Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Supporting Information

Removal of SO_2 on a Nanoporous Photoelectrode with Simultaneous H_2 Production

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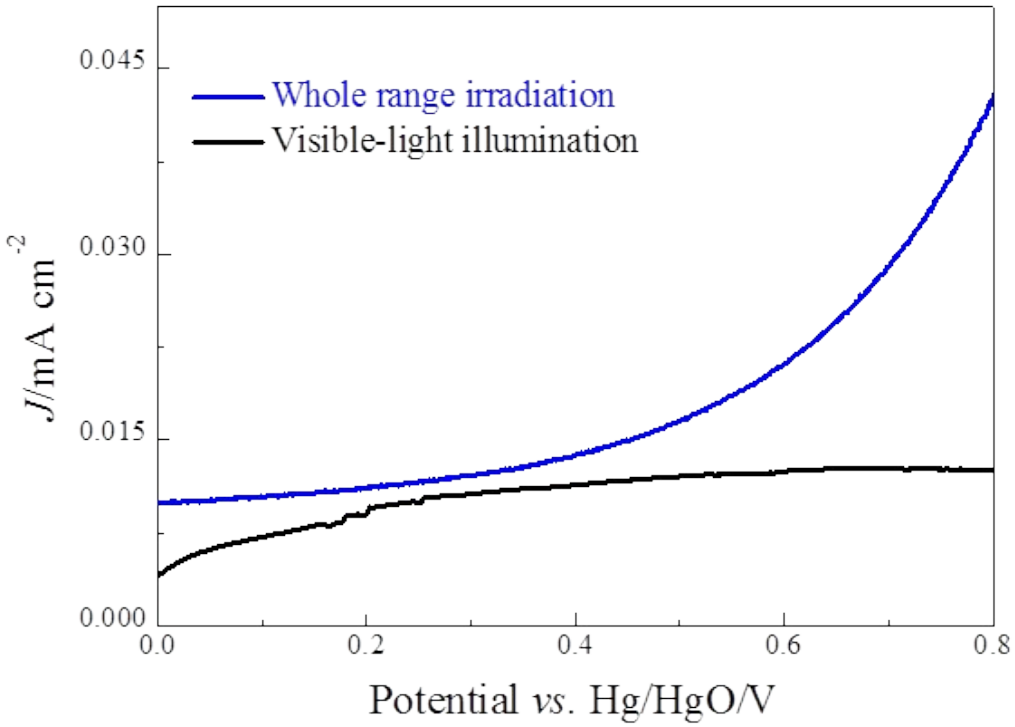

Fig. S1 *J-V* curves of porous $BiVO_4$ in NaOH (aq) under visible-light illumination and whole range irradiation.

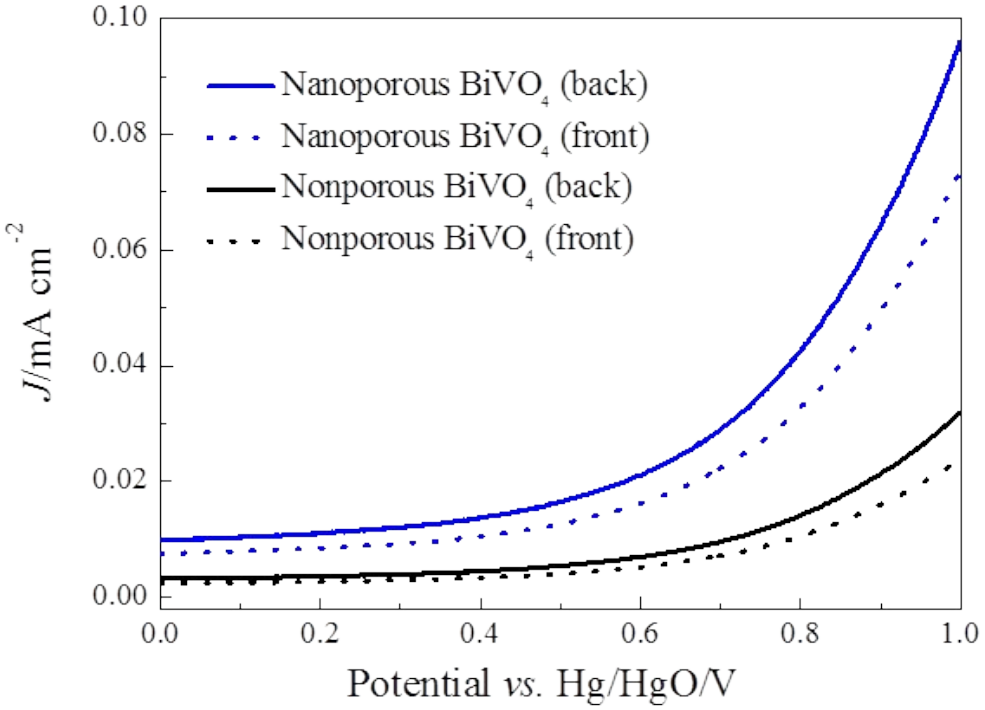

Fig. S2 *J-V* curves of porous $BiVO_4$ and nonporous one frome back side and film side separately in NaOH(aq).

As shown in Fig. S2, for all these electrodes, back-side illumination produces higher photocurrent than front-side illumination, which has been reported to be related to the poor electron transport in $BiVO_4$ (J. Phys. Chem. C 115, 17594 – 17598 (2011)). In $BiVO_4$, the $BiVO_4$ crystal is composed of non-interconnecting VO4 tetrahedra. The conduction band of $BiVO_4$ consists mainly of V 3d orbitals, consequently, the photogenerated electrons have to hop between VO_4 tetrahedra in $BiVO_4$. In the PEC cell, the photogenerated electrons need to travel from the place generated to the FTO conductive substrate. Under backside illumination most electrons are generated close to the FTO substrate, the required diffuse length is thus shorter than for front side illumination.

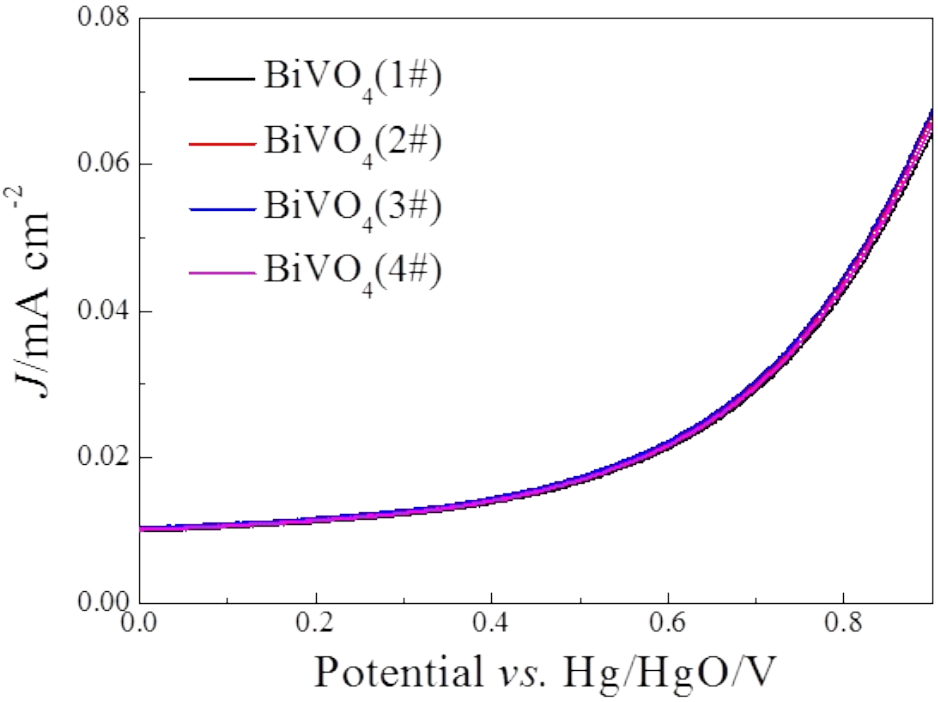

Fig. S3 *J-V* curves of porous $BiVO_4$ in NaOH(aq) (4 different samples prepared under same condition).

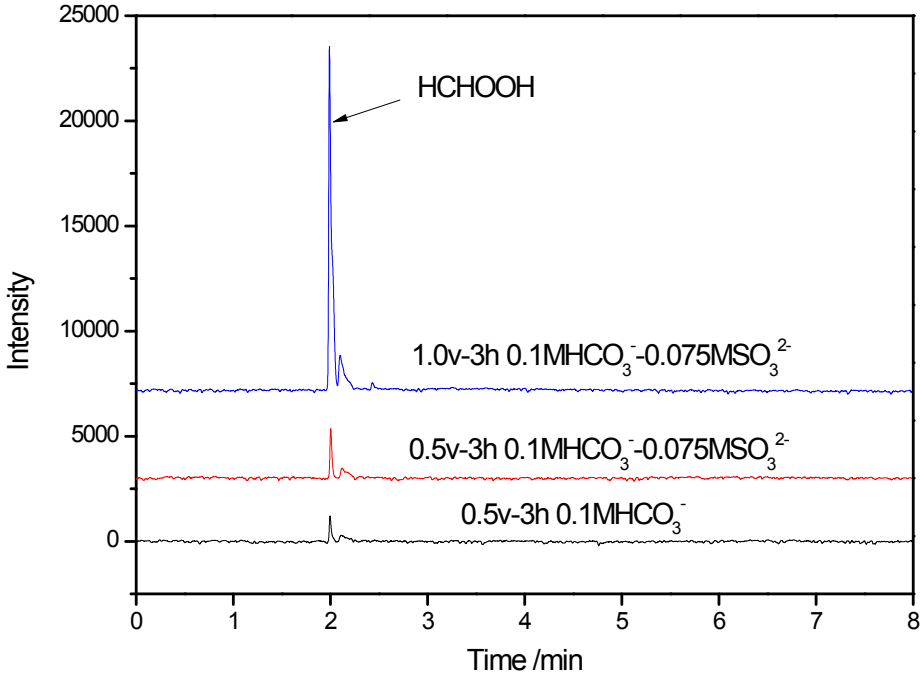

Fig. S4 The liqiud phase ananlysis of the product by GC.

It is shown that CO_2 is reduced to HCHOOH, if there is a high amount of CO_2 in the flue gas. However, the SO_2 removal rate is still higher than 97%. Only the H_2 production is decreased due to the consumption of electrons for CO_2 reduction. This result also shows that the current PEC process may also be promising for a simultaneous removal of SO_2 and CO_2. Another research work on simultaneous removal of SO_2 and reduction of CO_2 is underway in our lab, which is not the research focus in this work.