ESI

Bimetallic phosphide decorated Mo-$BiVO_4$ for significantly improved photoelectrochemical activity and stability

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Table S1. The dissolved amount of V and Bi in the used electrolyte after stability testing for three kinds of films.

Samples	The dissolved amount of Bi (mg/L)	The dissolved amount of V (mg/L)
$BiVO_4$	0.36996	0.67617
Mo-$BiVO_4$	0.33365	0.62050
NiCoP/Mo-$BiVO_4$	0.24561	0.24907

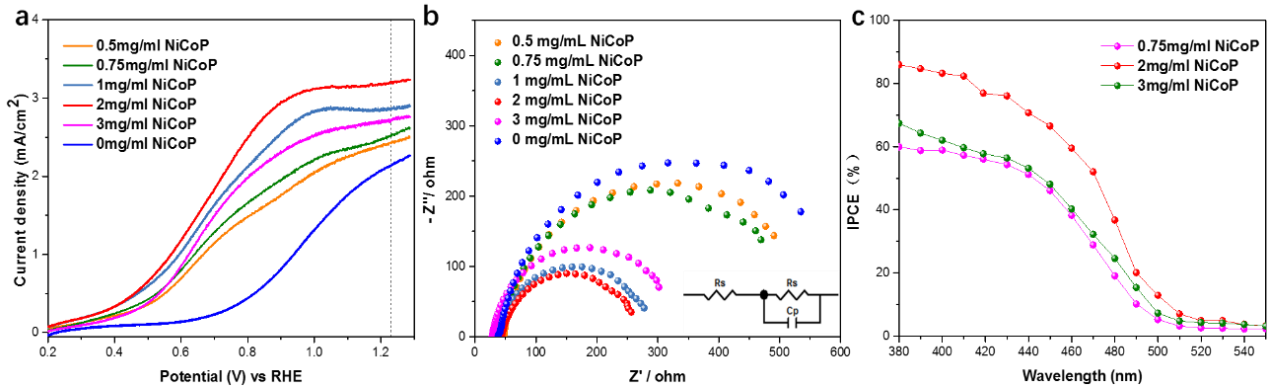


Fig. S1. J-V curves recorded under AM 1.5G illumination (a), EIS in Nyquist plots measured at 0.9 V *vs.* RHE under AM 1.5G illumination (b) and IPCE spectra measured at 1.23 V *vs.* RHE (c) for optimizing the amount of NiCoP decorated on Mo-$BiVO_4$. The sample of 2 mg/mL NiCoP shows the best PEC activity among all samples. Therefore, it is chosen as the optimal decoration amount (corresponding to ca. 2% NiCoP decorated on Mo-$BiVO_4$).

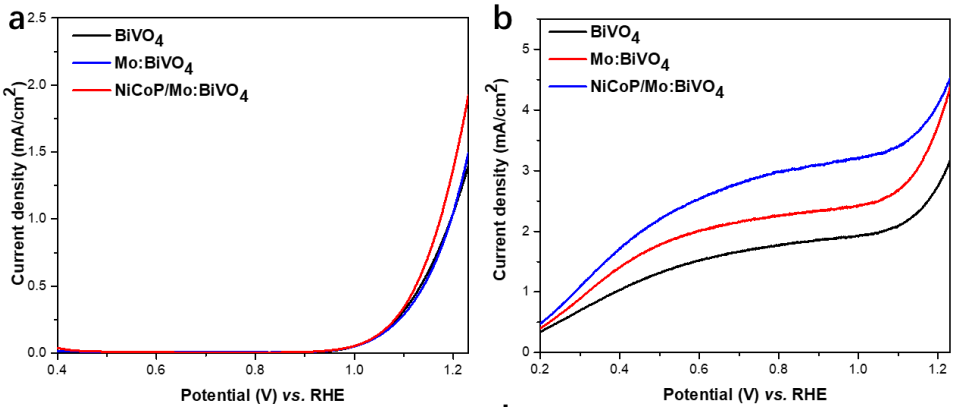


Fig. S2. J-V curves measured without (a) and with (b) AM 1.5G illumination for sulfite oxidation (with 0.1 M Na_2SO_3) of pure $BiVO_4$, Mo-$BiVO_4$ and NiCoP/Mo-$BiVO_4$ photoanodes. (c) Charge separation efficiency and charge injection efficiency (d).

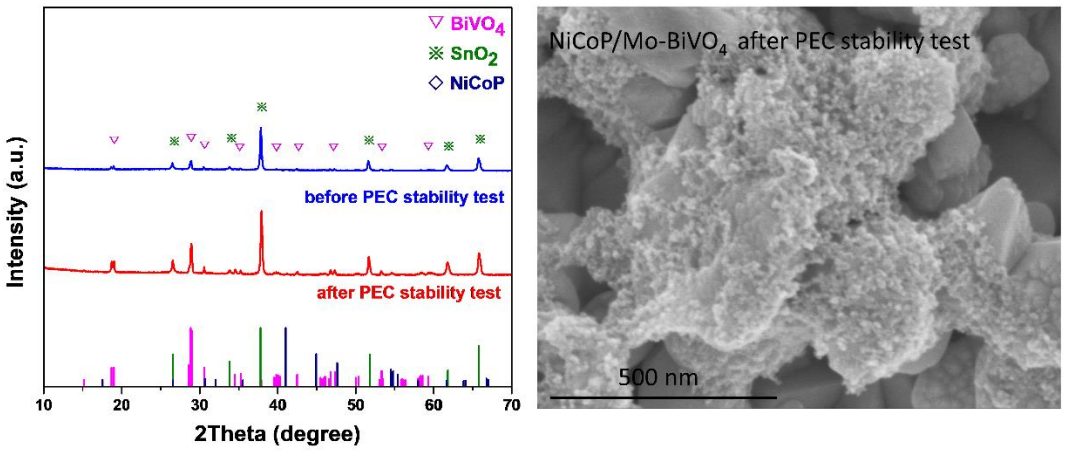
To exclude the influence of the sulfite oxidation kinetics on the surface of different samples, J-V measurements for sulfite oxidation without light illumination for the prepared photoanodes are carried out, and the results shows that there is no obvious distinction of the onset potential among pure $BiVO_4$, Mo-$BiVO_4$ and NiCoP/Mo-$BiVO_4$ samples, revealing that all photoanodes present very slow sulfite oxidation kinetics. Under AM 1.5G illumination, the photocurrent density of pure $BiVO_4$ is 3.11 mA/cm^2, while Mo-$BiVO_4$ and NiCoP/Mo-$BiVO_4$ photoanode display the photocurrent density of 4.30 mA/cm^2 and 4.55 mA/cm^2, respectively.

The calculation of surface charge injection and separation efficiency was according to the following equation:

$$\eta_{\text{inj}} = J_{H_2O}/J_{Na_2SO_3}$$

$$\eta_{\text{sep}} = J_{Na_2SO_3}/J_{abs}$$

where η_{inj} is the surface charge injection efficiency of the semiconductor, η_{sep} is the charge separation efficiency, J_{H_2O} is the photocurrent density for water oxidation acquired in Na_2SO_4 solution, $J_{Na_2SO_3}$ is the photocurrent density for sulfite oxidation acquired with the presence of 0.1 M Na_2SO_3 in the Na_2SO_4 solution, and J_{abs} is the theoretical photocurrent density assuming that the absorbed irradiation was completely converted.



(a) (b)

Fig. S3. XRD patterns (a) before and after PEC stability test of NiCoP/Mo-$BiVO_4$ and SEM images (b) of NiCoP/Mo-$BiVO_4$ after PEC stability test.