Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Enhanced Hydrogen Production by Carbon-doped TiO_2 Decorated with Reduced Graphene Oxide (rGO) under Visible Light Irradiation

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S1. Synthesis of GO

3 g graphite powder (Catalog # G67-500, Sigma, USA) was added into 400 mL of 4 °C cold concentrated H_2SO_4 containing 18 g of $KMnO_4$. The suspension was mixed by a magnetic stirrer for 4.5 h for the oxidation. The color of the mixture gradually changed from dark purplish green to dark brown. To stop the oxidation process, 20 mL 30% H_2O_2 solution was added. GO formed was washed three times with 1-M HCl aqueous solution and with DI water. The washing process was carried out by decanting the supernatant using a centrifugation technique. During the washing process with DI water, GO experience defoliation, which resulted in thickening of the GO solution. The GO gel was subsequently dried in air to obtain the GO powder.

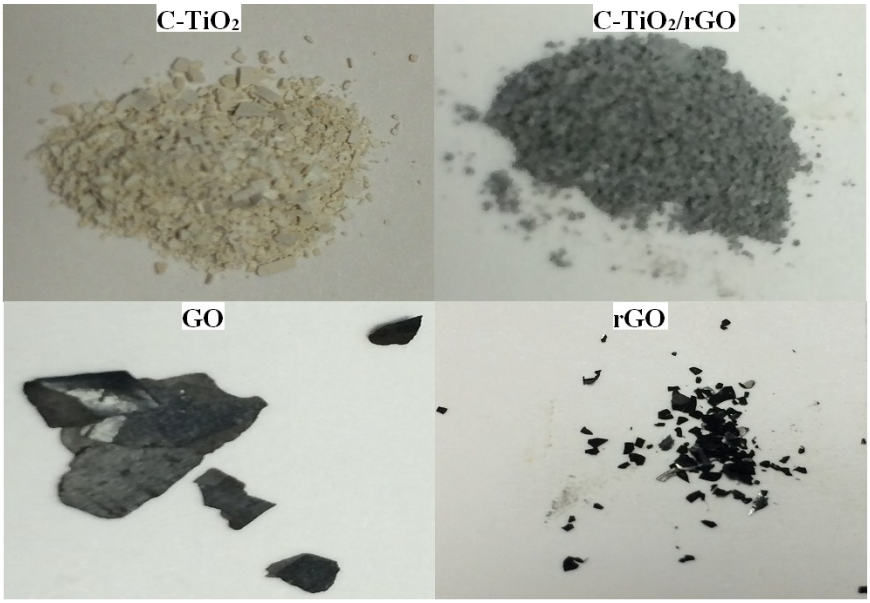

Figure S1. Images of C-TiO_2, C-TiO_2/rGO, GO and rGO.

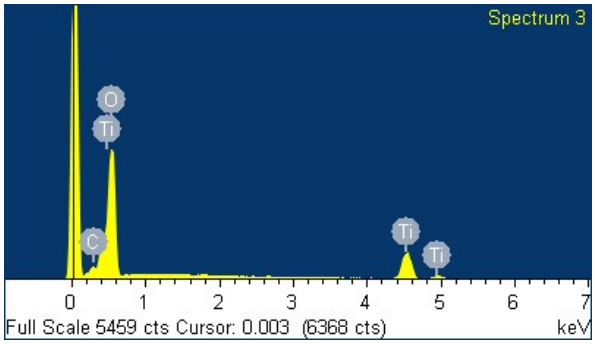

Figure S2. EDS of C-TiO_2.

S2. Photocatalytic H_2 production using TEOA

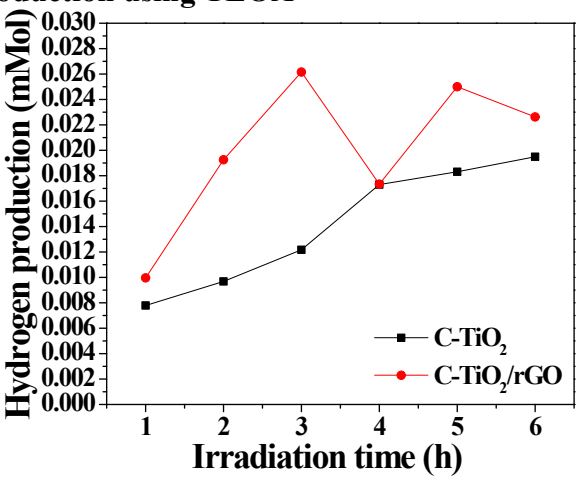

Figure S3. Photocatalytic H_2 production kinetics by C-TiO_2 and C-TiO_2/rGO (0.33 g L^{-1}) in the presence of TEOA (15% v/v). The concentration of TEOA was chosen to be at the similar levels as reported previously.[1-4]

S3. Photocatalytic reaction stoichiometry

$$h^+ + H_2O \rightarrow \bullet OH + H^+ \quad \text{(S1)}$$

$$CH_3OH + \bullet OH \rightarrow \bullet CH_2OH + H_2O \quad \text{(S2)}$$

$$\bullet CH_2OH \rightarrow HCHO + H^+ + e^- \quad \text{(S3)}$$

$$2H_2O + 2e^- \rightarrow H_2 + 2OH^- \quad \text{(S4)}$$

$$CH_3OH \xrightarrow{hv,catalyst} HCHO + H_2 \quad \text{(S5)}$$

$$HCHO + H_2O \xrightarrow{hv,catalyst} HCOOH + H_2 \quad \text{(S6)}$$

$$HCOOH \xrightarrow{hv,catalyst} CO_2 + H_2 \quad \text{(S7)}$$

Overall reaction: $CH_3OH + H_2O \xrightarrow{hv,catalyst} CO_2 + 3H_2$ (S8)

References

1. Z. Mou, Y. Dong, S. Li, Y. Du, X. Wang, P. Yang and S. Wang, *Int. J. Hydrogen Energy*, 2011, **36**, 8885-8893.
2. S. Min and G. Lu, *Int. J. Hydrogen Energy*, 2013, **38**, 2106-2116.
3. S. Min and G. Lu, *Int. J. Hydrogen Energy*, 2012, **37**, 10564-10574.
4. S. Min and G. Lu, *J. Phys. Chem. C*, 2012, **116**, 25415-25424.