

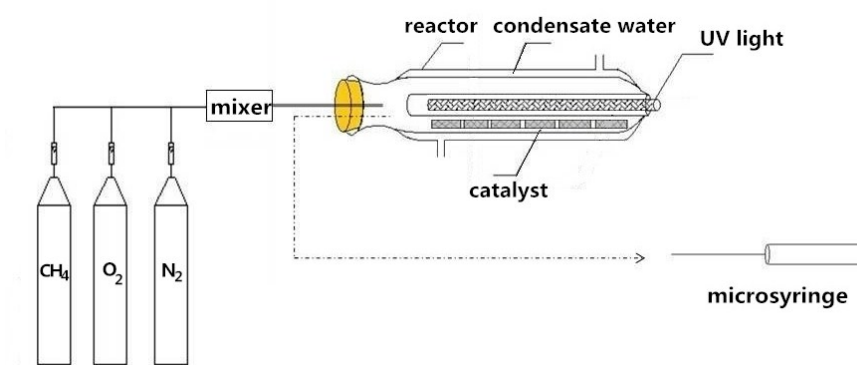
## Electronic Supplementary Information of Manuscript

### Efficient photocatalytic oxidation of methane over $\beta\text{-Ga}_2\text{O}_3$ /activated carbon composites

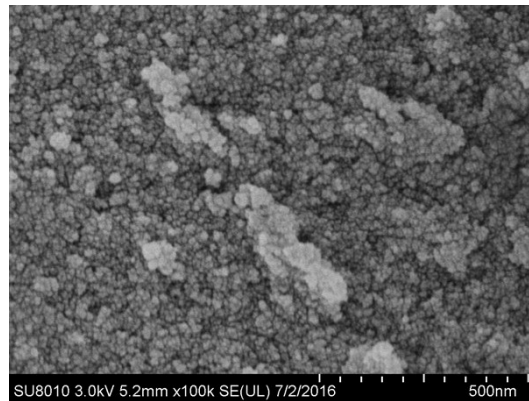
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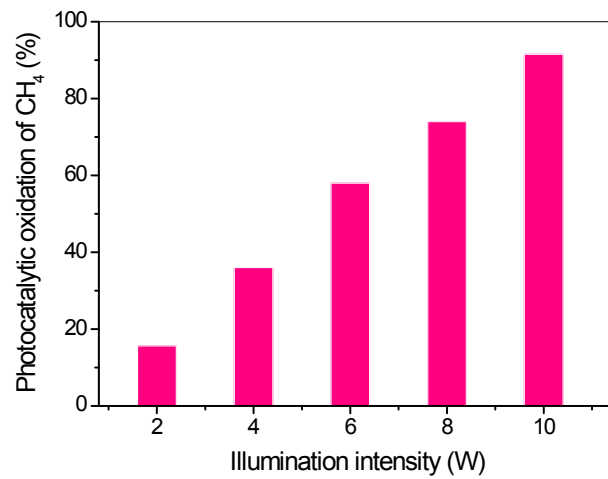
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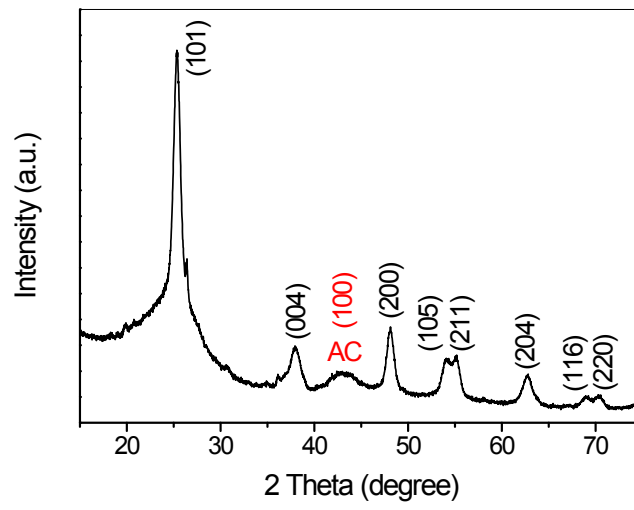
**Fig. S1** The schematic diagram of photocatalytic experimental apparatus. For operation details please see the photocatalytic oxidation of CH<sub>4</sub> in Experimental section.



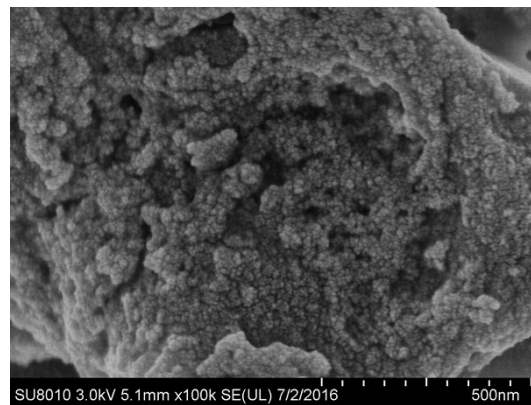
**Fig. S2** SEM image of bare Ga<sub>2</sub>O<sub>3</sub> nanoparticles.



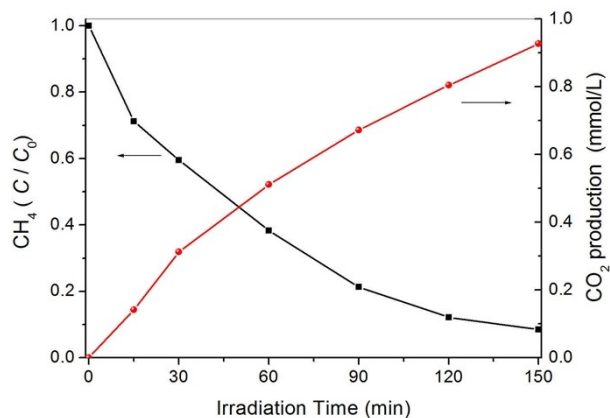
**Fig. S3** The effect of the light intensity on the photocatalytic oxidation of CH<sub>4</sub> over 15%-Ga<sub>2</sub>O<sub>3</sub>/AC sample for 150 min UV irradiation.



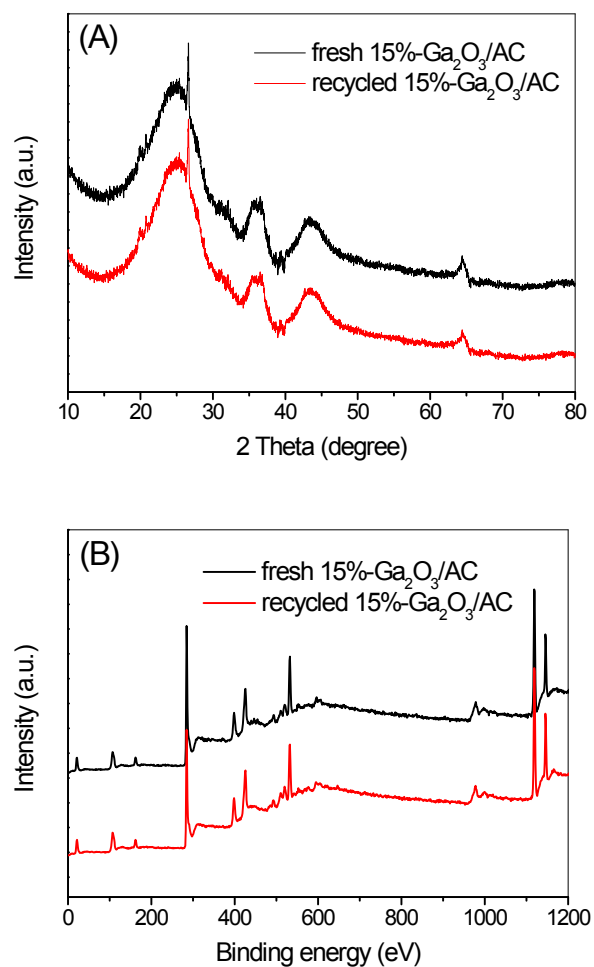
**Fig. S4** XRD pattern of as-prepared 15%-TiO<sub>2</sub>/AC composite.



**Fig. S5** SEM image of 15%-TiO<sub>2</sub>/AC composite.



**Fig. S6** The photocatalytic oxidation of CH<sub>4</sub> and the amount of produced CO<sub>2</sub> over 15%-Ga<sub>2</sub>O<sub>3</sub>/AC as a function of irradiation time.



**Fig. S7** (A) XRD patterns and (B) XPS spectra of freshly prepared and recycled 15%-Ga<sub>2</sub>O<sub>3</sub>/AC composite after six consecutive photocatalytic cycles.