

## Supplementary Information

# Carbon Quantum Dots Enhance the Photocatalytic Performance of BiVO<sub>4</sub> with Different Exposed Facets

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## Experimental

### Catalyst Preparation

All chemicals were purchased from Sigma–Aldrich.

*Preparation of CQDs:* CQDs were synthesized through a electrochemical method: In a typical experiment, The graphite rod (99.99%, Alfa Aesar Co. Ltd.) was inserted into the ultrapure water as anode ( $18.4 \text{ M}\Omega \text{ cm}^{-1}$ , 600 mL), placed parallel to the other graphite rod as counter-electrode with a separation of 7.5 cm. Static potentials of 15~60 V were applied to the two electrodes using a direct current (DC) power supply. After 120 h continuous stirring, the anode graphite rod corroded, and a dark-yellow solution appeared gradually in the reactor. The solution was filtered with slow-speed quantitative filter paper, and the resultant solution was centrifugated at 22000 rpm for 30 min to

remove the precipitated graphite oxide and graphite particles. Finally, the obtained solution was water soluble C-dots.<sup>1</sup>

***Preparation of monoclinic BiVO<sub>4</sub> nanospheres:*** in the preparation, 5mmol Bi(NO<sub>3</sub>)<sub>3</sub>·5H<sub>2</sub>O and 5mmol NH<sub>4</sub>VO<sub>3</sub> were mixed together in 60ml distilled water, the mixture was then stirred for 1 h at room temperature. After that, the mixture was exposed to high-intensity ultrasound irradiation for 60 min. The yellow precipitates were centrifuged, washed with de-ionized water and absolute ethanol, and then dried at 338K in air for 12 h. At last, the obtained yellow powder was calcined at 683K to make sure the crystal phase of BiVO<sub>4</sub> changed from tetragonal (s-t) to monoclinic scheelite structure (s-m).<sup>2-3</sup>

***Preparation of monoclinic BiVO<sub>4</sub> nanoplates:*** in a typical synthesis, 0.5mmol BiCl<sub>3</sub> was added into 50 ml distilled water under mild stir, a white suspension was formed immediately due to the hydrolysis of BiCl<sub>3</sub>. Then, 0.5mmol NH<sub>4</sub>VO<sub>3</sub> were added into the white suspension, and an orange suspension was formed. The pH value of the orange suspension is 2.21. The pH value quickly reached 6.15, and the suspension changed into light yellow and became a colloid solution when 0.5 ml 1M aqueous ethanalamine was added into the suspension. The colloid solution was loaded into a Teflon-lined autoclave. The autoclave was sealed, heated in an oven of 433K for 12 h, and then naturally cooled to room temperature, and a yellow powder formed, which was then collected, washed with

distilled water and ethanol several times to remove ions and possible remnants, and vacuum-dried for further characterization.<sup>4</sup>

***Preparation of CQDs/BiVO<sub>4</sub> nanocomposites:*** To synthesize BiVO<sub>4</sub>/CQDs nanocomposites, we added 0.35g BiVO<sub>4</sub> powder (no matter nanospheres or nanoplates) into 50ml CQDs aqueous solution. Then the nanocomposites were obtained via an oil bath reflux strategy at 363K for 3h. The obtained CQDs/BiVO<sub>4</sub> samples were washed with water, and finally dried in an oven at 338K for 12 h.

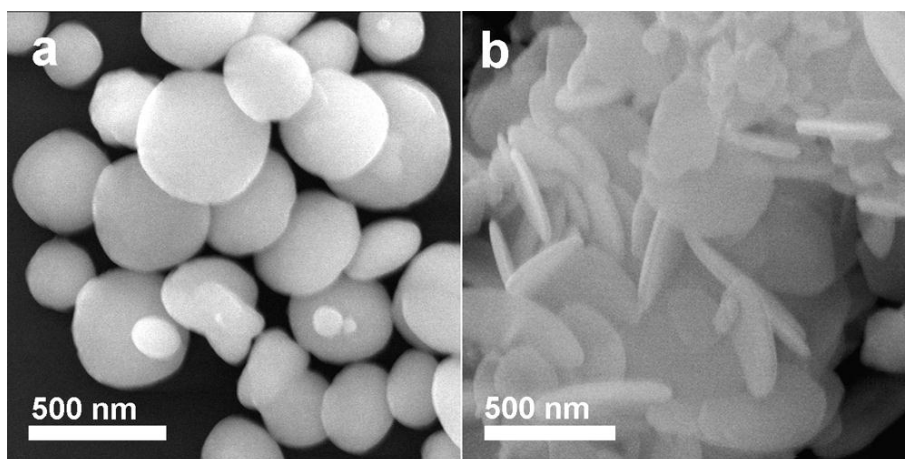
## **Catalyst Characterization**

Scanning electron microscopy (SEM) images and energy dispersive X-ray analysis (EDX) spectroscopy were taken on a FEI-quanta 200 scanning electron microscope with acceleration voltage of 20 kV. The transmission electron microscopy (TEM) and high-resolution TEM (HRTEM) images were obtained with a FEI/Philips Tecnai 12 BioTWIN transmission electron microscope and a CM200 FEG transmission electron microscope, respectively. The normal TEM samples were prepared by dropping the solution onto a copper grid covered with carbon film and dried in air. Raman spectra were collected on an HR 800 Raman spectroscope (J Y, France) equipped with a synapse CCD detector and a confocal Olympus microscope. The spectrograph uses 600 g mm<sup>-1</sup> gratings and a 633 nm He–Ne laser. Room temperature UV–Vis

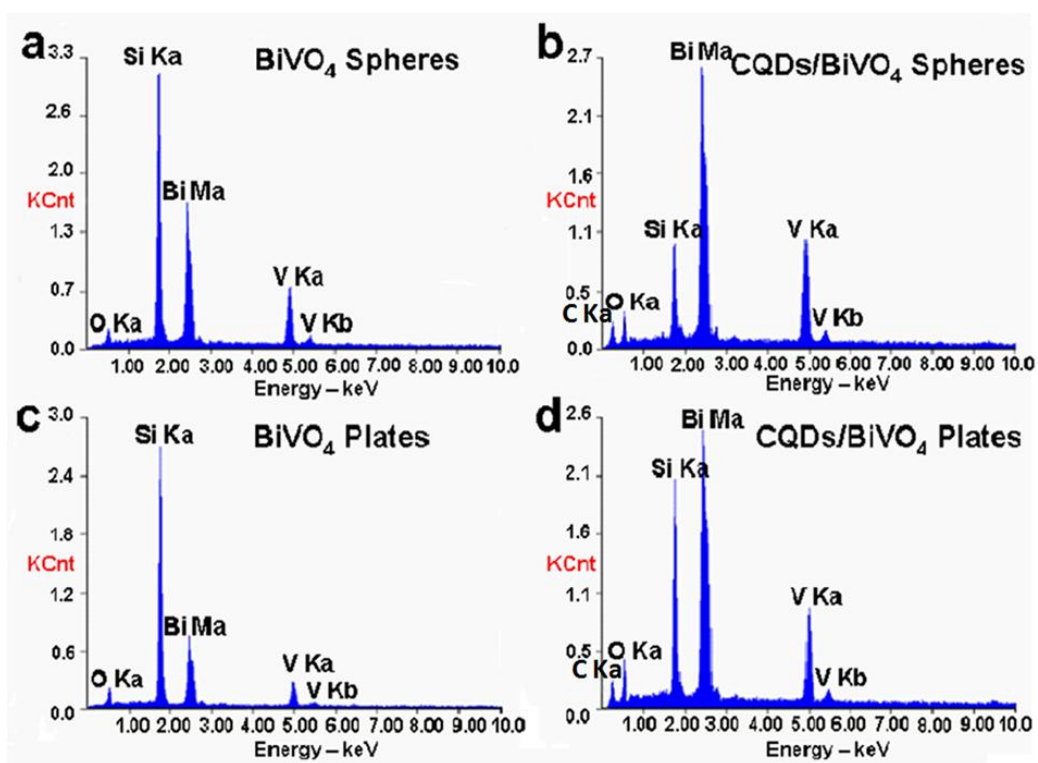
absorption was recorded on a Lambda 750 (PerkingElmer) spectrophotometer in the wavelength range of 200–1000 nm. The crystal structure of the resultant products was characterized by X-ray powder diffraction (XRD) by using a X'Pert-ProMPD (Holand) D/max-γAX-ray diffractometer with Cu Kα radiation ( $\lambda=0.154178$  nm).

### ***Photocatalytic Activity***

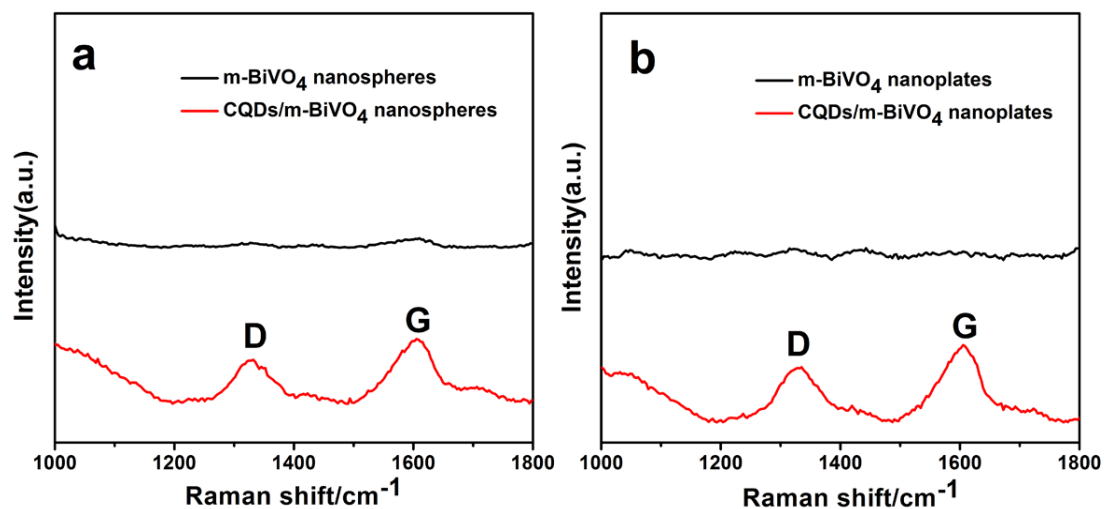
*Photocatalytic degradation of methylene blue:* the photocatalytic activities of the m-BiVO<sub>4</sub> nanospheres, CQDs/m-BiVO<sub>4</sub> nanospheres, m-BiVO<sub>4</sub> nanoplates, CQDs/m-BiVO<sub>4</sub> nanoplates were orderly evaluated by degradation of MB in an aqueous solution under visible light from a 300W Xe lamp equipped with cutoff filter to remove light of  $\lambda < 420$  nm. 0.2 g photocatalyst was suspended in 30 mL aqueous solution of 50 ppm MB. The solution was stirred for 1h without light to ensure the establishment of an adsorption–desorption equilibrium. During the irradiation, 3 mL aliquots were removed at certain time intervals and analyzed on a UV-Vis spectrophotometer to record concentrations. Before the spectroscopy measurement, these photocatalysts were removed from the photocatalytic reaction systems by centrifugation.



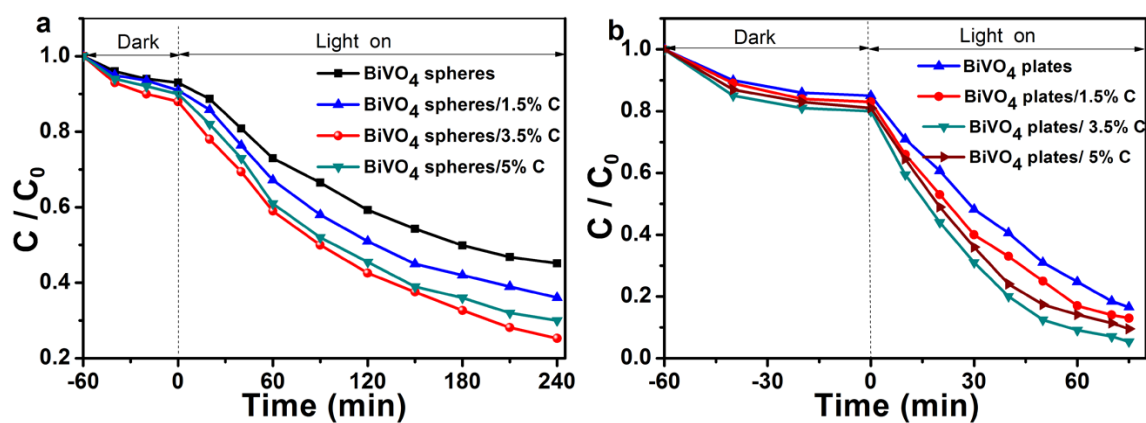
**Fig. S1** SEM images of (a) monoclinic BiVO<sub>4</sub> nanospheres and (b) BiVO<sub>4</sub> nanoplates.



**Fig. S2** EDS patterns of (a) BiVO<sub>4</sub> nanospheres; (b) CQDs/BiVO<sub>4</sub> nanospheres; (c) BiVO<sub>4</sub> nanoplates; (d) CQDs/BiVO<sub>4</sub> nanoplates.



**Fig. S3** The enlarged Raman spectra of (a) m-BiVO<sub>4</sub> nanospheres and its composites, (b) m-BiVO<sub>4</sub> nanoplates and its composites.



**Fig. S4** The effect of different CQDs amounts (0 wt%, 1.5 wt%, 3.5 wt%, 5 wt%) on photocatalytic activities of (a) m-BiVO<sub>4</sub> nanospheres, (b) m-BiVO<sub>4</sub> nanoplates for MB degradation under visible light irradiation.

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