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Supplementary Materials: Mixed Carbon Nanomaterial/Epoxy Resin for Electrically Conductive Adhesives

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Table S1. Settings used to operate the three-roll mill for the dispersion of nanomaterials in the epoxy resin.

	Roll 1 and 2		Roll 2 and 3		
Step	**Mode**	Setting	Mode	Setting	Speed
1	Gap	90 μm	Gap	30 μm	250 rpm
2	Gap	60 μm	Gap	20 μm	300 rpm
3	Gap	30 μm	Gap	10 μm	300 rpm
4	Gap	15 μm	Gap	5 μm	350 rpm
5	Gap	8 μm	Force	2–3 N·m	300 rpm
6	Gap	15 μm	Gap	5 μm	200 rpm

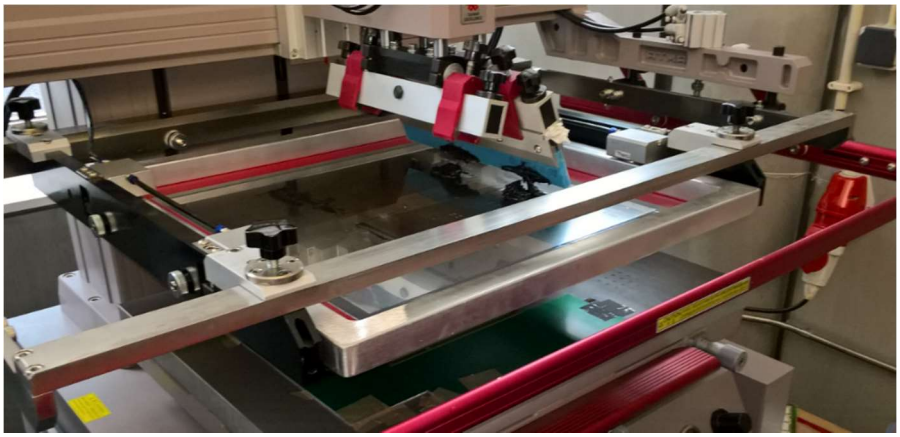


Figure S1. Stencil printing equipment used to deposit electrically conductive composits on the PCB´s.

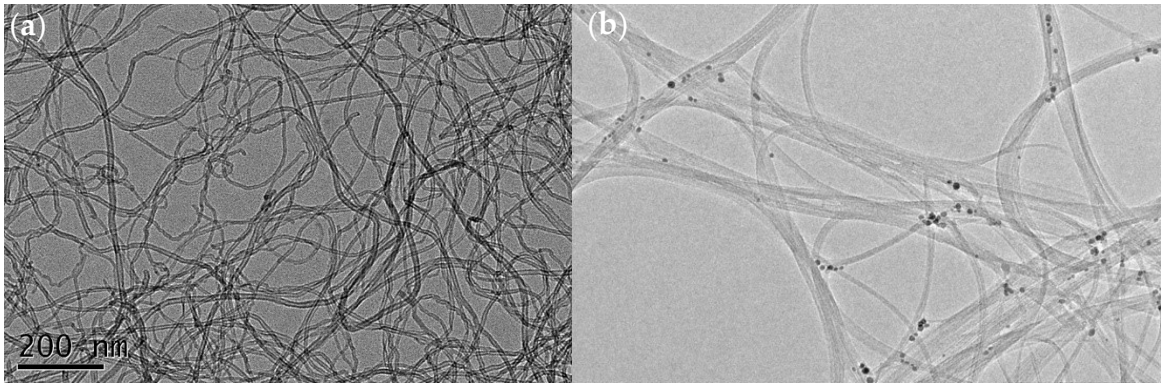
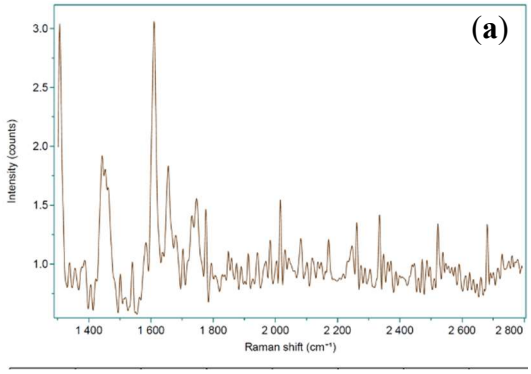
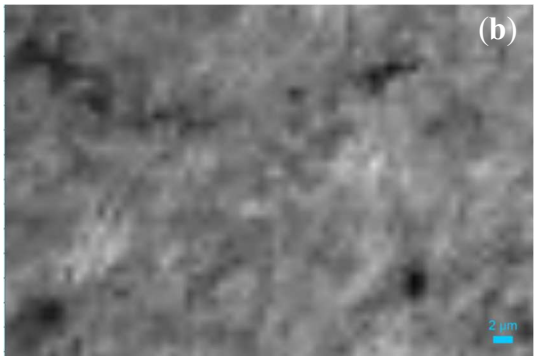


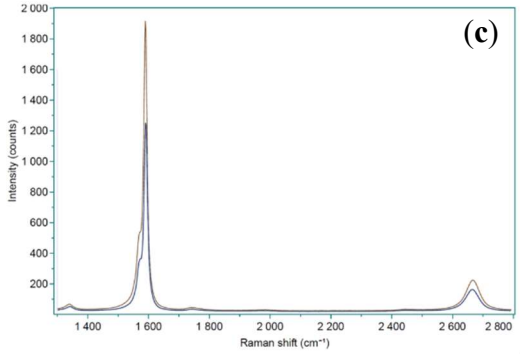
Figure S2. Transmission electron microscopy images of (**a**) individual MWCNTs NC7000 and (**b**) ropes of SWCNTs Tuball (obtained from OCSiAl site: https://ocsial.com/en/material-solutions/tuball/).

Epoxy

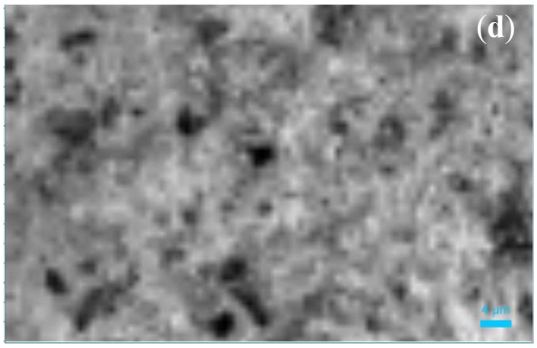


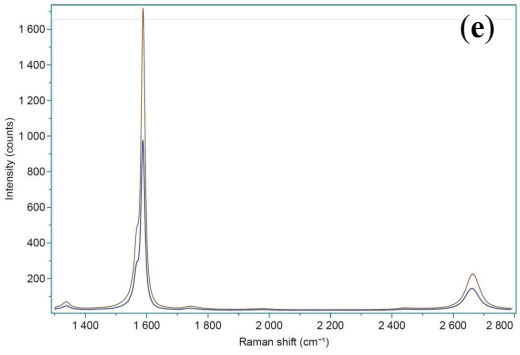
1.2 wt.% SWCNT



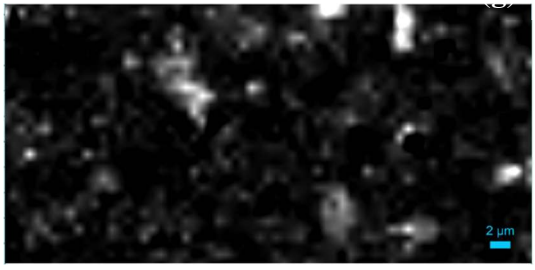


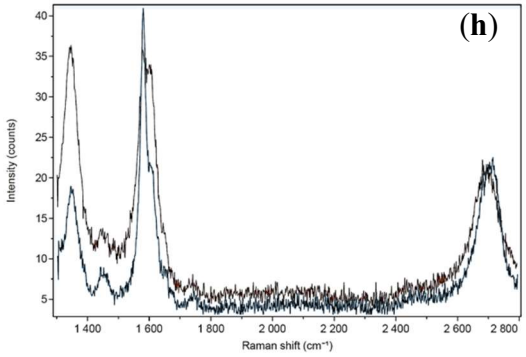
1.2 wt.% SWCNT 5 wt.% EG



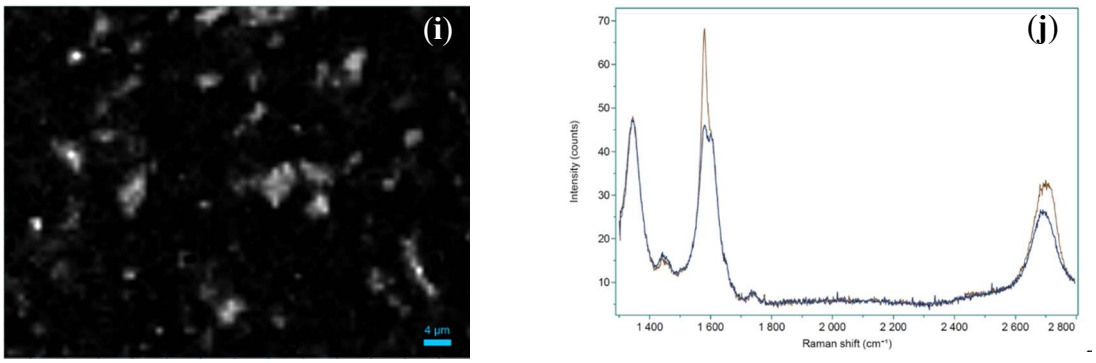


0.4 wt.% MWCNT 2 wt.% EG





0.4 wt.% MWCNT 5 wt.% EG



1.2 wt.% MWCNT 2 wt.% EG

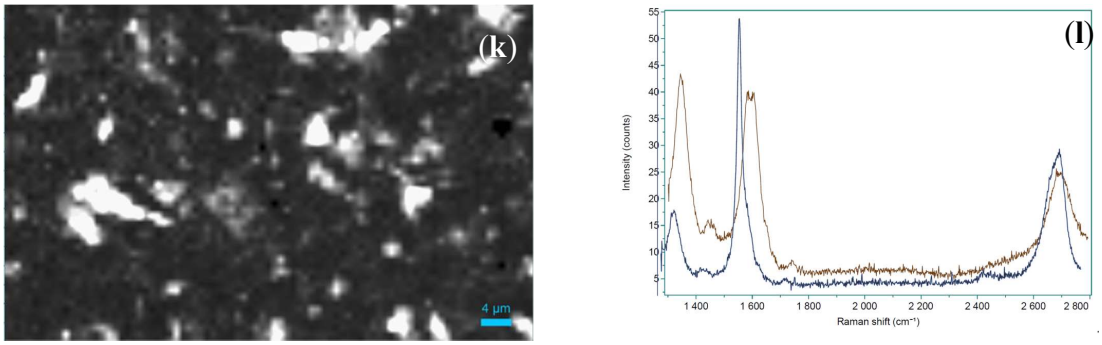


Figure S3. Images of Raman intensity maps and typical Raman spectra: (**a**) Raman spectra of the epoxy resin, (**b**) G band intensity distribution of the composite with 1.2 wt.% of SWCNT (higher intensity areas in white); (**c**) Raman spectra of the regions presenting higher and lower intensity in (**b**); (**d**) G band intensity distribution of the composite with 1.2 wt.% SWCNT and 5wt.% of EG (**e**) Raman spectra corresponding to the regions of higher and lower intensities in (**d**); (**f**) D band intensity distribution of the composite with 0.4 wt.% of MWCNT and 2 wt.% EG (darker areas corresponding to EG); (**g**) G to D intensity ratio distribution where regions of higher intensity ratio appear in white (EG) and lower intensity ratio in black (MWCNT) of the same composite; and (**h**) Raman spectra corresponding to the regions of higher and lower intensity ratio in (g); (**i**) G to D intensity ratio distribution of the composite with 0.4 wt.% of MWCNT and 5 wt.% EG; (**j**) Raman spectra corresponding to the regions of higher and lower intensity ratio in (**i**); (**k**) G to D intensity ratio distribution of the composite with 1.2 wt.% of MWCNT and 2 wt.% EG; and (**l**) Raman spectra corresponding to the regions of higher and lower intensity ratio in (**k**).

Table S2. Volume electrical resistivity for the composites prepared with epoxy CR141 and each carbon filler.

Composition	R_0 (Ω·cm)
1 wt.% EG	$2.9 \times 10^7 \pm 2.79 \times 10^7$
2 wt.% EG	$2.3 \times 10^6 \pm 1.36 \times 10^6$
3 wt.% EG	$2.6 \times 10^6 \pm 1.24 \times 10^6$
4 wt.% EG	$6.6 \times 10^5 \pm 1.69 \times 10^5$
5 wt.% EG	$3.6 \times 10^5 \pm 1.65 \times 10^5$
0.01 wt.% SWCNT	$2.53 \times 10^3 \pm 1.21 \times 10^3$
0.02 wt.% SWCNT	$5.36 \times 10^3 \pm 3.21 \times 10^3$
0.04 wt.% SWCNT	$2.96 \times 10^3 \pm 2.24 \times 10^3$
0.08 wt.% SWCNT	$4.75 \times 10^2 \pm 1.47 \times 10^2$
0.1 wt.% SWCNT	$2.99 \times 10^2 \pm 1.09 \times 10^2$
0.2 wt.% SWCNT	$7.82 \times 10^1 \pm 8.50 \times 10^0$
0.4 wt.% SWCNT	$5.56 \times 10^1 \pm 1.68 \times 10^1$
0.8 wt.% SWCNT	$1.61 \times 10^1 \pm 7.57 \times 10^0$
0.02 wt.% MWCNT	$2.2 \times 10^8 \pm 3.5 \times 10^7$
0.04 wt.% MWCNT	$2.9 \times 10^8 \pm 8.2 \times 10^7$
0.08 wt.% MWCNT	$5.5 \times 10^4 \pm 4.7 \times 10^4$
0.1 wt.% MWCNT	$2.4 \times 10^4 \pm 1.2 \times 10^4$
0.4 wt.% MWCNT	$1.9 \times 10^3 \pm 6.6 \times 10^2$
0.8 wt.% MWCNT	$3.8 \times 10^2 \pm 2.1 \times 10^2$
1 wt.% MWCNT	$2.8 \times 10^2 \pm 1.2 \times 10^2$

Figure S4. Schematic of the preparation of the samples for AFM analyze, with depiction, left side of the mica lamella, of the reason for the appearance off the atonic terrace observed in Figure 7a.

Table S3. Thermal conductivity of the epoxy nanocomposites prepared with epoxy CR141 and SWCNT, EG and selected combinations.

Sample	Thermal Conductivity (W/m·K)	
epoxy	0.172	± 0.003
0.2 SW	0.226	± 0.010
0.2 SW 2 EG	0.252	± 0.008
0.2 SW 5 EG	0.323	± 0.022
1.2 SW	0.327	± 0.020
1.2 SW 2 EG	0.410	± 0.036
1.2 SW 5 EG	0.454	± 0.000
2 EG	0.271	± 0.008
5 EG	0.419	± 0.005