Supporting Information

Controlled synthesis of highly dispersed $BiPO_4$ photocatalyst with surface oxygen vacancy

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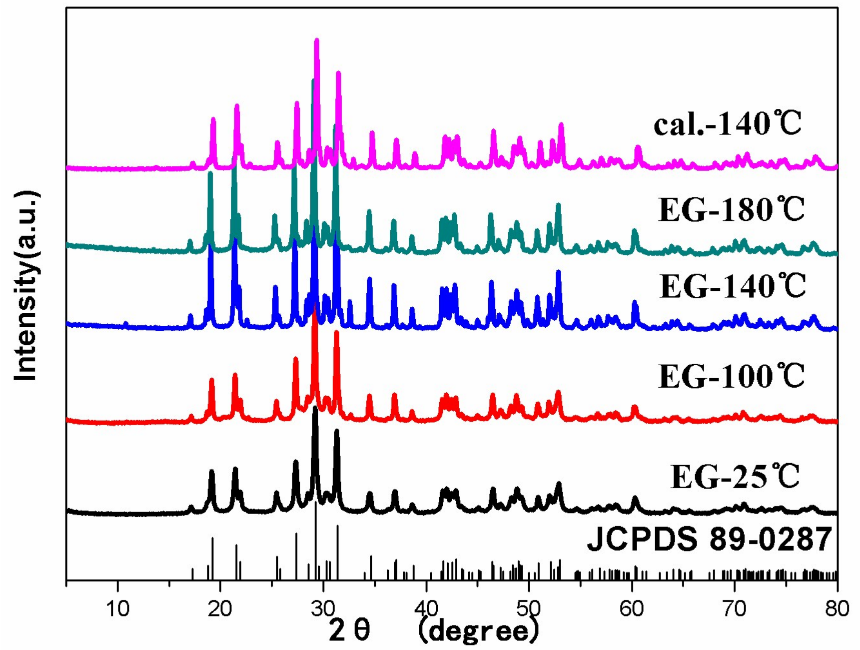

Fig. S1A XRD patterns of $BiPO_4$ synthesized at different reaction temperatures

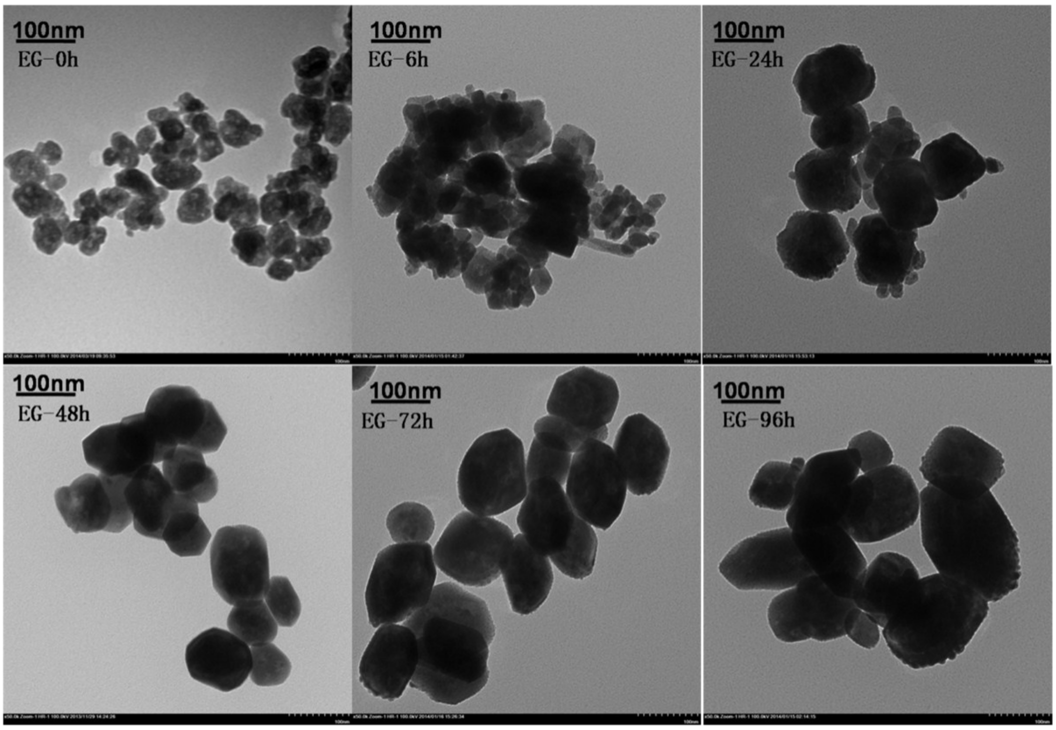

Fig. S1B TEM images of $BiPO_4$ synthesized at 140°C for different reaction time

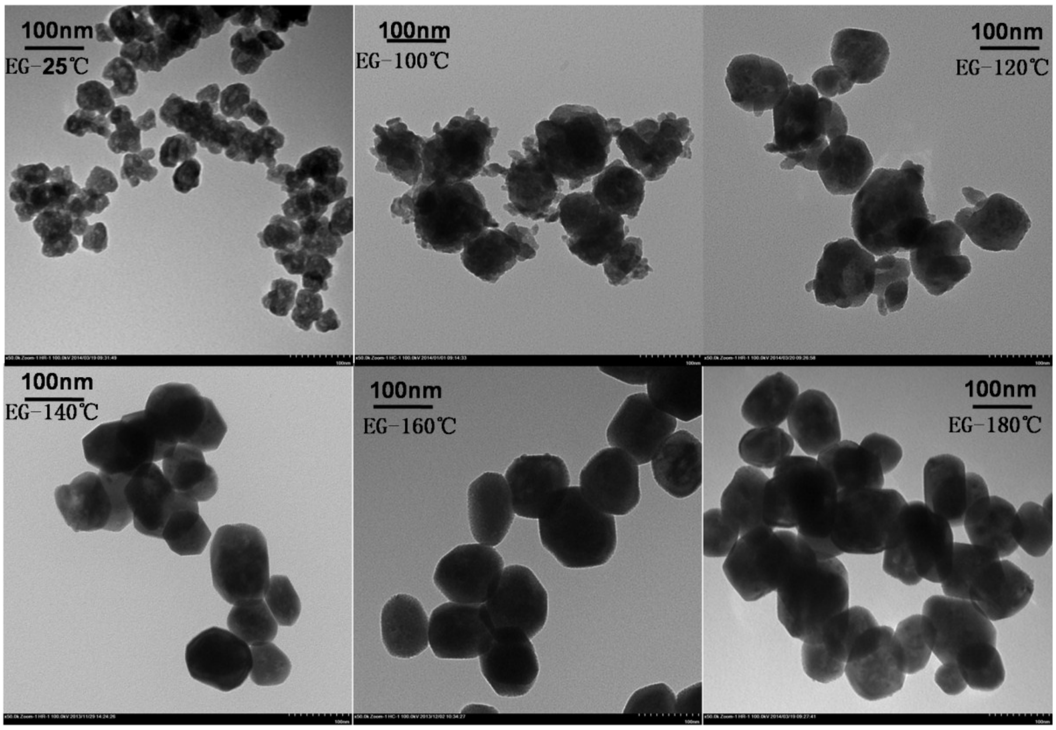

Fig. S1C TEM images of $BiPO_4$ synthesized at different reaction temperatures for 48 h

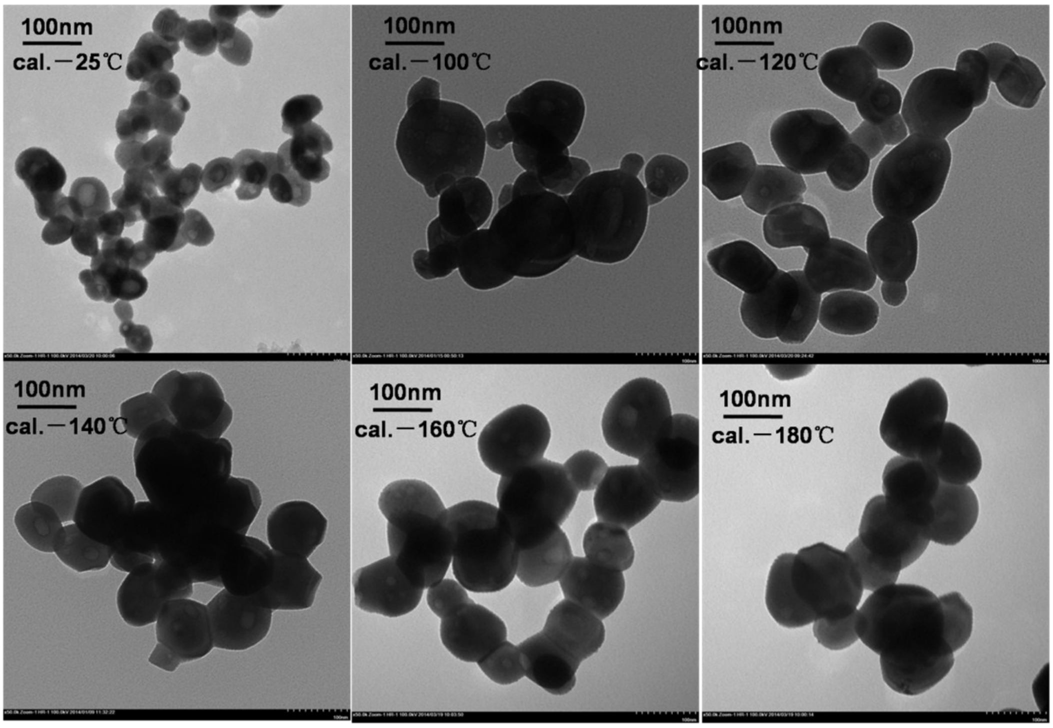

Fig. S1D TEM images of calcinated $BiPO_4$ synthesized at different solvothermal temperatures

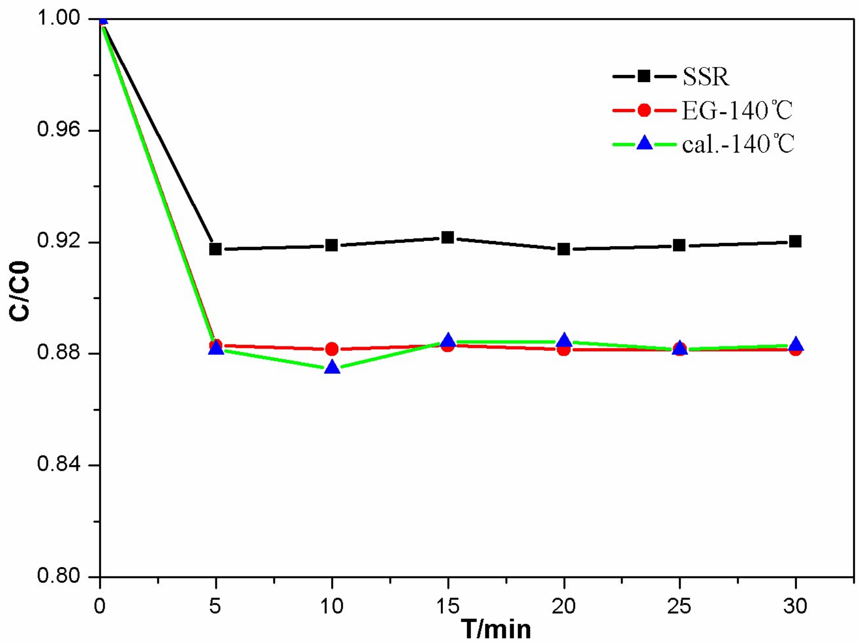

Fig. S2 The adsorption of SSR, EG-140°C, and cal.-140°C on the degradation of MB solution, in dark

In order to test the adsorption capacity of the photocatalysts, the adsorption-desorption equilibrium experiments were conducted (results shown in the Fig.S2). As can be seen from Fig.S2, the adsorption percentages of MB on EG-140°C and cal.-140°C are almost identical, which are about 12%

and both are higher than that for SSR (about 4%). Therefore, the adsorption capacity of the highly dispersed photocatalysts are strong, which contributes to their efficient removal of the pollutants.

Fig. S3 Photos of EG-140°C and cal.-140°C dispersed in MB,RhB and MO 2×10^{-5} mol/L solutions stand for 0h (upper) and 24h (lower)

As can be seen in Fig. S3, EG-140°C and cal.-140°C not only exhibit good dispersion performance in water, but also in the solution of MB, RhB and MO, since they are very small particles and do not agglomerate with these pollutants.

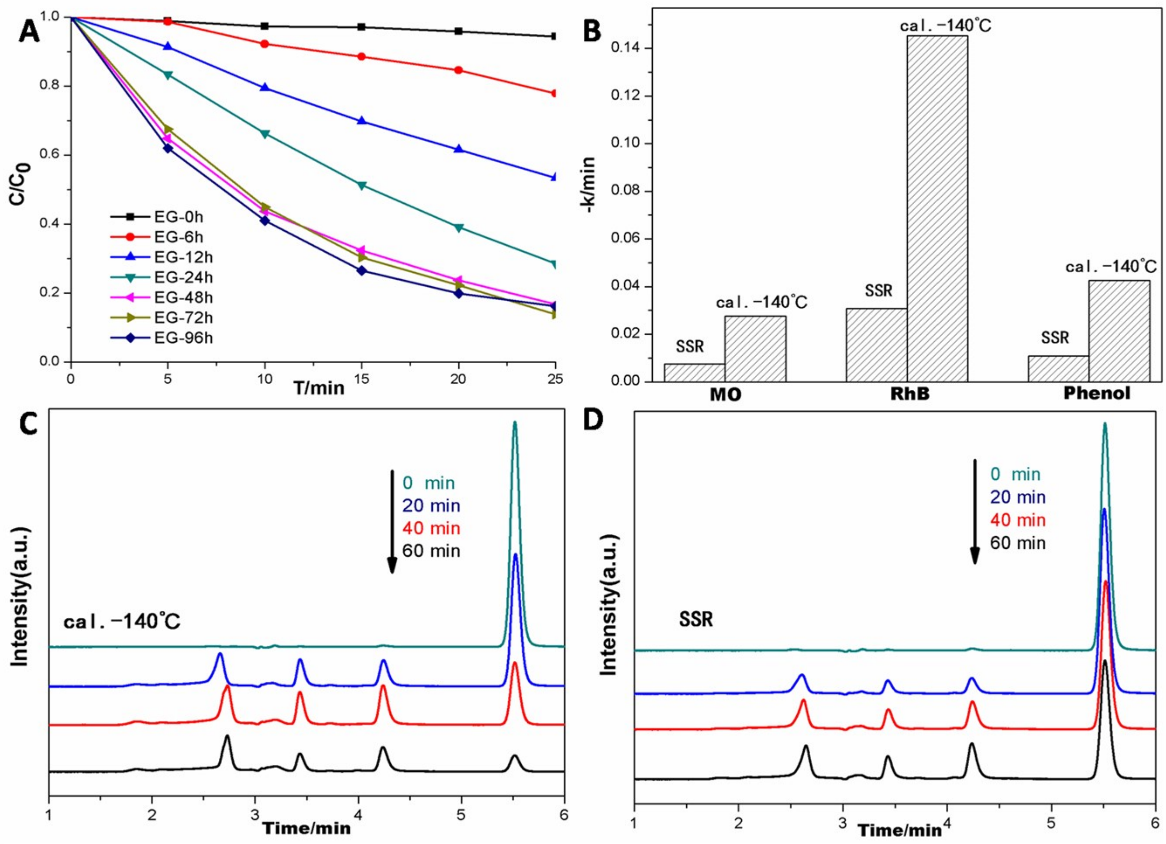

Fig. S4 (A)Degradation curves of MB (1×10^{-5} mol/L) by $BiPO_4$ prepared by different solvothermal time; (B) Apparent rate constants of degrading MO, RhB and phenol by SSR and cal.140°C; (C)and (D) are liquid chromatography of degrading phenol by cal.-140°C and SSR respectively.

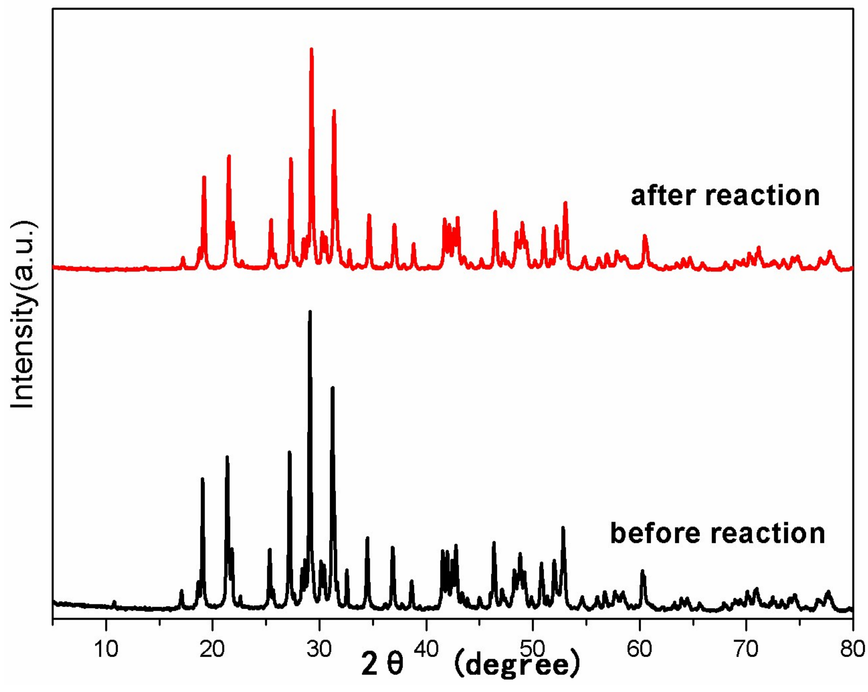

Fig. S5 XRD patterns of cal.-140°C after 5 cycles of degradation of MB solution

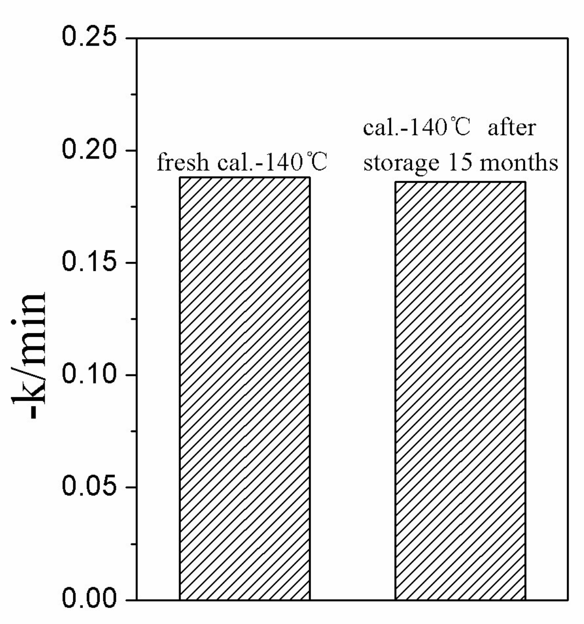

Fig. S6 The photocatalytic activities of fresh and after storage 15 months cal.-140°C on the degradation of MB.

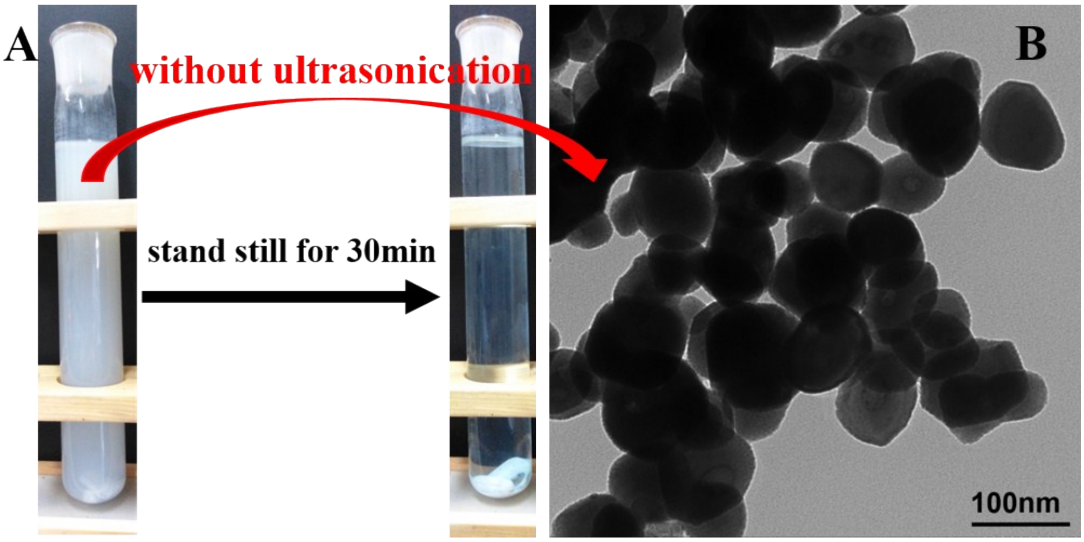

Fig. S7 Optical photos and TEM images of of catalysts cycled for 5 times without ultrasonication.

It is really difficult to recycle small particles. If the cal.-140°C disperses into water, it is difficult to subside completely for a week. With the reaction of photocatalysis, the hydrophilic organics on the surface is desorbed gradually and the absolute value of Zeta potential will decrease. This phenomenon becomes more and more obvious as the reaction of photocatalysis proceeds. The photocatalyst after 5 times recycle could be subsided completely after still standing for 30 min (shown in Fig. S7A). So it has solved the separation problem. The particles are aggregated after recycle for many times (shown in Fig. S7B).

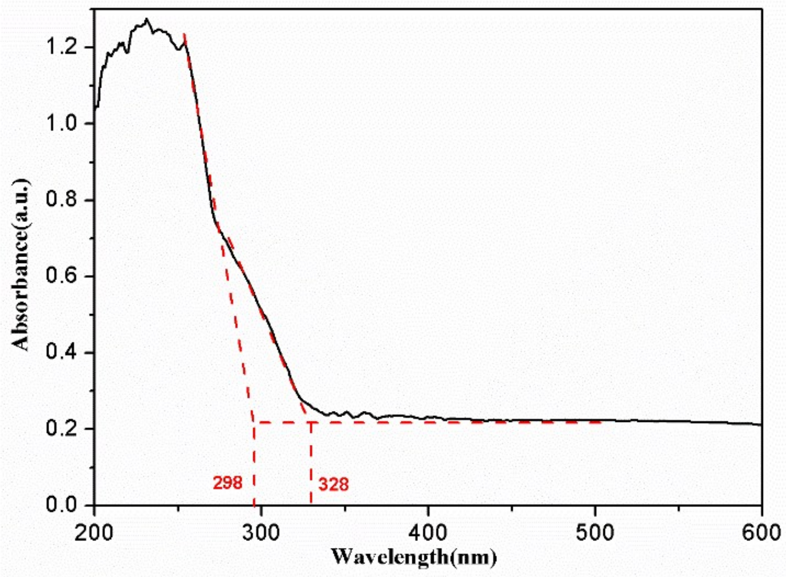

Fig. S8 UV–vis diffuse reflectance spectra of cal.-140°C.

As shown in the DRS of cal.-140°C, the main absorption edge is about 298 nm, corresponding to the band gap of 4.16 eV. Besides, another absorption edge is 328 nm, corresponding to the band gap of 3.78 eV. According to the literature J. Mater. Chem. A, 2014, 2, 1174-1182 and J. Phys. Chem. C 2013, 117, 18520−18528, the band gap of pure monoclinic BiPO4 is about 4.1 eV. Therefore, 4.16 eV is confirmed to be the intrinsic band gap of monoclinic BiPO4, and 3.78 eV is the gap between the energy level induced by surface oxygen vacancy.