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Supplementary Information

A promising nanohybrid of silicon carbide nanowires scrolled by graphene oxide sheets with synergistic effect for poly(propylene carbonate) nanocomposites

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Dispersion amount of SiC nanowires in the SiC/GO suspension

The SiC/GO dispersions with the concentration of 2 mg ml^{-1} was estimated by weighting the amount of the dispersed solid (upper layer after standing overnight) after evaporation process. The content of SiC nanowires in the resulting SiC/GO dispersed solid was then analyzed by TGA. The dispersion amount of SiC was calculated using equations: $Y=M_u/M_o$. Where M_u is the content of SiC nanowires in the upper layer of SiC/GO suspension, M_o is the content of SiC nanowires in the original SiC/GO suspension. The dispersion amount of SiC means the amount of SiC dispersed by GO sheets. Dispersion stability was studied by UV-*vis* absorption spectra as shown in **Figure S1**.

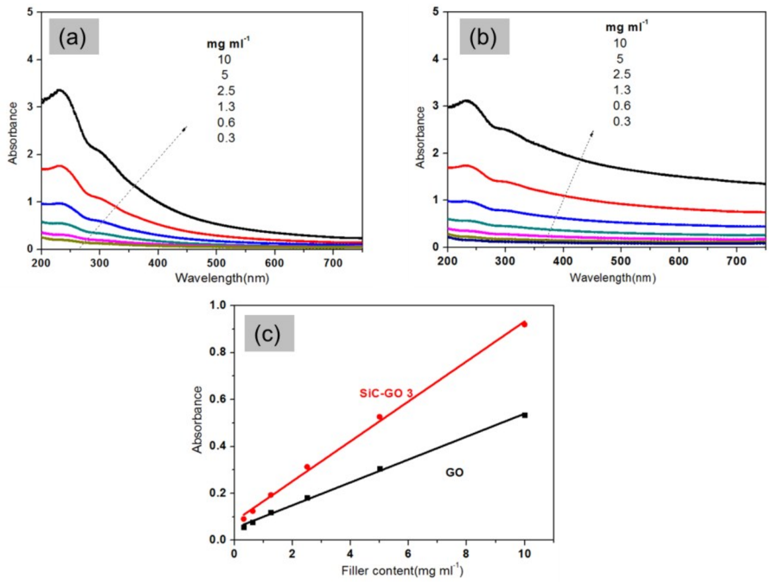

Figure S1. UV-*vis* absorption spectra of (a) GO and (b) SiC-GO 3 hybrid dispersed in water with different concentrations; (c) optical density at 500 nm of SiC-GO and GO at different concentrations.

Hydrogen interactions between GO and SiC

We assumed that the abundant oxygen groups of GO interact with the surface hydroxyl groups of SiC through hydrogen bonding, and then a SiC/GO scroll-like structure was formed. The hydrogen bonding was analyzed by FTIR in this study and result was presented in **Figure S2**. For the convenience of observation, the weight ratio of GO to SiC (GO/SiC=0-50) used in the mixture are different from that used for the fabrication of composites (GO/SiC=1). **Figure S2 (a)** shows that the interactions between SiC and GO weaken the interaction of GO itself, so the frequencies of peak at 1618 cm^{-1} corresponding to the C=O bonds present in GO is slightly shifted towards high wavenumbers with increasing amount of SiC in the GO/SiC nanohybrid. Additionally, **Figure S2 (b)** shows the peak at 941 cm^{-1} corresponding to the O-H bonds of SiC were lowered (4-5 cm^{-1}) by the increasing amount of GO in the SiC/GO nanohybrid. These results indicate that the interactions between OH groups of SiC and COOH groups of GO weaken the interactions of GO itself, which is in a good agreement with our morphological observation for the SiC/GO nanohybrids.

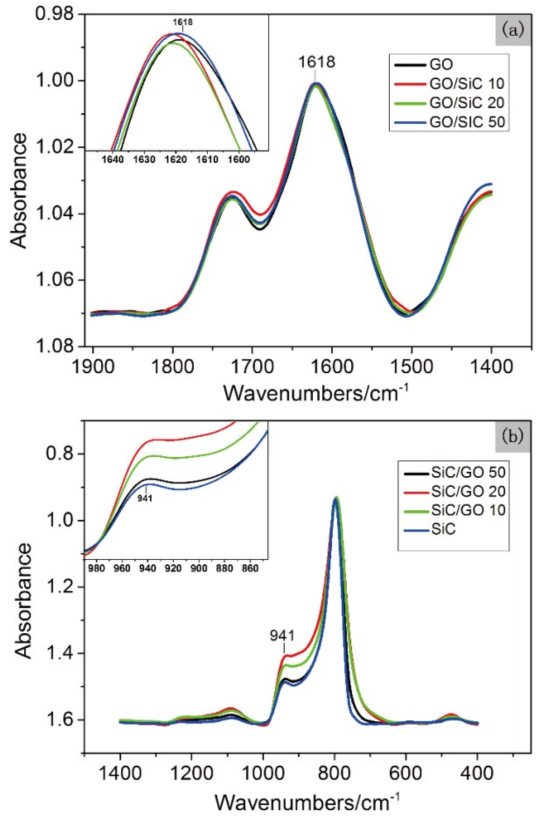

Figure S2. FTIR spectra of (a) GO and nanohybrids with different GO/SiC ratios; (b) SiC and nanohybrids with different SiC/GO ratios.

Tensile properties of neat PPC and PPC-SiC/GO nanocomposites

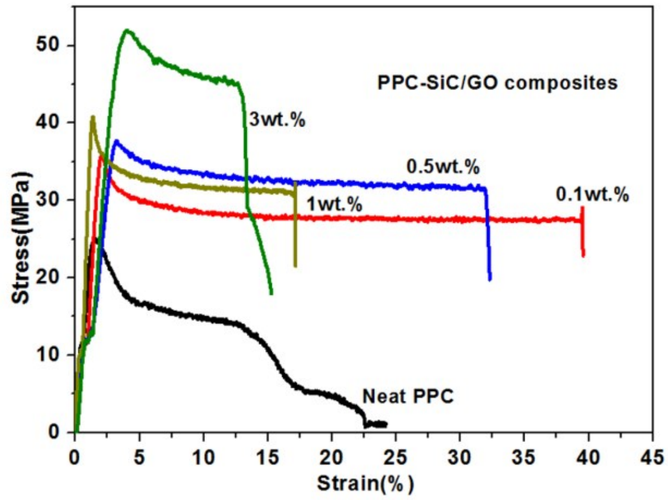

Figure S3. Tensile properties of neat PPC and PPC-SiC/GO nanocomposites composites with different filler contents.

Theoretical values of tensile modules of PPC-based nanocomposites

The SiC nanowires composites were considered as random oriented discontinuous fibers, and the GO sheets were assumed as effective rectangular solid fibers, the modulus of the PPC-SiC and PPC-GO composites can be calculated from the Equations S1 and S2, respectively.

PPC-SiC composite:

$$E_c = \frac{3}{8}\frac{1+2\left(\frac{l_{NT}}{d_{NT}}\right)\left[\frac{E_R-1}{E_R+2\left(l_{NT}/d_{NT}\right)}\right]}{1-\left[\frac{E_R-1}{E_R+2\left(l_{NT}/d_{NT}\right)}\right]}\times E_M+\frac{5}{8}\frac{1+2\left[\frac{E_R-1}{E_R+2}\right]V_{NT}}{1-\left[\frac{E_R-1}{E_R+2}\right]V_{NT}}\times E_M \qquad \text{S1}$$

In the Halpin–Tsai model, E_c is the tensile modulus of the composite, l_{NT} is the length of nanowires (100 μm), d_{NT} is the average diameter of the nanotubes (300 nm), $E_R = E_{eq}/E_M$, E_{eq} is the equivalent modulus of nanowires (581 GPa), E_M is the tensile modulus of PPC matrix (3.03GPa) and V_{NT} is the volume content of the nanowires.

PPC-GO composite:

$$E_c = \frac{3}{8}\frac{1+\left((W/L)/t\right)\left[\frac{E_r-1}{E_r+\left((W/L)/t\right)}\right]V_{GPL}}{1-\left[\frac{E_r-1}{E_r+\left((W/L)/t\right)}\right]V_{GPL}}\times E_M+\frac{5}{8}\frac{1+2\left[\frac{E_r-1}{E_r+2}\right]V_{GPL}}{1-\left[\frac{E_r-1}{E_r+2}\right]V_{GPL}}\times E_M \qquad \text{S2}$$

In the modified Halpin–Tsai model, E_c is the tensile modulus of the composite, W is the average width of GO sheets (5 µm), L is the average length of the GO sheets (5µm), t is the average thickness of GO sheets (1.1nm), $E_r = E_{GPL}/E_M$, E_{GPL} is the equivalent modulus of GO sheets (1.11 TPa), E_M is the tensile odulus of PPC matrix (3.03 GPa) and V_{GPL} is the volume content of the GO sheets.

The V_{NT} and V_{GPL} in equation S1 and S2 can be calculated from wt % of SiC nanowires and GO sheets, respectively.