Electronic Supplementary Information

Distinct positive temperature coefficient effect of polymer-carbon filler composites evaluated in terms of polymer absorption on fiber surface

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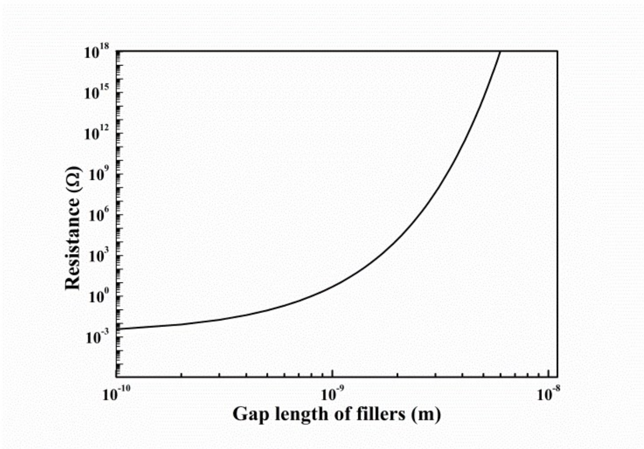

Fig. S1 Resistance calculated from tunneling mold as a function of gap length between fillers.

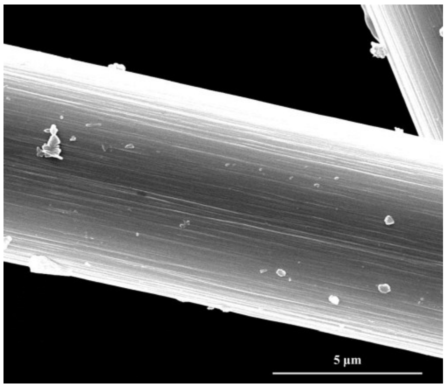

Fig. S2 SEM micrograph of CF.

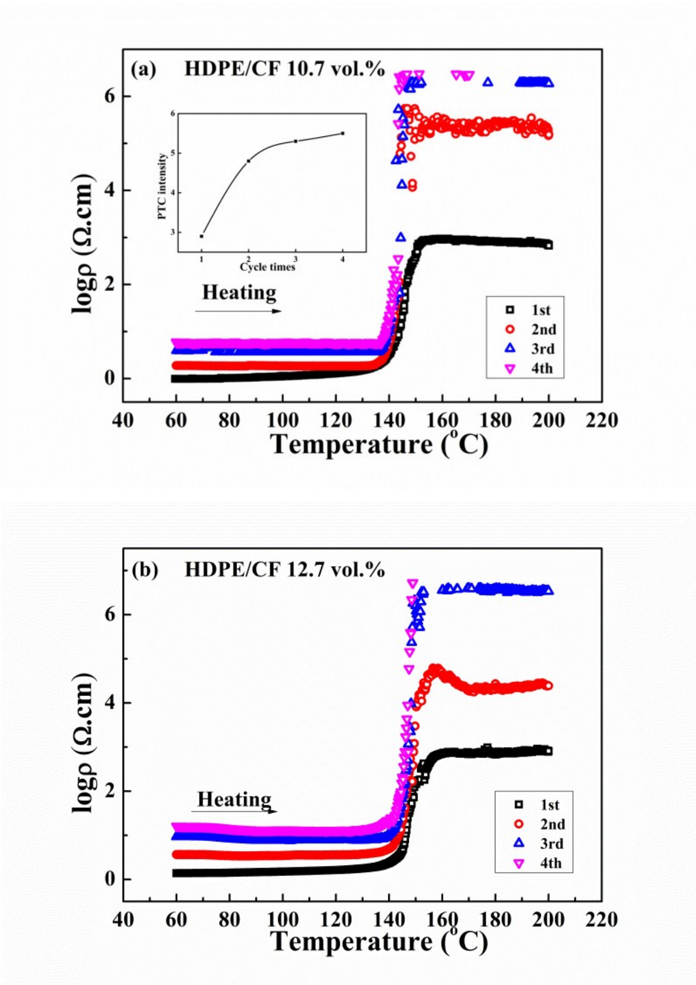

Fig. S3 Temperature dependence of resistivity for (a) 10.7 vol.% and (b) 12.7 vol.% CF filled HDPE composites during four continuous heating processes; insets: relationship between PTC intensity and cycle times during heating processes.

It was obvious in Fig. S3 that the initial and final resistivity was increased with increasing thermal cycles and the rise of final resistivity was marked for the composites with different CF content. And the PTC intensity increased obviously with increasing thermal cycles shown as the insets in Fig. S3.

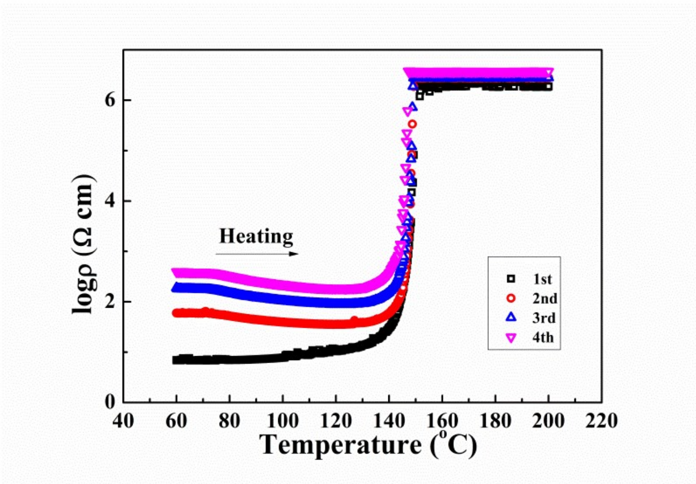

Fig. S4 Temperature dependence of resistivity for 8.8 vol.% CF filled HDPE (5000S, Lanzhou petroleum Chemical Co, Ltd, China. ρ=0.953 g/cm³) composites during four continuous heating processes.

As seen from Fig. S4, significant PTC effect happened when the temperature was close to the melting point of HDPE (5000S) during every heating process. It was obvious that the initial resistivity increased markedly, whereas the rise of the final resistivity was not so distinct with increasing thermal cycles. This phenomenon indicated the worse conductive network with increasing thermal cycles, while the broken of the conductive network in this system was not so severe as CF filled 2911 HDPE.

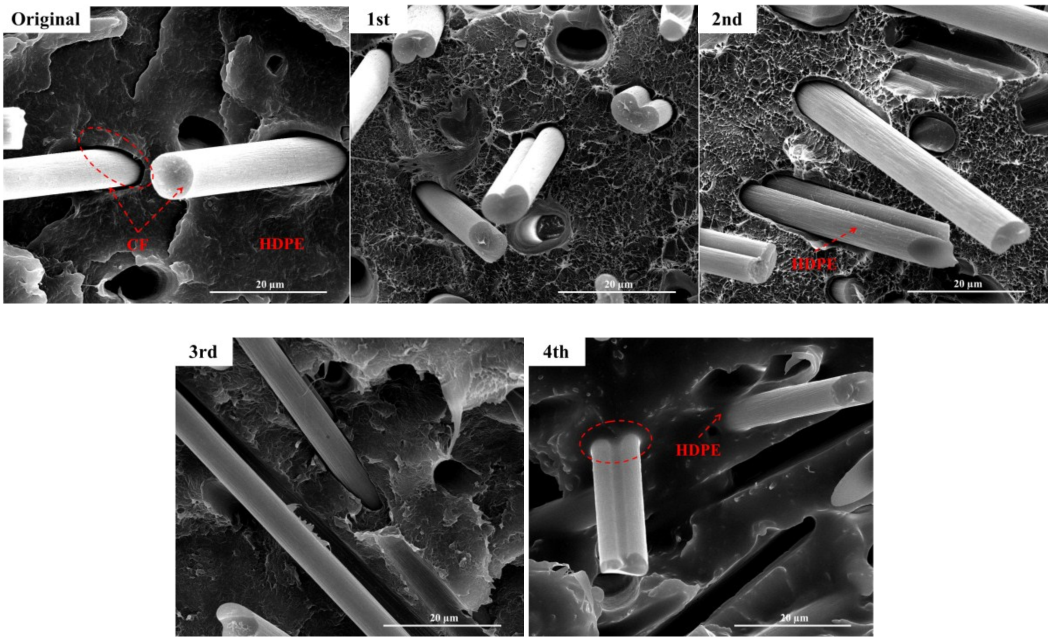

Fig. S5 SEM micrographs of 8.8 vol.% CF filled HDPE(5000S)/CF composites with increasing thermal cycles.

Fig. S5 showed the SEM micrographs of HDPE(5000S)/CF composites before thermal cycles and after increasing thermal cycles. Before thermal cycles, the interaction between CF and HDPE was weak which manifest as obvious gap marked with dotted circle. Some polymer absorbed on the surface of CF with thermal cycles, resulting to the increase of gap between adjacent CFs. After the composites undergone four continuous thermal cycles, the CF surface was covered with a layer of HDPE matrix. While, the absorption of polymer on CF surface was not as obvious as the situation of HDPE (2911)/CF system. The less obviously increased final resistivity with increasing thermal cycles was the related consequence.