**Supporting Information**

# Z-scheme 2D/3D hierarchical $MoS_2$@$CoMoS_4$ flower-shaped arrays with enhanced full spectrum light photoelectrocatalytic activity for $H_2O_2$/*p*-aminophenol production and contaminants degradation

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## SEM of pure $MoS_2$nanosheets:

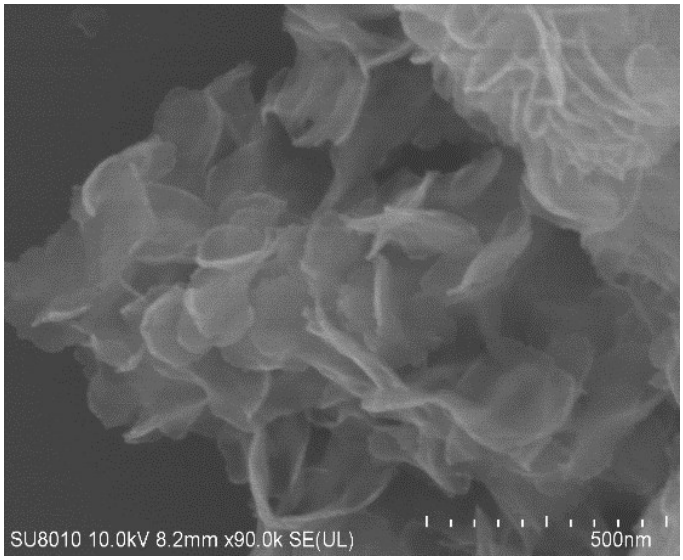


**Fig. S1**.SEM image of $MoS_2$ nanosheets.

**Bias potential optimization curve**

Fig. S2 showed the effect of photo-cathodic bias potential (–0.4 to –0.8 V *vs* SCE) on $H_2O_2$ production using the $MoS_2$@$CoMoS_4$ photo-cathode. It can be seen that the $H_2O_2$ yields increased when the cathodic bias potential decreased from –0.4 V to –0.5 V. When the cathodic bias potential exceeded –0.5 V, the $H_2O_2$ yield declined. The increase of cathodic bias potential can enhance the electron transfer photogenerated on the $MoS_2$@$CoMoS_4$ photo-cathode, which can further promote the $H_2O_2$ production. When the photo-cathodic bias potential became more negative than –0.5 V, hydrogen evolution reaction could appear and become more remarkable on the photo-cathode, which inhibited the accumulation of $H_2O_2$. Therefore, –0.5V is the best bias potential in this experiment.

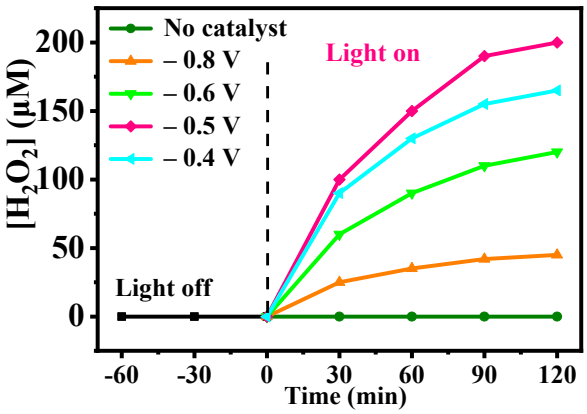


**Fig. S2.** The effects of applied potentials (*vs*. SCE) on the yields of $H_2O_2$ over $MoS_2$@$CoMoS_4$.

**$MoS_2$ modifying dosages optimization curve**

The addition amount of $MoS_2$ was 0.037 g, 0.075 g, 0.112 g, 0.149 g and 0.186g, respectively. When the addition amount of $MoS_2$ was 0.149 g, the catalytic production of $H_2O_2$ reached the maximum, which was chose as the optimal $MoS_2$ addition amount.

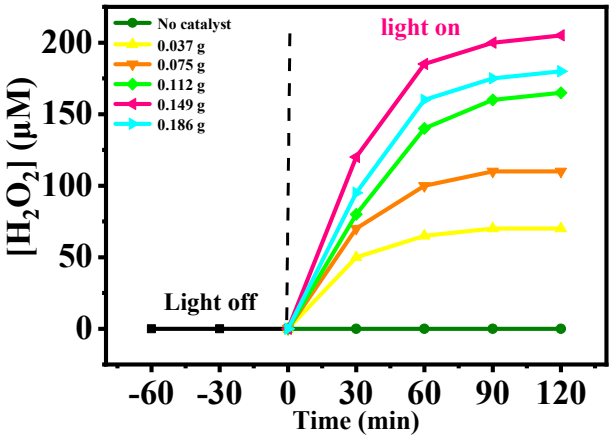


**Fig. S3.** The effect of $MoS_2$ modifying dosages on the yields of $H_2O_2$ over $MoS_2$@$CoMoS_4$.

**The HPLC chromatogramsof pure *p*-NP and *p*-AP.**

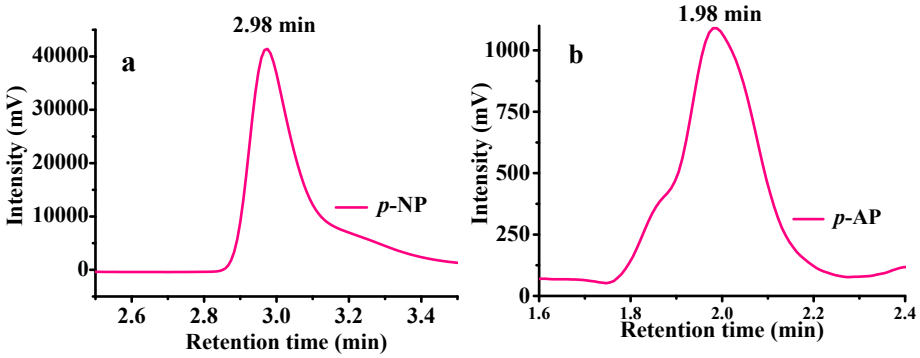


**Fig. S4**. HPLC chromatograms of *p*-NP standard (a) and *p*-AP standard (b) under the same conditions.