Electronic Supplementary Information

Preparation and microwave absorption properties of uniform TiO_2@C core-shell nanocrystals

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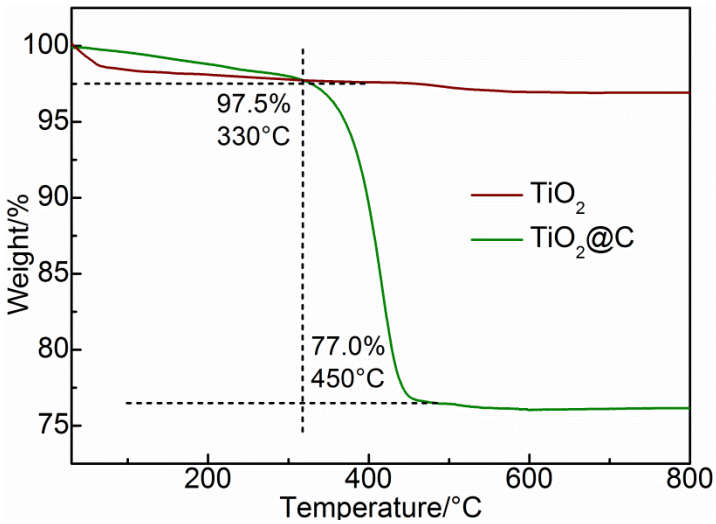

Fig. S1 TGA spectra of bare TiO_2 and TiO_2@C nanocrystals.

To find out how much carbon was coated on the TiO_2 nanocrystals, we did TGA measurements on both samples. The TGA were conducted under air atmosphere from room temperature to 800 ^{o}C (Fig. S1). The 2.5 wt% weight loss below 330 ^{o}C was attributed mainly to the water and the acetylene polymeric products physically or chemically adsorbed on the surface or trapped inside the carbon layer. So the percentage of carbon was about 20.5 wt% in the TiO_2@C nanocrystals.

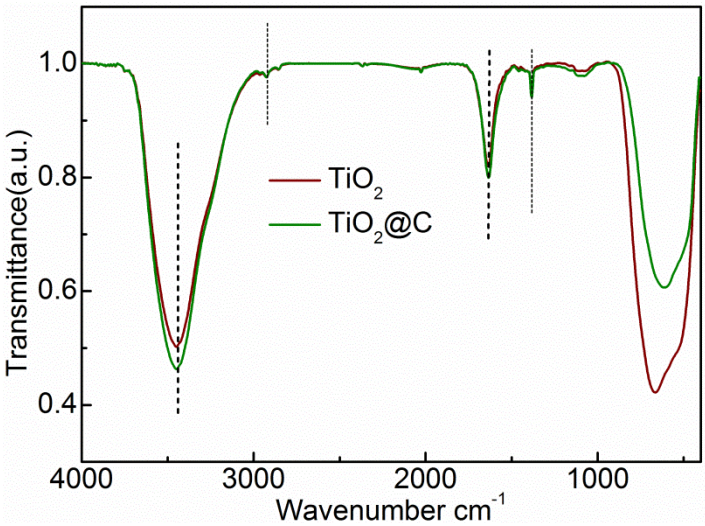

Fig. S2 TGA spectra of bare TiO_2 and TiO_2@C nanocrystals.

Fig. S2 shows the typical FT-IR spectra of bare TiO_2 and TiO_2@C nanocrystals. Both samples display similar FTIR spectra. The slightly large OH bands in the TiO_2@C nanocrystals suggest that its OH content was slightly higher than the bare TiO_2 nanocrystals.

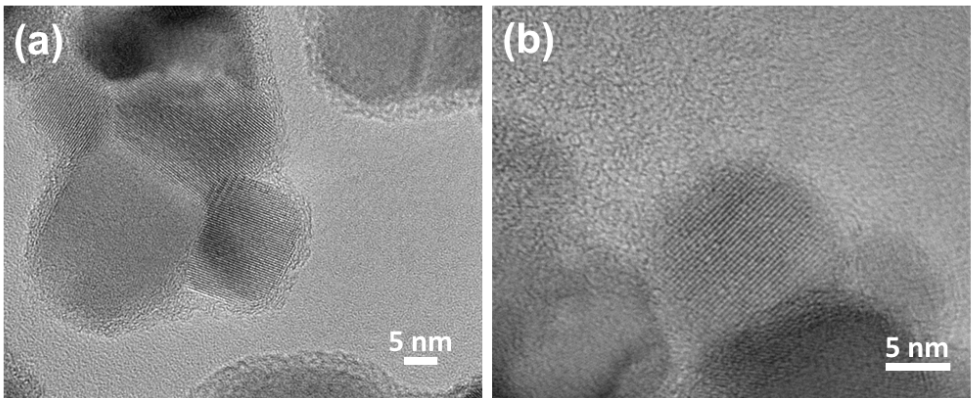

Fig. S3 TEM images of products obtained at (a) 400 ºC and (b) 300 ºC.

Fig. S3 shows the TEM images TiO_2@C obtained at 400 ºC and 300 ºC. It can be seen that the thickness of carbon shell decreased with the decreased temperature. However, we found that the higher synthesis temperature (600 ºC) led to the decomposition of C_2H_2 and the phase transition of TiO_2. Therefore, the present method is difficult to further adjust the thickness of carbon shell.

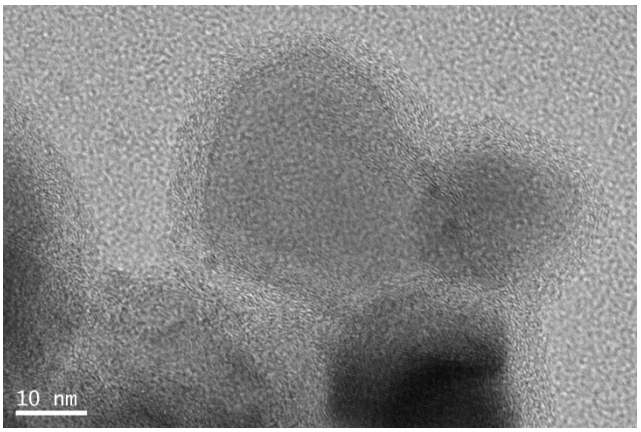

Fig. S4 TEM image of TiO_2@C (500 ºC, 1h).

The effect of time on the formation of carbon shell is also not quite obvious. The uniform carbon shell can be obtained in less 10 min and the thickness of carbon shell keeps nearly unchanged even the reaction time was increased to 1 h (Fig. S4).

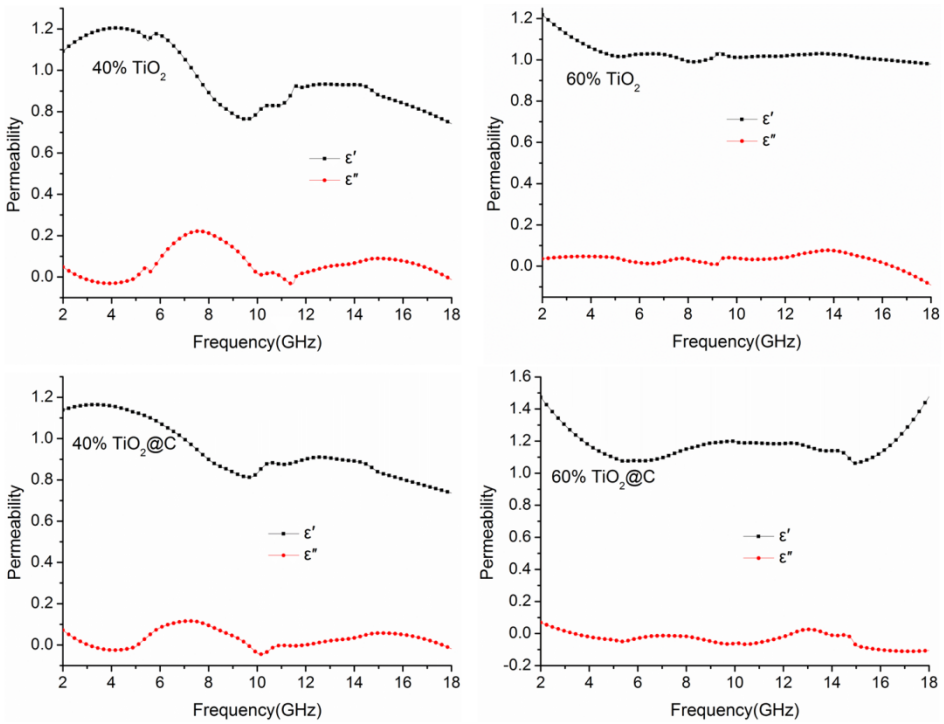

Fig. S5 Frequency dependence of the complex permeability of the bare TiO_2 and

TiO_2@C nanocrystals.

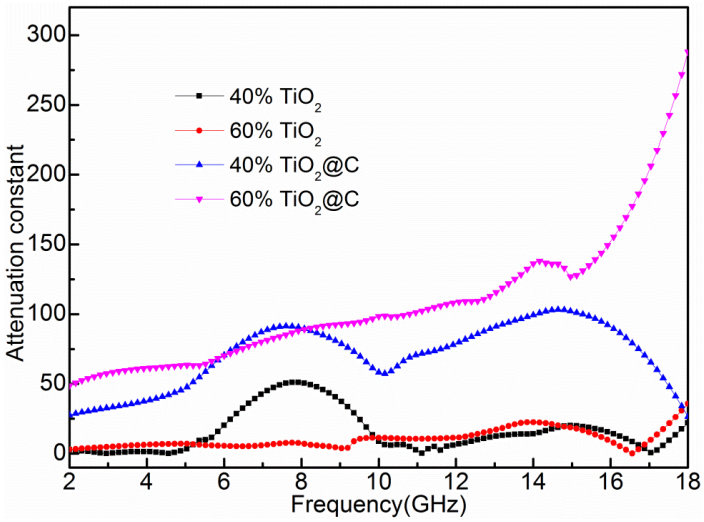

Fig. S6 Attenuation constant of the TiO_2–paraffin composite and TiO_2@C–paraffin composite.

EM wave attenuation in the interior of absorber is one of key factors for an excellent absorber. The attenuation constant α, which determines the attenuation properties of materials, can be denoted by[1]:

$$\alpha = \frac{\sqrt{2}\pi f}{c} \times \sqrt{(\mu''\varepsilon'' - \mu'\varepsilon') + \sqrt{(\mu''\varepsilon'' - \mu'\varepsilon')^2 + (\mu'\varepsilon'' + \mu''\varepsilon')^2}}$$

where f is the frequency of microwave and c is the velocity of light. Fig. S6 shows the dependence of the attenuation constant α in the frequency range of 2–18 GHz. It can be seen that the TiO_2@C -paraffin composite has larger attenuation constant over the whole frequency range, which further confirms its excellent absorption.

1. X. Liu, Z. Ou, D. Geng, Z. Han, J. Jiang, W. Liu and Z. Zhang, *Carbon*, 2010, **48**, 891.

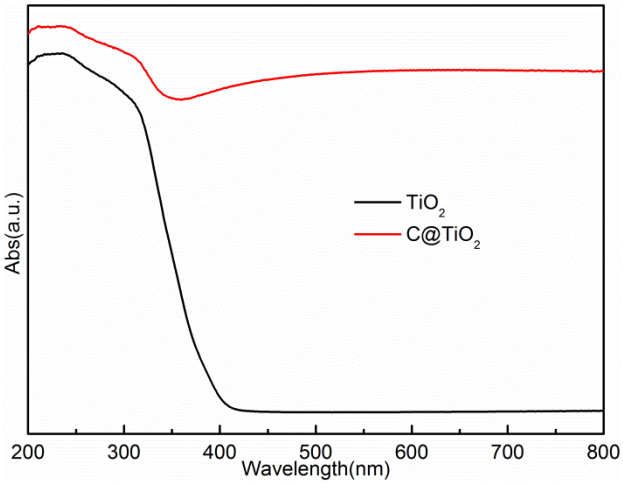

Fig .S7 UV-vis diffuse reflection spectra of TiO_2 and TiO_2@C.