times 10^{2} \pm 1.3 \times 10^{3}$	$1.1 \times 10^{4} \pm 2.6 \times 10^{3}$	$3.5 \times 10^{4} \pm 2.5 \times 10^{3}$	$8.8 \times 10^{-5} \pm 7.4 \times 10^{-5}$	$1.3 \cdot 10^{-3} \pm 6.2 \times 10^{-4}$