Supporting Information

Irradiation of Poly(L-lactide) Biopolymer Reinforced with Functionalized MWCNTs

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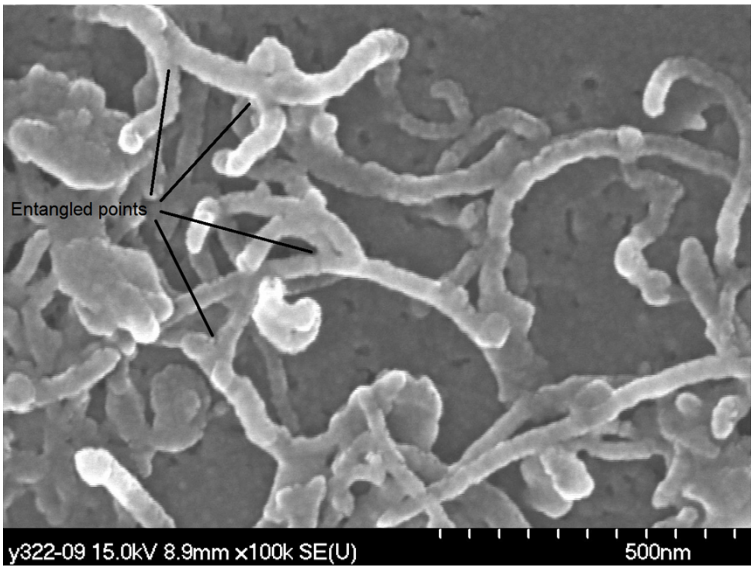

Fig. S1 The SEM micrographs of MWCNT-g-PLACLs at high magnification

Fig. S1 presents the SEM micrograph of MWCNT-g-PLLAs. It can be seen that the MWCNT-g-PLLAs are entangled to each other at the intersection points. This indicates that the grafting reaction take place over the whole surface of MWCNTs. The grafted PLLA chains on to the surface of MWCNT can entangle with grafted PLLA chains of neighbor MWCNT after evaporation of chloroform like hairbrush. The higher magnification of SEM imaging and study the individual MWCNT-g-PLLAs at high amount of grafted PLLA chains is impossible due to fast deformation of grafted PLLA under electron beam and charge collection effect, it is hard to get the clear micrograph at high magnification.

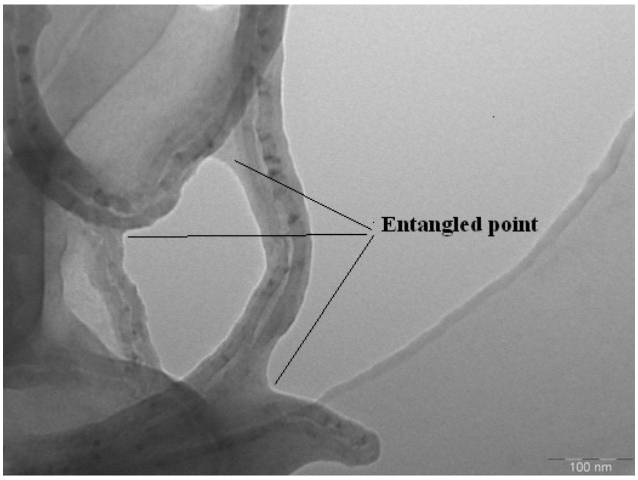

Fig. S2 shows the TEM micrographs of MWCNT-g-PLLAs

Fig. S2 presents the TEM micrograph of MWCNT-g-PLLAs. It can be seen that the MWCNT-g-PLLA has three shells. The out shell refers to the grafted PLLA chains. In addition, it is hard to get a clear and high contrast image from the core shell structure of MWCNT-g-PLLAs, which indicates that the MWCNTs are covalently covered by the grafted PLLA chains. It can be seen that the grafted PLLA chains on the sidewall of each MWCNT entangled to that of neighbor MWCNT.

For TEM analysis, a TEM, HITACH model Mic H-7650 was employed at the acceleration voltage of 100 kV to investigate the fine nanostructure of synthesized materials. For TEM sample preparation, specimens were dissolved in chloroform and then were dropped the solution on 200 mesh carbon coated copper grid and dried them at room temperature.

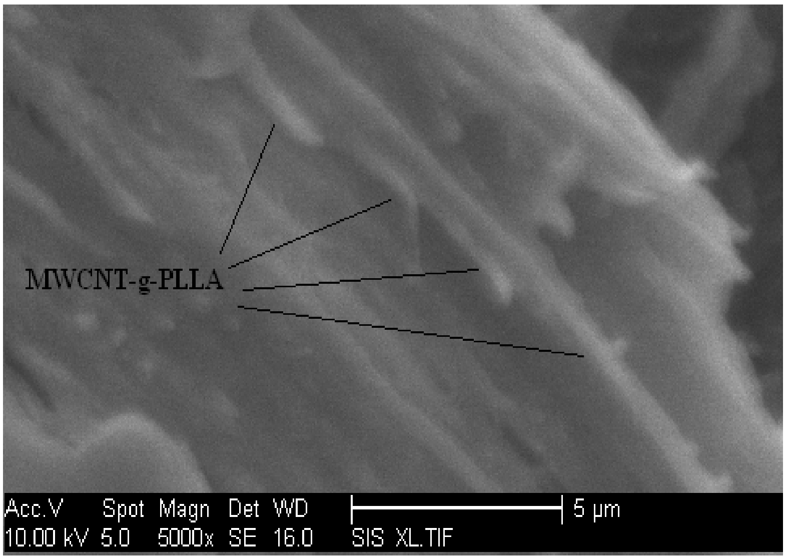

Fig. S3 SEM micrograph of fracture surface of MWCNT-g-PLLAs/PLLA composites after tensile test

Fig. S3 presents the fracture surface of MWCNT-g-PLLAs/PLLA composites after elongation at break during the tensile test. It can be seen that the tensile loading in MWCNT-g-PLLAs/PLLA completely transferred to the filler materials, eventually leading to a full breakage of the MWCNT-g-PLLA. It reveals that the adhesion effect between the matrix and the MWCNT-g-PLLA significantly enhance via grafting of polymer from the sidewall of MWCNTs.

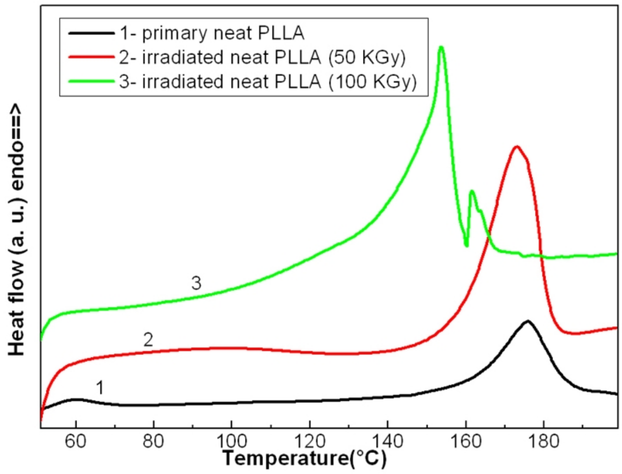

Fig. S4 DSC curves of neat PLLA before and after γ irradiation under the air atmosphere at room temperature.

Table S1 The melting point and melting enthalpy of neat PLLA, before and after γ irradiation under the air atmosphere at room temperature

γ dose (KGy)	Melting point (°C)	Melting Enthalpy (J/g)
0	174.8	33.57
50	173.2	47.3
100	153.5	52.3

Fig. S4 shows the DSC curves of neat PLLA before and after gamma irradiation under the air atmosphere at room temperature. The melting point and melting enthalpy of neat PLLA before and after γ irradiation under the air atmosphere at room temperature are illuminated in table S1. It can be seen that the melting point of neat PLLA decreases after gamma irradiation. The result indicates that the chain scissoring is occurred during gamma irradiation. Hence, the melting point of PLLA decreases due to molecular chain scissoring. As can be seen, the melting enthalpy of irradiated neat PLLA is slightly higher than that of primary neat PLLA. It reveals that the crystallinity of neat PLLA slightly increases during gamma irradiation. It may due to cross-linking effect of gamma radiation on PLLA molecular chains and creation of smaller lamellaes with short PLLA polymer chains that made of scissoring effect of gamma irradiation on PLLA chains. The chain scissoring in amorphous phase during the gamma irradiation, decreases the viscosity, increases the chain mobility and creates defects during gamma irradiation. Hence, the melting point of neat PLLA decreases gradually with increasing the gamma dose.