Supplementary Materials

Poly(lactide)-Functionalized and Fe_3O_4 Nanoparticle-Decorated Multiwalled Carbon Nanotubes for Preparation of Electrically-Conductive and Magnetic Poly(lactide) Films and Electrospun Nanofibers

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X-Ray diffraction (XRD) measurements

XRD measurements were performed with an instrument of Rigaku D/max-3C OD-2988N wide angle XRD using Cu K_α line (λ = 0.15418 nm) as a radiation source. The Fe_3O_4 structure is characterized with the peaks at about 30° (111), 36° (311), 48° (400), 57° (511), and 62.5° (440) (Figure S1), which is coincident to the data of cubic Fe_3O_4 (JCPDS file No. 75-0033).The 311 diffraction peaks have been utilized for calculation of the diameters of the Fe_3O_4 nanoparticles. The particle sizes of Fe_3O_4 nanoparticles and MNP-MBA, being obtained with the calculation from the data of XRD and Debye-scherrer formula, are 11.3 and 13.5 nm, respectively.

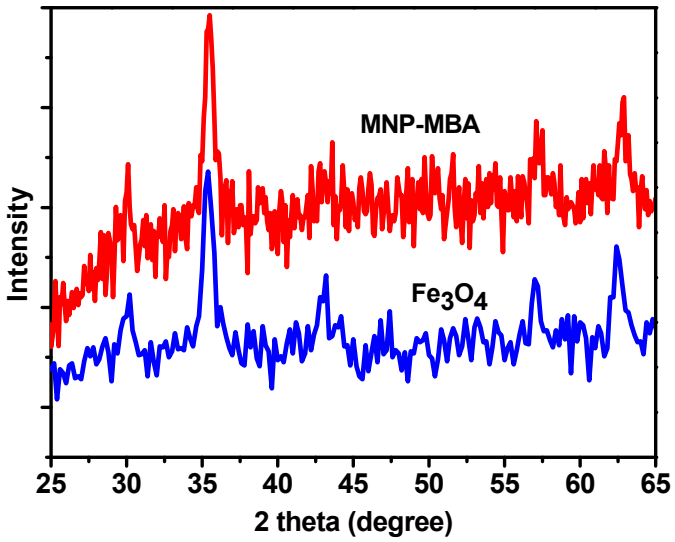

Figure S1. XRD diffraction patterns of neat and MBA-functionalized Fe_3O_4 nanoparticles.

Differential scanning calorimetry (DSC) measurements

DSC measurements have been carried out with a TA-DSC Q-100 DSC (Thermal Analysis Instrument) under a nitrogen gas flow (50 mL min^{-1}) at a heating rate of 10 ^{o}C min^{-1}. The introduced samples were about 3.0 mg. Figure S2 shows the DSC thermograms of neat PLA and its nanocomposites with functionalized MWCNTs. The melting points of the PLA/MWCNT nanocomposites are of about 168 ^{o}C compared to the melting point (165 ^{o}C) of neat PLA.

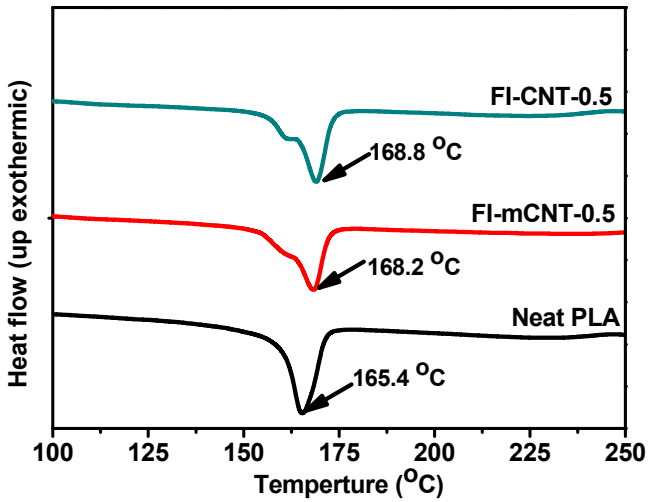

Figure S2. DSC thermograms of neat PLA its nanocomposites with functionalized MWCNTs.

Calculation of Fe_3O_4 and PLA weight fractions with TGA thermograms

The TGA thermograms used for calculation of Fe_3O_4 and PLA weight fractions in the prepared samples is shown here as Figure S3. MNP-MBA possess 7.7 wt% of MBA. Assume the MWCNT and MNP-MBA fraction of MWCNT-MNP is x and y, respectively.

$$x + y = 1.0 \qquad (1)$$

The char yield of MWCNT-MNP comes from both MWCNT and MNP-MBA.

$$0.1x + 0.923y = 0.50 \qquad (2)$$

From Eq. (1) and (2) we obtain y = 0.486. Hence, the Fe_3O_4 fraction (0.923y) of MWCNT-MNP is about 45 wt%.

Assume the PLA weight fraction of *m*CNT-PLA is z. The char yield of *m*CNT-PLA (47 wt%) comes from both MWCNT and Fe_3O_4.

$$0.45(1-z) + 0.514*0.1*(1-z) = 0.47 \qquad (3)$$

From Eq. (3) we obtain z = 0.062. The PLA weight fraction of *m*CNT-PLA is about 6.2 wt%.

As a result, the Fe_3O_4 fraction of *m*CNT-PLA is about 42.4 wt% (45 wt% divided by 1.062).

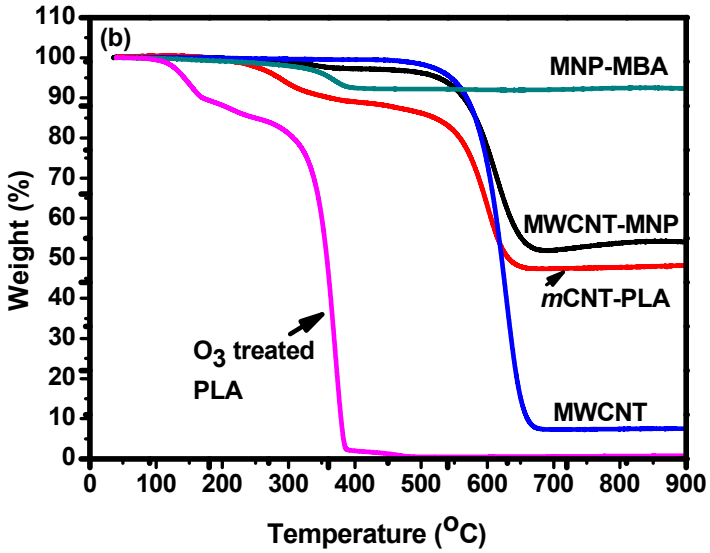

Figure S3. The TGA thermograms of the prepared samples under air atmosphere.

Calculation of Fe_3O_4 weight fractions with EDX analysis

The Fe weight fractions of the samples have been measured with an energy-dispersive X-ray Spectroscopy (Horiba ES-320 EDX Micro Analyzer equipped in a Hitachi S-4700 SEM). The results are shown in Figure S4. From the data the Fe_3O_4 contents of MWCNT-MNP and *m*CNT-PLA are about 48 wt% and 46 wt%, respectively. The values are comparable to the values obtained with TGA.

Element	Weight%	Atomic%
C K	50.80	73.56
O K	14.34	15.59
Fe K	34.87	10.86
Totals	100.00	

Element	Weight%	Atomic%
C K	50.51	72.39
O K	16.09	17.32
Fe K	33.40	10.30
Totals	100.00	

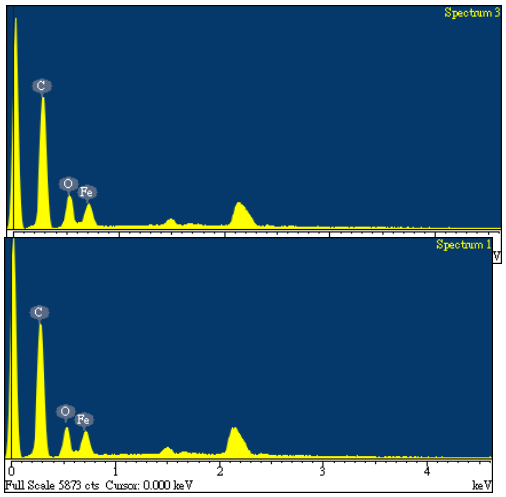

Figure S4. EDX elemental analysis results of MWCNT-MNP (upper) and *m*CNT-PLA (lower).