Supporting Information

Facile construction of BiVO₄/CoV-LDHs/Ag photoanode for enhanced photo-electrocatalytic glycerol oxidation and hydrogen evolution

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Fig. S1 (a) SEM image and (b) XRD pattern of BiOI film on a FTO substrate.



Fig. S2 (a) Low-magnification, (b) high-magnification top view SEM images, (c) cross-sectional view SEM image, and (d) XRD pattern of pristine BVO photoanode.



Fig. S3 XRD patterns of (a) Co-based LDHs and (b) Ni-based LDHs synthesized via hydrothermal procedures.



Fig. S4 SEM image of drop casting hydrothermally synthesized layered $Co(OH)_2$ on BVO photoanode, with $Co(OH)_2$ loading amount of 0.08 mg cm⁻².



Fig. S5 LSV curves of (a) BVO/Co-based LDHs and (b) BVO/Ni-based LDHs photoanodes prepared by drop-casting method with Co(Ni):M = 3:1 in LDHs, the electrolytes were 0.5 M Na₂SO₄ solution with 0.1 M glycerol. (c) and (d) Comparison of the current density at 1.23 V for various photoanodes under GOR condition. Scan rate was 10 mV s⁻¹.



Fig. S6 (a) SEM image and (b) XRD pattern of BVO/CoV-LDHs photoanode prepared via electrodeposition, with Co:V molar ratio of 10:1.



Fig. S7 LSV curves of BVO/Co-based LDHs (electrodeposition, Co:M molar ratio 5:1) photoanodes in 0.5 M Na₂SO₄ solution with 0.1 M glycerol, scan rate 10 mV s⁻¹.



Fig. S8 LSV curves of BVO/CoV-LDHs photoanodes prepared by electrodeposition with different Co/V ratio in CoV-LDHs, recorded in $0.5 \text{ M} \text{ Na}_2\text{SO}_4$ solution with 0.1 M glycerol, scan rate 10 mV s⁻¹.



Fig. S9 The line-scan profiles of BVO/CoV-LDHs/Ag photoanode.



Fig. S10 XRD pattern of BVO/CoV-LDHs/Ag photoanode.



Fig. S11 Diagram illustrating front- and back-side illumination, and the LSV curves of BVO/CoV-LDHs/Ag photoanode for front-side illumination and back-side illumination in 0.5 M Na₂SO₄ solution with 0.1 M glycerol, scan rate 10 mV s⁻¹.



Fig. S12 LSV curves of BVO, BVO/CoV-LDHs, and BVO/CoV-LDHs/Ag photoanodes under dark condition, recorded in 0.5 M Na_2SO_4 solution with 0.1 M glycerol, scan rate 10 mV s⁻¹.



Fig. S13 LSV curves of BVO/CoV-LDHs/Ag photoanode with different Ag loading amount (controlled by the immersion time of BVO/CoV-LDHs in AgNO₃ solution), recorded in 0.5 M Na₂SO₄ solution with the presence of 0.1 M glycerol, scan rate 10 mV s⁻¹.



Fig. S14 LSV curves of BVO, BVO/CoV-LDHs, and BVO/CoV-LDHs/Ag photoanode in 0.5 M Na_2SO_3 solution, scan rate 10 mV s⁻¹.



Fig. S15 HPLC chromatograms of collected solution products after GOR on BVO/CoV-LDHs/Ag photoanode at a constant potential of 0.8 V.



Fig. S16 Yield of oxidation products on various photoanodes in 0.5 M Na₂SO₄ solution with 0.1 M glycerol at a constant potential of 0.8 V, when the photoelectrocatalysis duration reached 2, 4, and 6 h.



Fig. S17 The proposed photo-electrocatalytic oxidation pathway of glycerol on BVO photoanode.



Fig. S18 (a) I-t curves of GOR performed at different applied potentials in 0.5 M Na_2SO_4 solution with 0.1 M glycerol. (b) Yield of photo-electrocatalytic oxidation products on BVO/CoV-LDHs/Ag photoanode at different applied potentials after 4 h.



Fig. S19 I-t curve of BVO/Co-V LDHs/Ag photoanode with a constant applied potential of 1.2 V for 10 h in 0.5 M Na_2SO_4 solution with the presence of 0.1 M glycerol.

Anodic catalyst	Electrolyte	Current density at 1.23 V (mA cm ⁻²)	Ref.
BVO/CoV-LDHs/Ag	$0.5 \text{ M Na}_2\text{SO}_4 + 0.1 \text{ M glycerol}$	7.15	This work
BVO/CoV-LDHs	$0.5 \text{ M Na}_2\text{SO}_4 + 0.1 \text{ M glycerol}$	4.98	This work
BVO	$0.5 \text{ M Na}_2\text{SO}_4 + 0.1 \text{ M glycerol}$	2.65	This work
BiVO4/NiCo-LDH-Act	$0.5 \text{ M Na}_2\text{SO}_4 + 0.6 \text{ M glycerol}$	4.58	[1]
MP-BiVO ₄	$0.5 \text{ M Na}_2\text{SO}_4 \text{ (pH} = 2) + 0.1 \text{ M}$ glycerol	6.04	[2]
BVO/TANF	$0.1 \text{ M Na}_2 \text{SO}_4 / \text{H}_2 \text{SO}_4 (\text{pH} = 2) + 0.1 \text{ M glycerol}$	5.26	[3]
Ta:BiVO ₄	$25 \text{ mM H}_2\text{SO}_4 + 1 \text{ M glycerol}$	3.07	[4]
Bi ₂ O ₃ /TiO ₂	0.5 M Na ₂ SO ₄ + 0.1 M glycerol	2.45	[5]
Mo-BiVO ₄	Phosphate buffer electrolyte (0.1 M, pH = 7) plus 10% glycerol	5.80	[6]
CoNiFe-LDH/Ta ₃ N ₅	1 M NaOH +10% glycerol	3.59	[7]
BVO (010)	0.1M NaBi+ 0.1 M glycerol	1.45	[8]

Table S1. Comparison of the photoelectrochemical GOR acitivity between BVO/CoV-LDHs/Ag and some other electrocatalysts in the recent literature reports.

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