Electronic Supplementary Material (ESI) for Catalysis Science & Technology.
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Supporting information for

Efficient hydrogen production from MIL-53(Fe) catalyst-modified Mo: $BiVO_4$ photoelectrodes

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Experimental Section

Preparation of 2%Mo:$BiVO_4$-FeOOH composite materials.

The 2%Mo:$BiVO_4$-FeOOH photoanode was prepared by photoelectron-deposition [1]. The experimental process was carried out in 0.1 M $FeSO_4 \cdot 7H_2O$ solution while gently stirring. Prior to the photoelectron-deposition of FeOOH, the solution was purged with nitrogen gas for 1 h. An three-electrode cell was used that was composed of a 2% Mo:$BiVO_4$ film as working electrode, a Pt as counter electrode, and a saturated calomel electrode (SCE) as reference electrode. The process was carried out at 0.1 V (vs. SCE) under a 300 W Xe arc lamp with an AM 1.5G filter for 10, 20 and 30 min, which were recorded as 2%Mo:$BiVO_4$/FeOOH-1, 2%Mo:$BiVO_4$/FeOOH-2 and 2%Mo:$BiVO_4$/FeOOH-3.

Reference

[1] T. W. Kim and K. S. Choi, *Science*, **2014**, *343*, 990-994.

Supplemental Figures

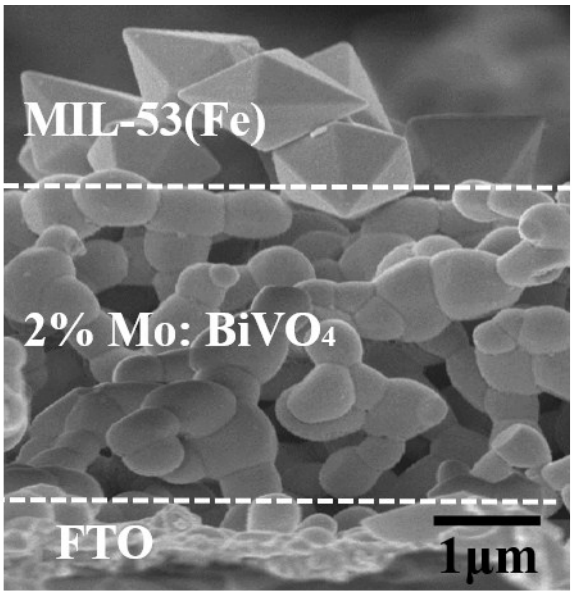

Figure S1. The cross-sectional SEM image of the FMBV photoanode.

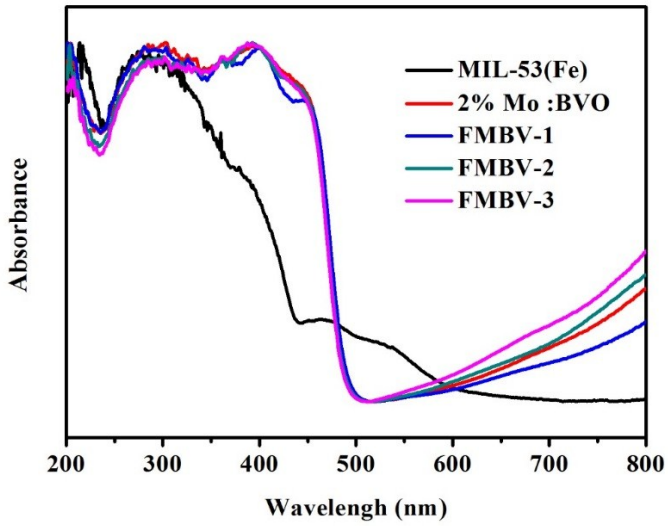

Figure S2. UV-vis absorption spectra of FMBV films with various amounts of prepared MIL-53(Fe).

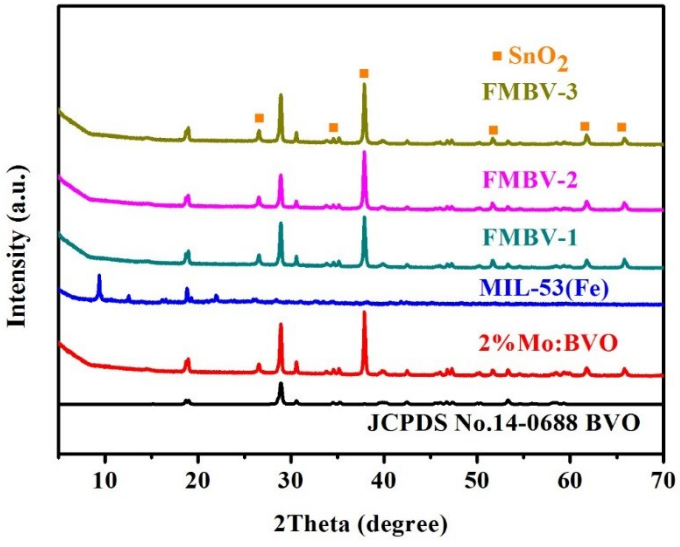

Figure S3. XRD patterns of MIL-53(Fe), 2% Mo:$BiVO_4$ and FMBV films.

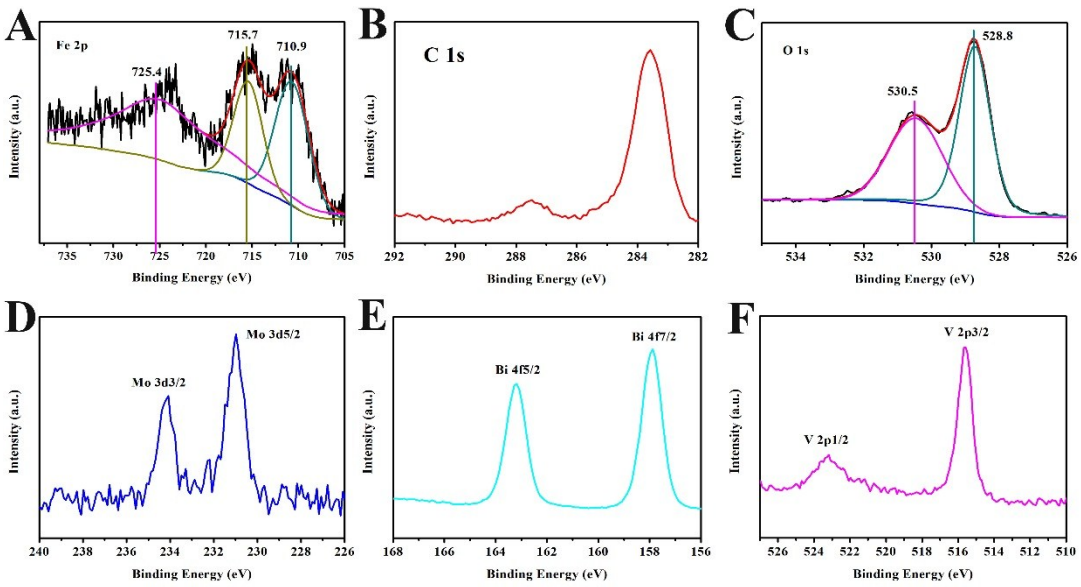

Figure S4. XPS of high resolution Fe 2p, C 1s, O 1s, Mo 3d, Bi 4f and V 2p spectra of the FMBV film.

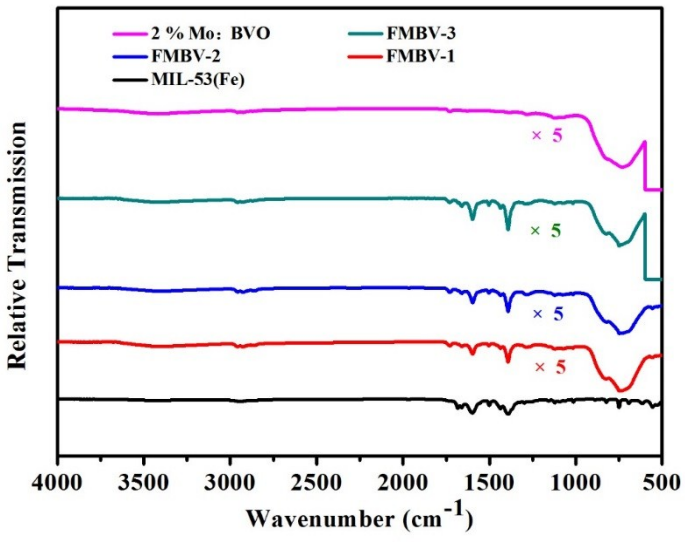

Figure S5. FTIR spectra of MIL-53(Fe), 2% Mo:$BiVO_4$ and FMBV films.

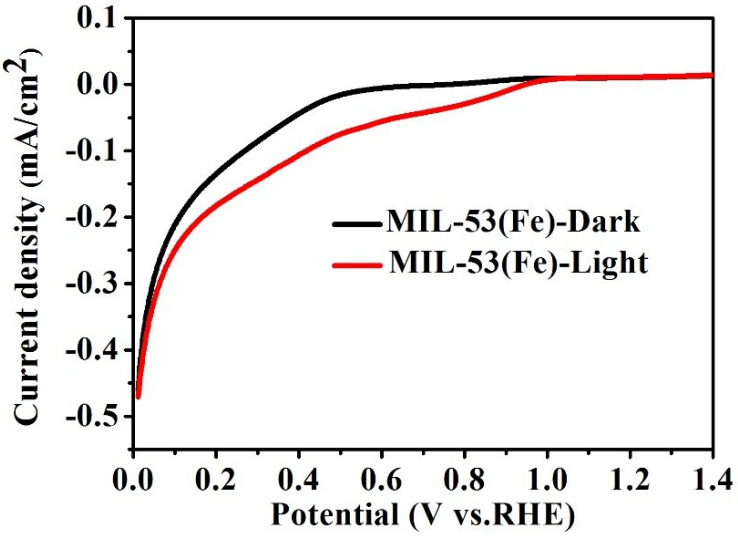

Figure S6. Current-potential characteristics of the pure MIL-53(Fe) photoanode.

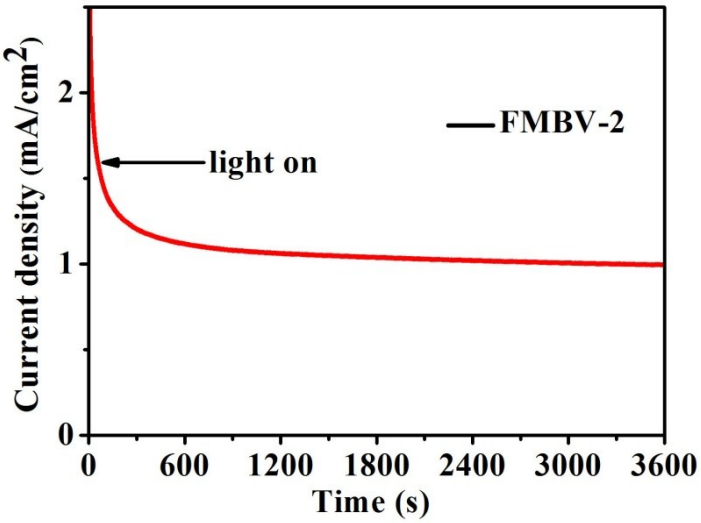

Figure S7. Water oxidation photocurrent *i-t* curve for FMBV-2 photoanode measured up to 3600s at 1.0 V (vs. RHE) constant potential.

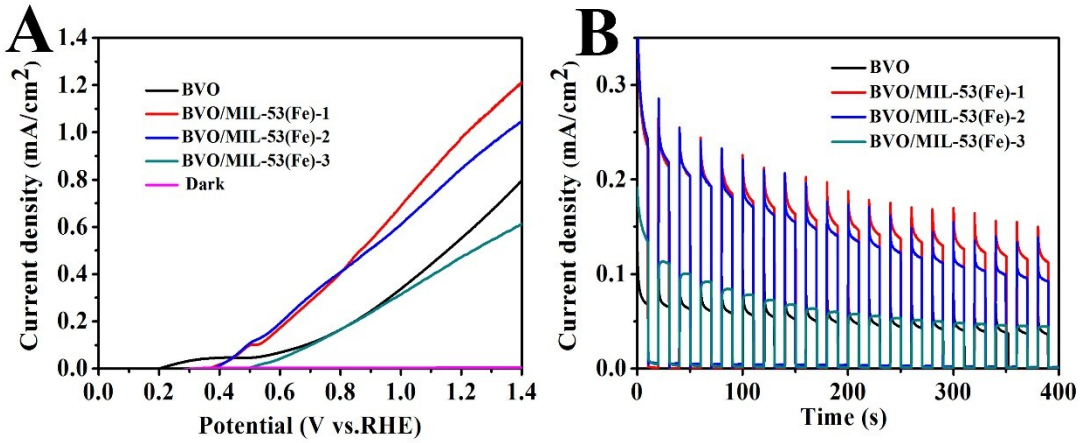

Figure S8. (A) Current-potential characteristics and (B) *i-t* curves of $BiVO_4$ and $BiVO_4$-MIL-53(Fe) films.

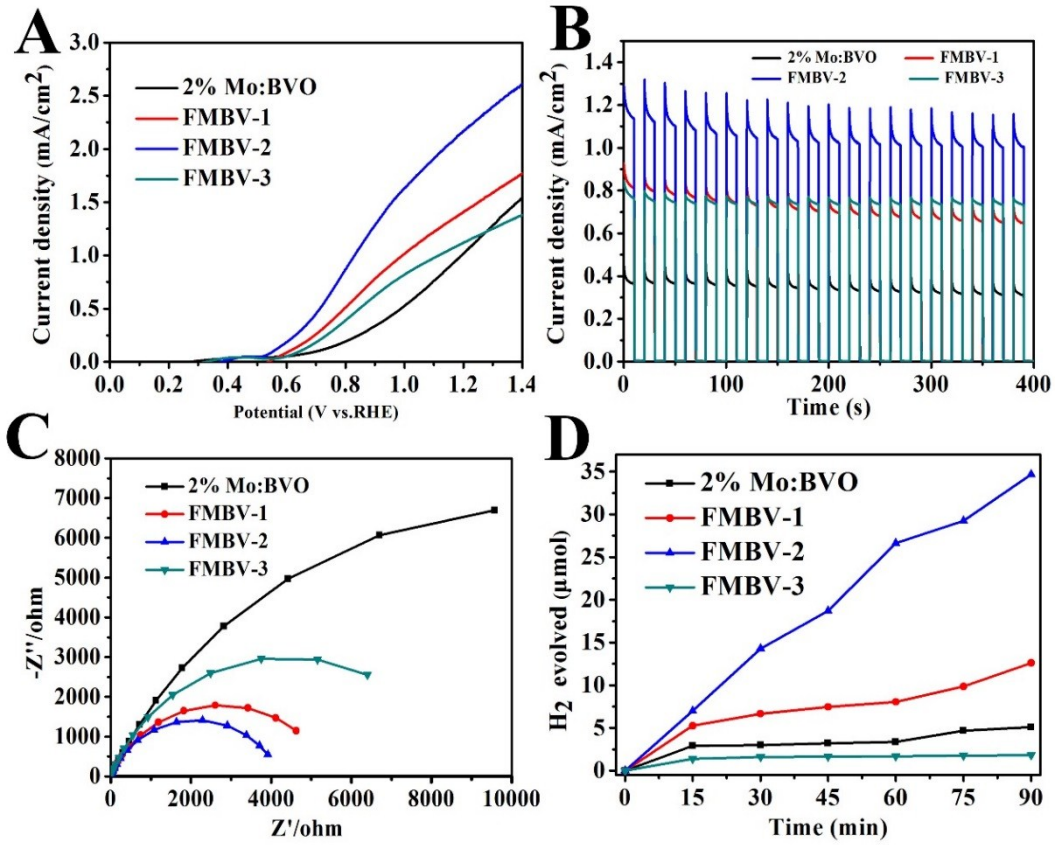

Figure S9. (A) Current-potential characteristics, (B) *i-t* curves, (C) electrochemical impedance spectra, and (D) the production of H_2 of 2% Mo:$BiVO_4$ and FMBV composite materials with different amounts of prepared MIL-53(Fe).

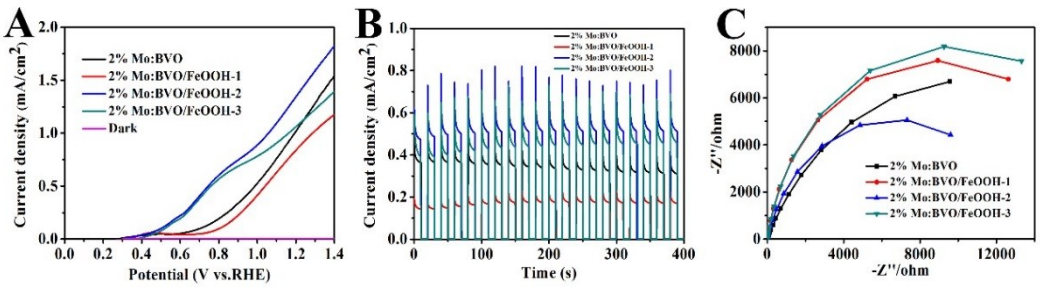

Figure S10. (A) Current-potential characteristics, (B) *i-t* curves, (C) electrochemical impedance spectra of 2% Mo:$BiVO_4$ and 2% Mo:$BiVO_4$/FeOOH films.

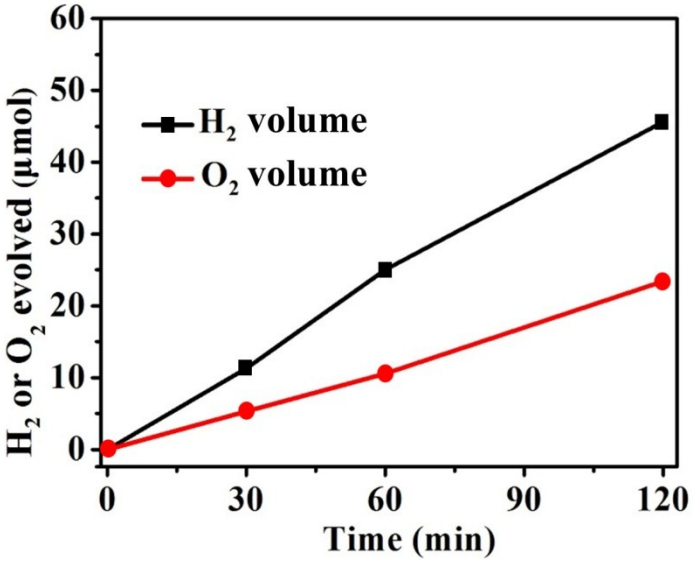

Figure S11. The H_2 and O_2 evolution volumes of the FMBV-2 photoanode at 1.23 V_{RHE} at 0.2 M Na_2SO_4 electrolyte under AM 1.5G (100 mW cm^{-2}) illumination.

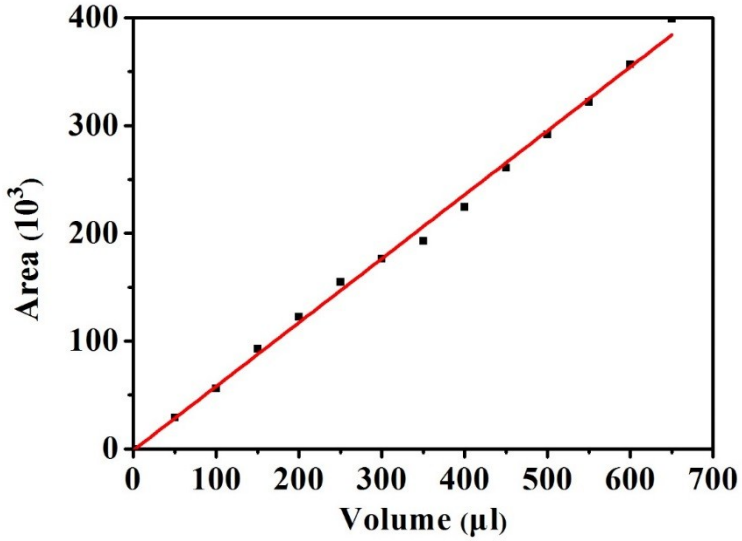

Figure S12. Standard H_2 evolution curve.

The equation between the volume of H_2 and the corresponding peak area can be expressed as follows: A (a.u.) = 593.38905 × V (µl) – 1442.8.