Electronic Supplementary Material (ESI) for EES Catalysis.

Zr-doped $BaTaO_2N$ photocatalyst modified with Na-Pt cocatalyst for efficient hydrogen evolution and Z-scheme water splitting

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Table S1. Chemical compositions of three $BaTaO_2N$ samples.

Sample	Atomic ratio (at%)				
	Ba[a]	Ta[a]	Zr[a]	O[b]	N[b]
$BaTaO_2N$	20.24	20.04	-	38.88	20.84
$BaTaO_2N$:Zr0.01	19.19	20.00	0.20	39.60	21.01
$BaTaO_2N$:Zr0.1	18.29	18.89	1.99	40.76	20.08

[a]Measured by ICP-OES

[b]Measured by the N-O combustion analyzer

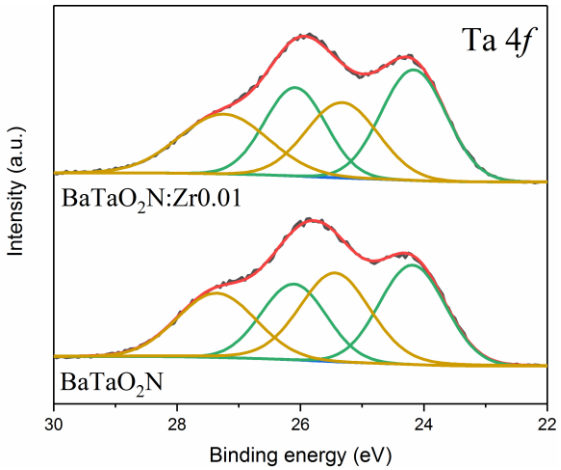

Figure S1. Ta 4*f* XPS spectra of $BaTaO_2N$and $BaTaO_2N$:Zr0.01.

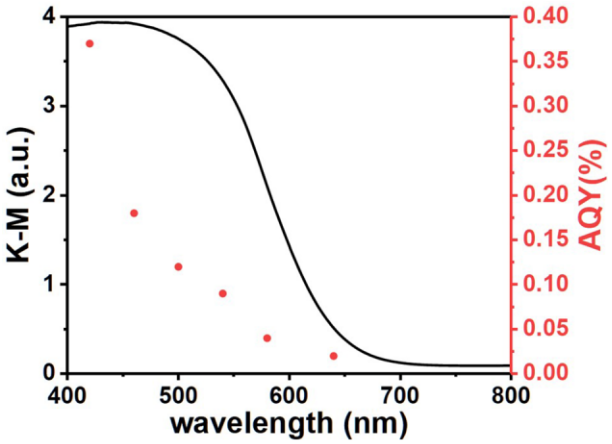

Figure S2. The action spectrum of Cr_2O_3 (0.9 wt% Cr)/0.23 wt% Na-0.3 wt% Pt/ $BaTaO_2N$:Zr0.01 (100 mg) for photocatalytic water reduction in an aqueous 50 mM sodium phosphate buffer solution at pH 6 (150 mL) containing 6 mM $K_4[Fe(CN)_6]$ under 300 W xenon lamp (420 nm < λ < 800 nm) equipped with various band-pass filters.

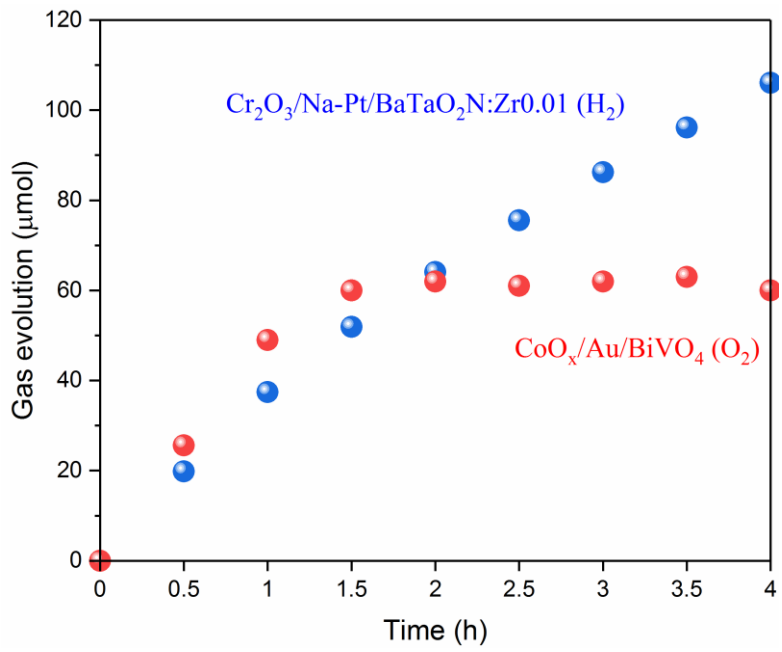

Figure S3. Time courses of H_2 evolution over Cr_2O_3 (0.9 wt% Cr)/0.23 wt% Na-0.3 wt% Pt/ $BaTaO_2N$:Zr0.01 (100 mg) in an aqueous 50 mM sodium phosphate buffer solution at pH 6 (150 mL) containing 6 mM $K_4[Fe(CN)_6]$ and O_2 evolution over CoO_x (0.5 wt% Co)/0.2 wt% Au/ $BiVO_4$ (100 mg) in the same sodium phosphate buffer solution but containing 6 mM $K_3[Fe(CN)_6]$. Light source: 300 W xenon lamp (420 nm < λ < 800 nm).

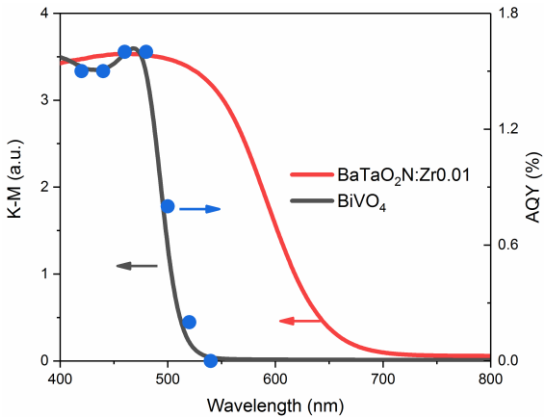

Figure S4. Dependence curve of AQY as a function of irradiation wavelength and diffuse reflectance spectra of the HEP and OEP. The gas evolution over ZOWS consisted of 0.9 wt% Cr_2O_3/0.23 wt% Na-0.3 wt% Pt/$BaTaO_2N$:Zr0.01 (70 mg), 0.5 wt% CoO_x/0.2 wt% Au/$BiVO_4$ (100 mg), and 150 mL 25 mM sodium phosphate buffer solution (pH 6.0) containing $K_4[Fe(CN)_6]$ (6 mM) was performed under 300 W xenon lamp (420 nm < λ < 800 nm) equipped with various band-pass filters.

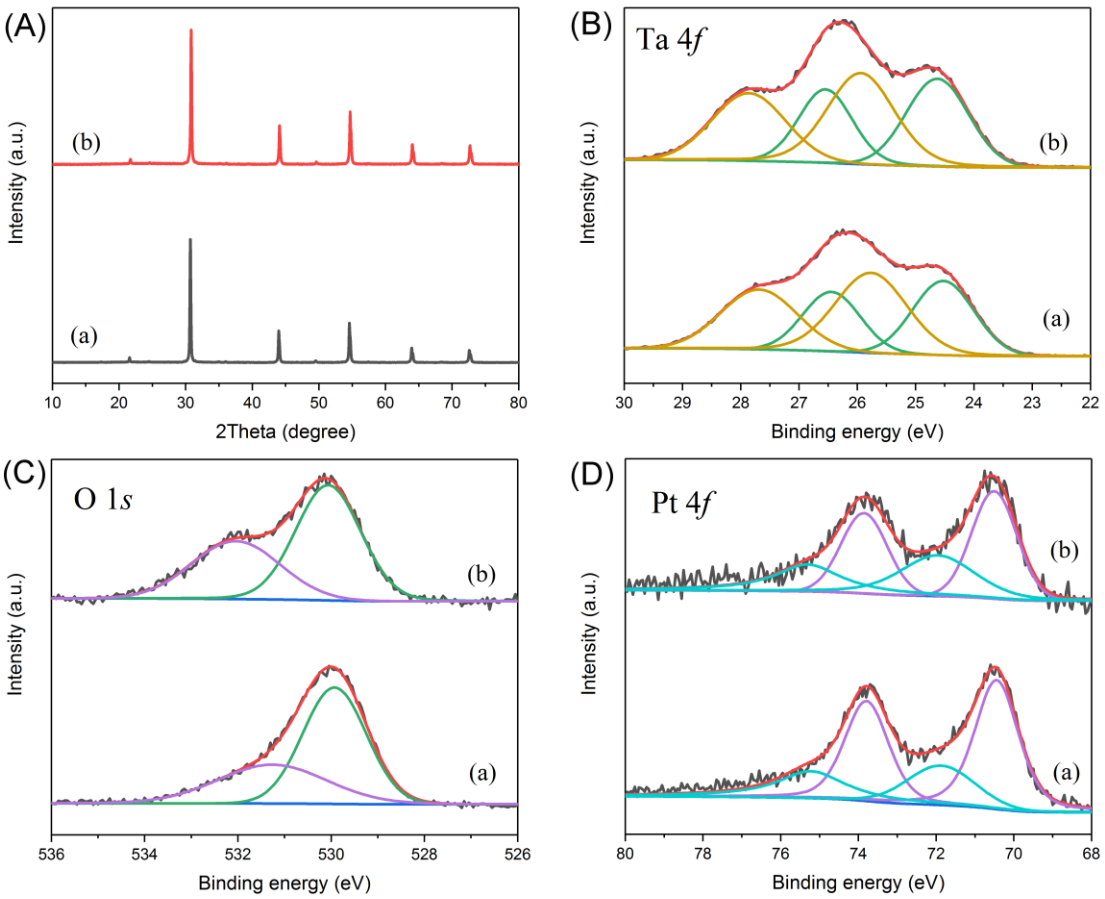

Figure S5. (A) XRD pattern and (B) Ta 4*f*, (C) O 1*s*, and (D) Pt 4*f* XPS spectra of $BaTaO_2N$:Zr0.01 (a) before and (b) after a HER reaction in an aqueous 50 mM sodium phosphate buffer solution at pH 6 (150 mL) containing 6 mM $K_4[Fe(CN)_6]$ under visible light irradiation.

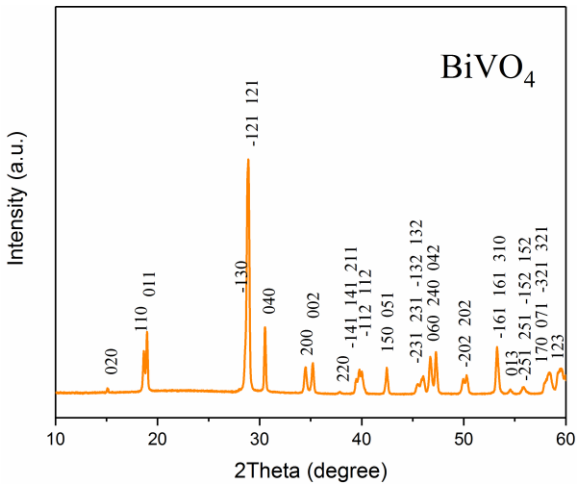

Figure S6. XRD pattern of as-prepared $BiVO_4$.