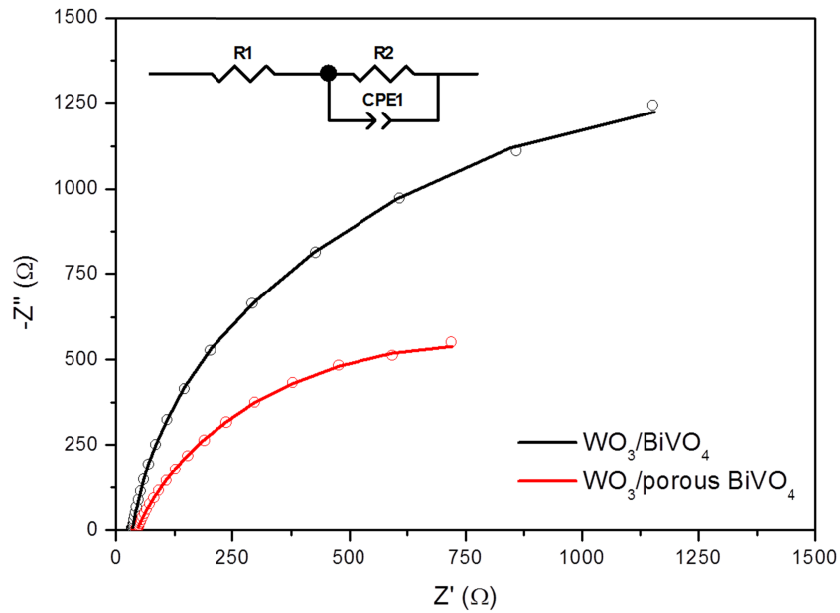


Supporting Information

**Morphology Control of One-Dimensional
Heterojunctions for Highly Efficient
Photoanodes Used for Solar Water Splitting**

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Sample	R1	R2	CPE1	n
WO ₃ /BiVO ₄	35.29	2776	7.3443 × 10 ⁻⁶	0.93033
WO ₃ /porous BiVO ₄	45.27	1464	2.6233 × 10 ⁻⁵	0.81103

Figure S1 Nyquist plots and the analyzed impedance parameters of the WO₃/BiVO₄ (BiVO₄ was spin-coated without binder), and WO₃/porous BiVO₄ photoanodes (BiVO₄ was spin-coated with EC binder). R₁ is a solution resistance, R₂ is a charge transfer resistance between electrode/electrolyte, and CPE1 is a constant phase element between electrode/electrolyte according to the equation, $Z_{CPE} = \frac{1}{C} j\omega^{-n}$. The impedance measurements indicated that the charge transfer resistance (R₂) and CPE decreased with the porous nature of BiVO₄ layer.

Table S1. Photocurrent density and IPCE value obtained in this work compared with the results of recent reports related to BiVO₄ photoanodes, including the highly efficient hematite Fe₂O₃ photoanode. Evidently, this work reports the highest photocurrent density of a BiVO₄ photoanode at 1.23 V vs RHE, prepared on an FTO substrate.

ref.	Current density (mA/cm ²)	IPCE	combination	doping	cocatalyst	Solution	year
this work	3.3 at 1.23V vs. RHE	60% at 1.23V vs. RHE	WO ₃	-	Co-Pi	0.5M Na ₂ SO ₄ K buffer (pH 7)	2014
1	1.7 at 1.2V vs. RHE	-	-	-	FeOOH	0.1M K buffer	2012
2	1 at 0.6V vs. Ag/AgCl	62% at 0.9V vs. Ag/AgCl	-	Mo-doped	Co-Pi	0.5M Na ₂ SO ₄ K buffer (pH 7)	2011
3	1.7 at 1.2V vs. RHE	40-60% at 1.2V vs. RHE	-	-	FeOOH	0.1M KH ₂ PO ₄ (pH 7)	2012
4	3.0 at 1.23 V vs. RHE	-	-	W-doped	Co-Pi	0.1M K buffer (pH 7.3)	2013
4	3.6 at 1.23 V vs. RHE	-	on a textured Asahi VU-type TCO	W-doped	Co-Pi	0.1M K buffer (pH 7.3)	2013
5	1.7 at 0.6V vs. Ag/AgCl	40% at 0.62V vs. Ag/AgCl	CuWO ₄	-	-	0.1M NaHCO ₃ (pH 7)	2013
6	1 at 0.6V vs. Ag/AgCl	-	-	-	-	1.0M Na ₂ SO ₄ (pH 7)	2010
7	1.7 at 1.23V vs. RHE	40% (front) 80%(back) at 1.23 vs. RHE	SnO ₂	-	Co-Pi	0.5M K ₂ SO ₄ K buffer (pH 5.6)	2012
8	1.3 at 0.6V Ag/AgCl	37% at 0.7V vs. Ag/AgCl	WO ₃	-	-	0.5M Na ₂ SO ₄	2011
9	3 at 1.2V vs. RHE	40% at 0.6V vs. RHE (in sulfite)	-	Mo-doped	FeOOH	0.1M K buffer (pH 7)	2014
10	1.7 at 0.6V vs. Ag/AgCl	37%	WO ₃	Mo-doped	-	0.5M Na ₂ SO ₄	2012
11	1.4 at 1.23 vs. RHE (integrated)	50% at 1.63V vs. RHE	SnO ₂	W-doped	-	0.15M K ₂ SO ₄ (pH 7)	2011
12	2.5 at 0.6V vs. Ag/AgCl	45% at 0.5V vs. Ag/AgCl	WO ₃	-	Co-Pi	0.5M Na ₂ SO ₄	2013
13	0.07 at 1V vs. Ag/AgCl	4%	RGO	-	-	0.1M Na ₂ SO ₄	2010
14	2.2 at 0.6V vs. SCE	-	-	Mo-doped	-	0.5M Na ₂ SO ₄ (pH 6.5)	2013
15	1.5 at 1.2V vs. RHE	35% at 1.2V vs. RHE	-	W-doped	Co-Pi		2011
16	2.4 at 1.23V vs. RHE	-	WO ₃	Mo-doped	Co-Pi	0.1M K buffer (pH 7)	2013
17	2.6 at 1.2V vs. RHE	50% at 1V vs. RHE	-	Mo-doped	RhO ₂	0.5M K ₂ SO ₄ K buffer (pH 6.5)	2011
18	2.1 at 1.23V vs. RHE / 4.0 at 1.53 V vs. RHE	-	-	Fe ₂ O ₃	-	1M NaOH (pH=13.6)	2013

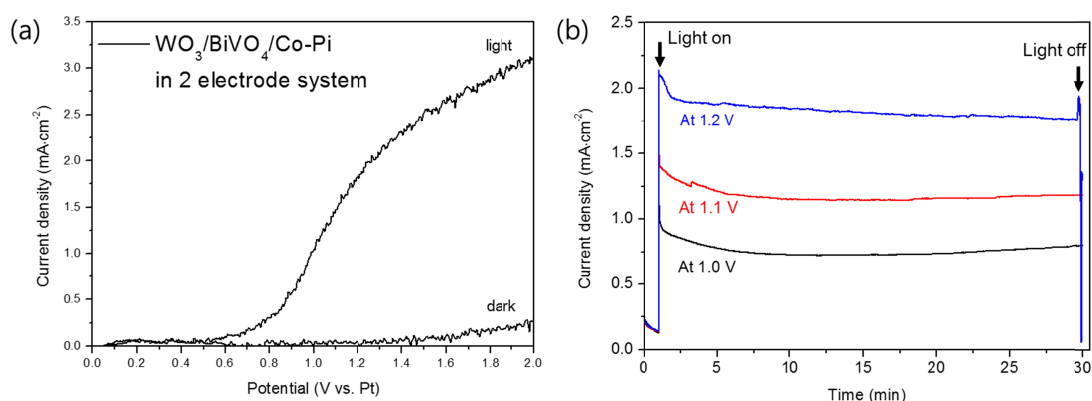


Figure S2 (a) Representative photocurrents regarding to bias potentials with 1-D $\text{WO}_3/\text{BiVO}_4/\text{Co-Pi}$ photoanode in a two electrode configuration using a Pt as a counter electrode, and (b) representative chronoamperometry measurements of the photocurrents at given bias potentials (1.0, 1.1, and 1.2 V) versus a Pt counter electrode while the GC analysis were performed. The photocurrents were monitored in the airtight closed PEC cell which was directly connected to the GC inlet, and Ar carrier gas was circulating while the gaseous products were accumulating for 30 min.

Potential (V vs Pt CE)	Faradaic efficiency (%)			Average (%)
	1 trial	2 trial	3 trial	
1.0	94.5	94.4	92.9	93.93
1.1	94.0	93.0	93.1	93.36
1.2	93.7	94.1	93.5	93.76

Table S2 Faradaic efficiencies for hydrogen at given bias potentials. The amount of the produced hydrogen and oxygen were measured after 30 min reaction in each measurement, which also showed 2:1 ratio of hydrogen to oxygen confirming water splitting.

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