Supplementary Materials: Graphene/Carbon Nanotubes Hybrid Nanocomposites: Effect of Compression Molding and Fused Filament Fabrication on Properties

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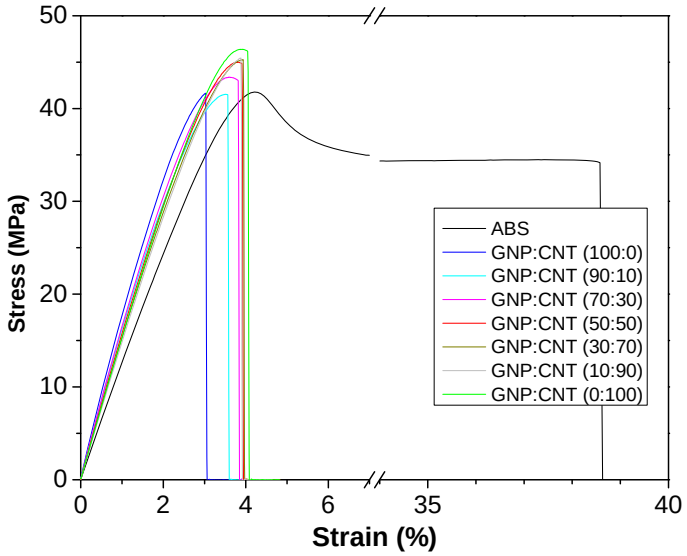
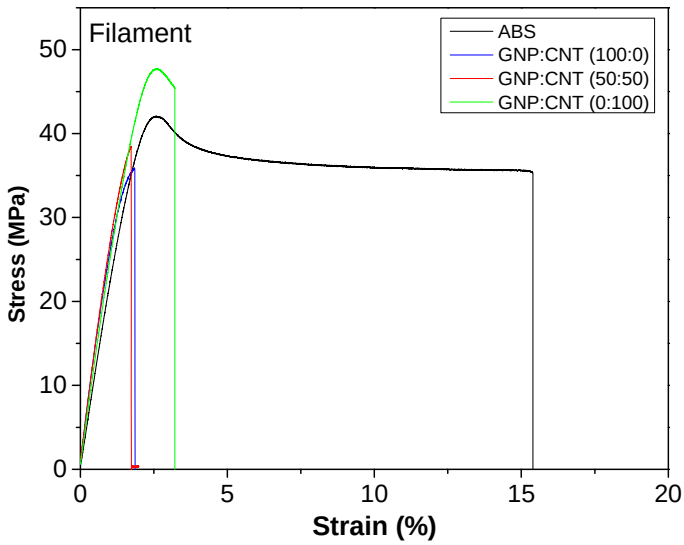
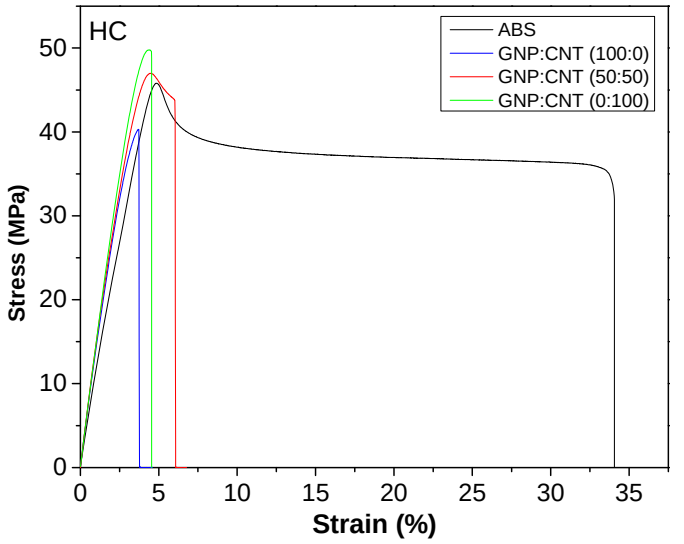
Table S1. Comparison of selected properties of GNP:CNT hybrid nanocomposites with 6% wt (melt compounded and compression molded samples).



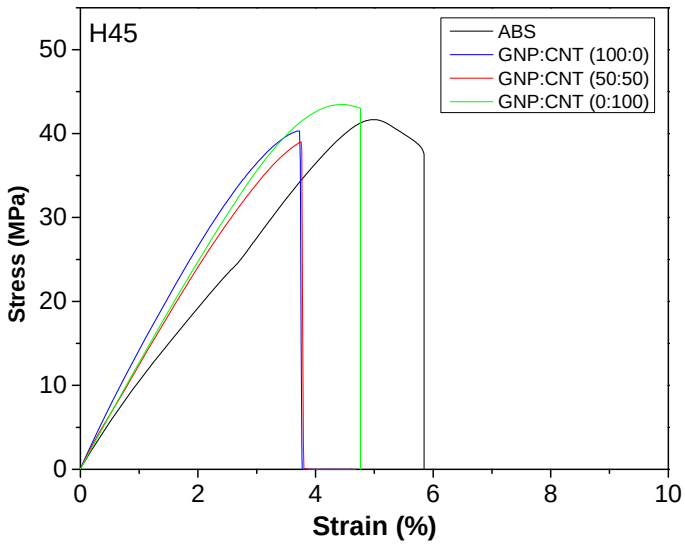
(a)


Filament
ABS
GNP:CNT (100:0)
GNP:CNT (50:50)
GNP:CNT (0:100)
Stress (MPa)
Strain (%)
0
10
20
30
40
50
0
5
10
15
20

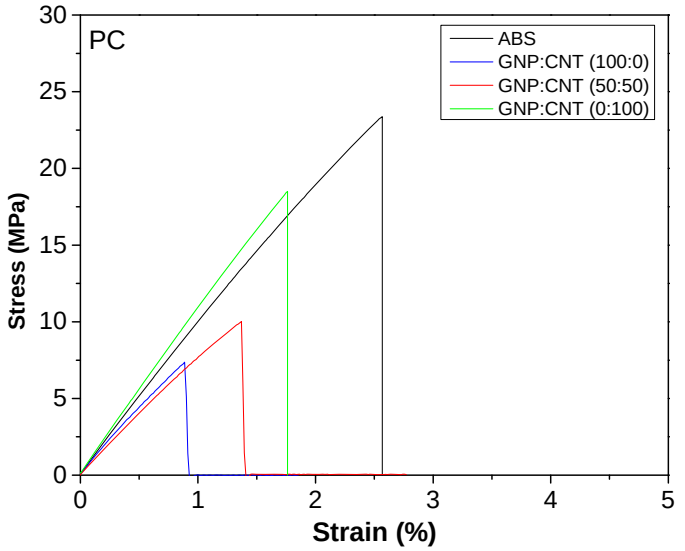
(b)


HC
ABS
GNP:CNT (100:0)
GNP:CNT (50:50)
GNP:CNT (0:100)
Stress (MPa)
Strain (%)
0
10
20
30
40
50
0
5
10
15
20
25
30
35

(c)



(d)



(e)

Figure S1. Representative stress-strain curves of neat ABS, and GNP:CNT (100:0), GNP:CNT (50:50), GNP:CNT (0:100) nanocomposites: (a) compression moulded samples, (b) filaments, (c) HC, (d) H45 and (e) PC samples.

The effect of GNP/CNT relative ratio can be quantitative evaluated by the comparative merit parameter $P_{E,M,\rho}$ taking into account the stiffness, the processability and the conductivity of ABS and its GNP:CNT composites. In particular the merit parameter $P_{E,M,\rho}$ has been previously defined [1] according to Equation (S1):

$$P_{E,M,\rho} = E \times MFI/\rho \quad \text{(Eq. S1)}$$

where E is the modulus, MFI is the melt flow index at 220°C/10kg and ρ is the resistivity. All data are reported in **Table S1**, and the resulting values are depicted in **Figure S2**.

Table S1. Comparison of selected properties of GNP:CNT hybrid nanocomposites with 6% wt (melt compounded and compression molded samples).

Relative ratio GNP-CNT	**MFI (g/10min)**	**ρ (Ω.cm)**	**E (MPa)**	**Strength (MPa)**	**ε_b (%)**	**TEB (MJ.mm^{-3})**	**$P_{E,M,\rho}$ = E × MFI/ρ**
0:0 *	23.61	3.27E+15	2315	41.7	35.9	11.785	1.67E-11
100:0	13.71	1.04E+15	3406	41.5	3.1	0.788	7.25E-10
90:10	9.77	1.49E+07	3338	41.7	3.5	0.868	2.19E-03
70:30	5.22	1.27E+01	3275	43.2	3.8	0.995	1.35E+03
50:50	1.97	4.13E+00	3189	45.2	4.1	1.156	1.52E+03
30:70	0.42	1.90E+00	3064	45.2	4.1	1.110	6.75E+02
10:90	0.09	1.54E+00	2899	45.7	3.9	1.030	1.68E+02
0:100	0.08	1.51E+00	2849	46.6	3.9	1.112	1.60E+02

*neat ABS

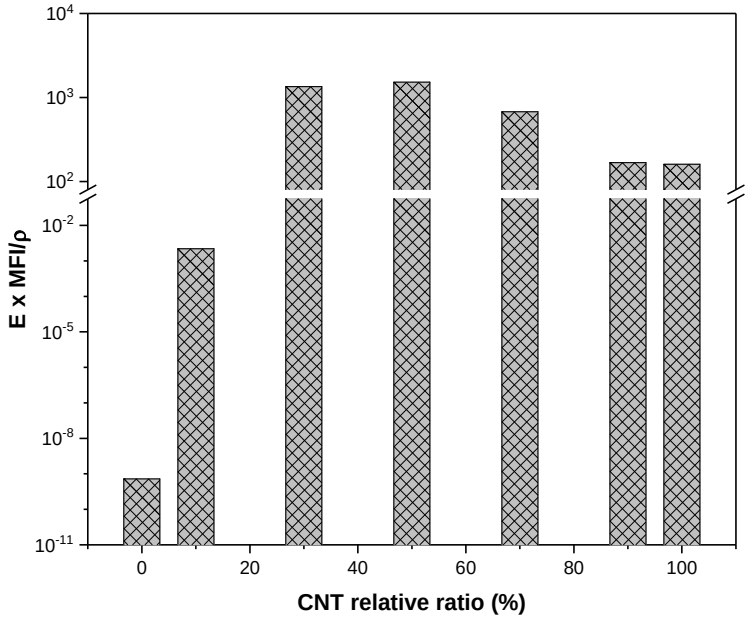
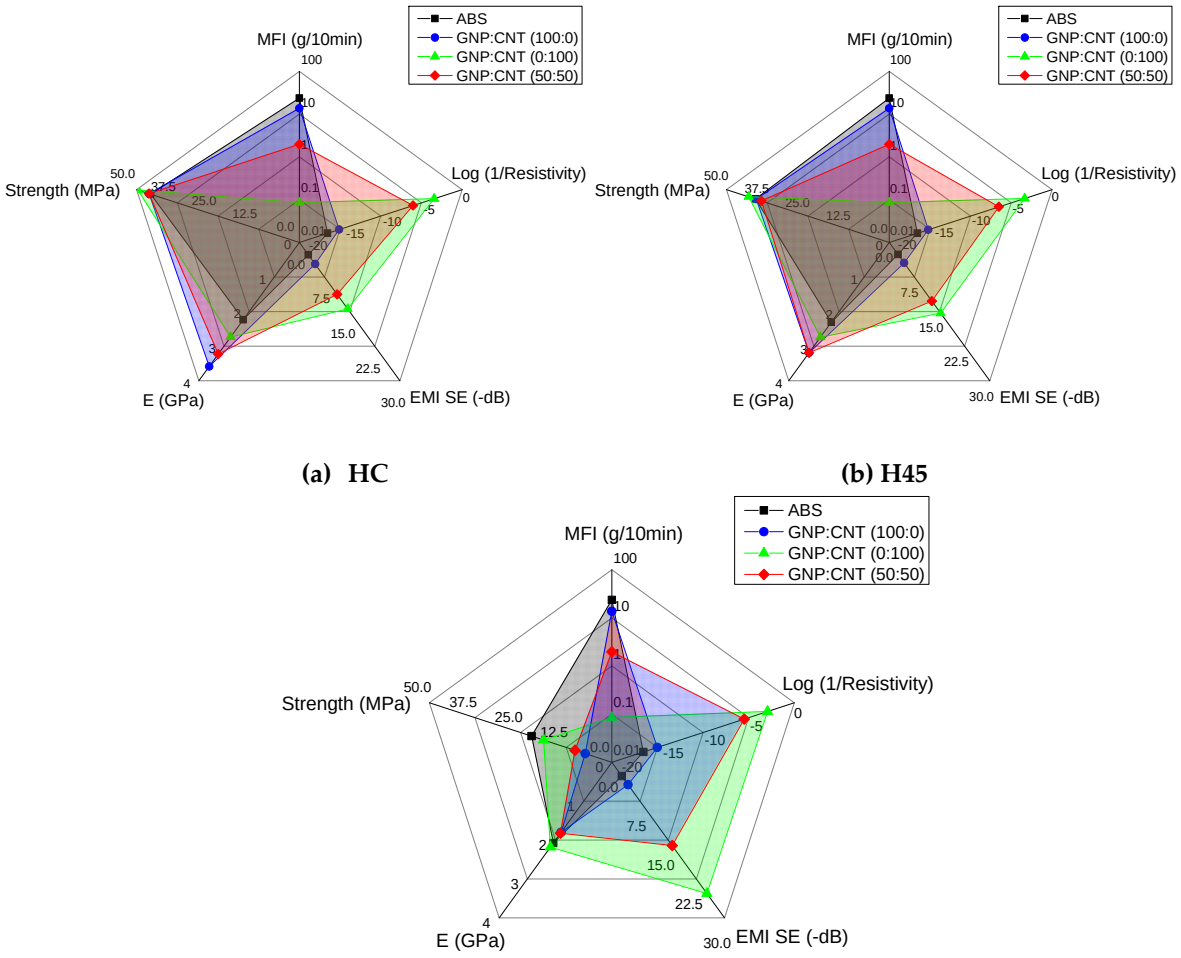


Figure S2. The merit parameter $P_{E,M,\rho}$ from **Eq. S1** combines and compares the effect of elastic modulus, melt flow index (220°C) and resistivity of nanocomposite with CNT/GNP 6 wt% as a function of relative content of CNT (from **Table S1**).



(a) HC **(b) H45**

(c) PC

Figure S3. Spider plots of FFF samples with relative comparison of processability (MFI), resistivity, electromagnetic shielding EMISE), and tensile properties of graphene, carbon nanotubes and 50:50 hybrid nanocomposites with respect to ABS matrix: (**a**) HC, (**b**) H45 and (**c**) PC.

Reference

1. Dul, S.; Pegoretti, A.; Fambri, L. Effects of the nanofillers on physical properties of acrylonitrile-butadiene-styrene nanocomposites: Comparison of graphene nanoplatelets and multiwall carbon nanotubes. *Nanomaterials* **2018**, *8*, 674-693.