Supplementary Information

Phase Morphology Control and the Selective Localization of MWCNT for Suppressing Dielectric Loss and Enhancing Dielectric Constant of HDPE/PA11/MWCNT Composites

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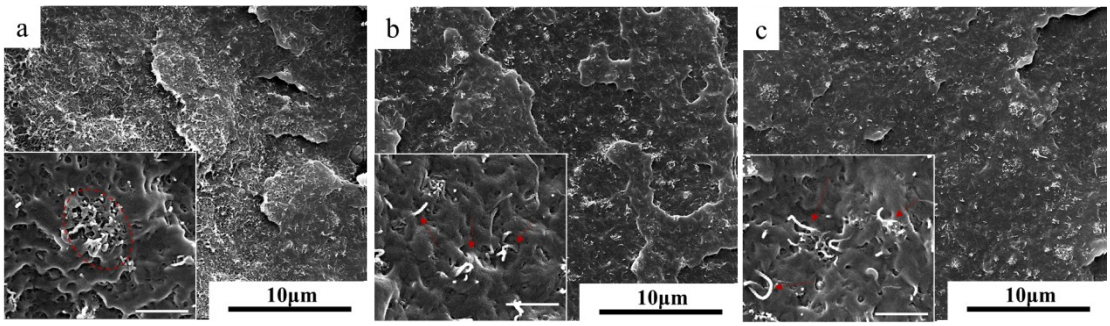

Figure S1. SEM image of the fractured surface of the HDPE/3wt%MWCNT composites containing (a) 0wt% compatibilizer, (b) 8wt% compatibilizer, (c) 15wt% compatibilizer. The insets show the magnified images and its scale bar is 1μm.

As seen from Fig.S1, a large amount of big aggregation of MWCNTs was appeared in HDPE/3wt%MWCNT composites. With the addition of compatibilizer (high density polyethylenegraftedmaleic anhydride (HDPE-g-MAH)) the dispersion of MWCNT became more uniform. Also, from the SEM results of HDPE/3wt%MWCNT with HDPE-g-MAH, only HDPE matrix and MWCNT were observed, but no phase separation of HDPE and HDPE-g-MAH was observed even at the high content of HDPE-g-MAH system. It can be concluded that the dispersion of MWCNTs was improved by the compatibilizer(HDPE-g-MAH) due to the great compatibility of HDPE and HDPE-g-MAH and the large interaction between HDPE-g-MAH and MWCNTs.

Table S1. Molecular weight of compatibilizer HDPE-g-MAH.

sample	M_n	M_w
HDPE-g-MAH	30516	89534

Molecular weight (M_w, M_n) of the HDPE-g-MAH sample were tested by a high temperature gel permeation chromatographer (HT-GPC) (PL-GPC 220, Agilent). Sample was dissolved in trichlorobenzene at 150°C.

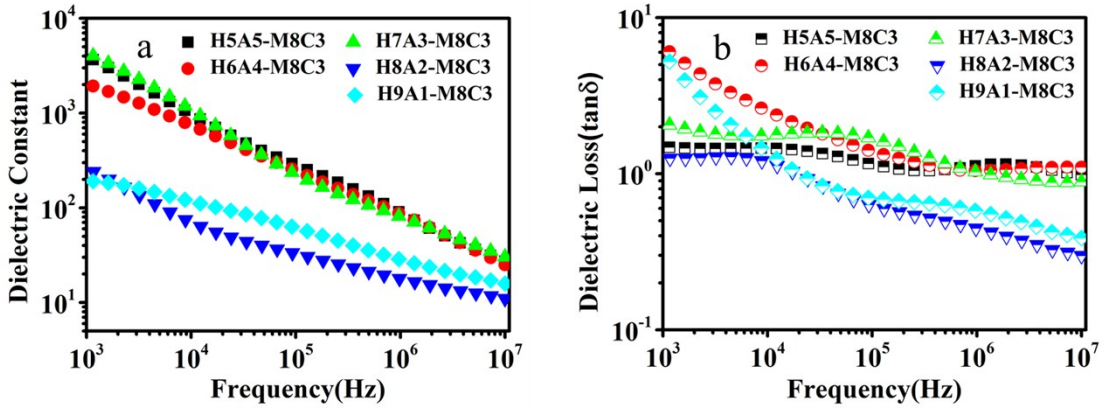

Figure S2. Frequency dependence of (a)dielectric constant and (b) dielectric loss of HDPE/PA11/ MWCNT composites containing 3wt%MWCNT and 8wt% compatibilizer with different mass ratio of HDPE and PA11.

It was obvious in Fig.S2 that the dielectric constant increased with the increase of polar PA11 phase. When the mass ratio of HDPE/PA11 was lower than 7:3, the dielectric constant of composites was no big changes. However, as the ratio of HDPE/PA11 increased up to 7:3, the dielectric constant was dramatically increased, especially at low frequencies (e.g., 240 to 4000 at 10^3Hz). When the content of PA11 continued to increase, the dielectric constant did not continue to increase. And when the mass ratio of HDPE/PA11 was 7:3, the dielectric loss of composite was also of low value and showed a weak correlation to frequency. So, the mass ratio of HDPE/PA11 maintained at 7:3 was a better blend component ratio.

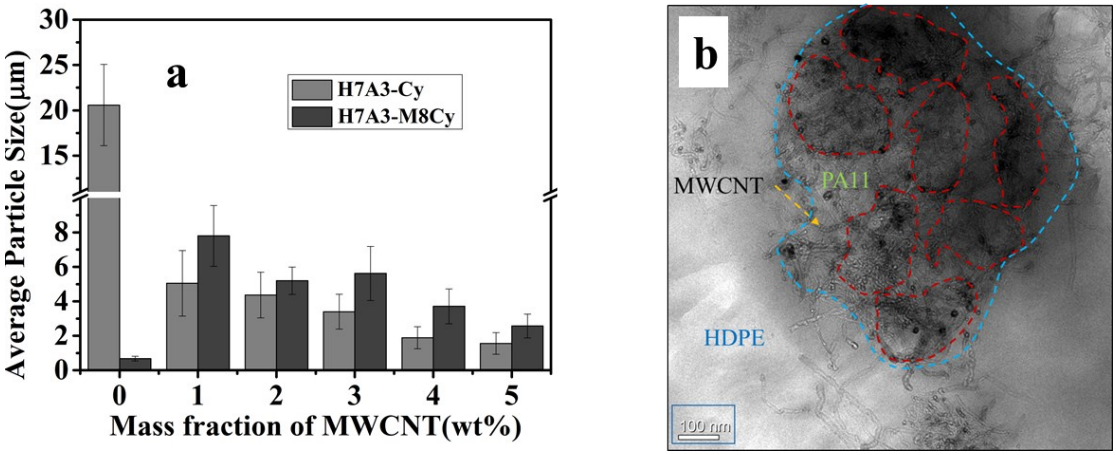

Fig. S3(a) The average particle size of the dispersed phase PA11 coated MWCNTs of H7A3-Cy system composites and H7A3-M8Cy system composites with various MWCNT content, (b) TEM image of H7A3-M8C3 composites sample.

The average particle size of the dispersed phase coated MWCNT for both composites was counted in Fig. S3. As seen in Fig. S3a, except for the composites without MWCNTs, the average particle size of the dispersed phase of H7A3-M8Cy system was higher than that of H7A3-Cy system which could be due to PA11 in the form of the dispersed phase coated MWCNTs might generate combination after compatibilizer added into HDPE/PA11/MWCNT composites. Herein, Fig. S3b showed the TEM image of H7A3-M8C3 composites sample. It was found that larger size of the dispersed phase was formed through aggregation of small size of dispersed phase PA11.As MWCNT content increased, the average particle size of the dispersed phase gradually reduced for both systems which was attributed to the addition of CNTs nanoparticles into the polymer matrix was found to increase the compatibility between the immiscible HDPE and PA11 components. So, for HDPE/PA11/MWCNT composites, the dielectric loss of composites with the maximum dielectric constant (at 1.5wt% MWCNTs) was about 13.5 at 10^3Hz. But, after compatibilizer was added into HDPE/PA11/MWCNT composites, the dielectric loss of composites with the maximum dielectric constant (at 3wt% MWCNTs) reduced to 2 at 10^3Hz. This was due to the stronger interfacial interaction between HDPE and PA11 and larger size of dispersed phase after compatibilizer added into HDPE/PA11/MWCNT composites.