

Supporting information

Facile transfer of surface plasmon electrons of Au-NPs to Zn₃V₂O₈ surfaces: A case study of sun-light driven H₂ generation from water splitting†

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Table S1: Crystallite size calculation by applying Scherer formula

Catalyst	FWHM	2θ	D (nm)	Eg (eV)
Zn ₃ V ₂ O ₈	0.5848	36.5270	14.95	3.0
Au@Zn ₃ V ₂ O ₈	0.4645	36.2070	18.80	2.9

Scherer Formula: To calculate the crystallite size of Zn₃V₂O₈ and Au@Zn₃V₂O₈ photocatalysts Scherer equation is used which is given below.

$$D = \frac{k\lambda}{\beta \cos\theta}$$

Where D is crystallite size, k is Scherer constant which is equal to 0.9, λ is wavelength which is equal to the 0.15, β is full width at half maximum (FWHM) of peaks and θ is the angle of diffraction.

Table S2: XRD parameters of Zn₃V₂O₈

JCPDS # PDF 34-0378 Zn ₃ V ₂ O ₈ Orthorhombic				
Sr. No.	2-Theta	Theta	d(Å)	(h k l)
1	15.365	7.682	5.7620	(0 2 0)
2	18.741	9.370	4.7310	(1 2 0)
3	26.450	13.225	3.3670	(2 2 0)
4	27.080	13.540	3.2900	(2 1 1)
5	29.454	14.727	3.0300	(1 3 1)
6	31.004	15.502	2.8820	(0 4 0)
7	34.910	17.455	2.5680	(1 2 2)
8	35.980	17.990	2.4940	(3 2 0)
9	36.464	18.232	2.4620	(3 1 1)
10	43.114	21.557	2.0964	(0 4 2)
11	43.301	21.650	2.0878	(1 5 1)
12	48.606	24.303	1.8716	(1 6 0)
13	57.703	28.851	1.5963	(1 6 2)
14	58.440	29.220	1.5779	(3 6 0)
15	60.562	30.281	1.5276	(0 0 4)
16	62.973	31.486	1.4748	(4 4 2)
17	64.606	32.303	1.4414	(0 8 0)

Table S3: Comparison of metal vanadates photocatalysts for hydrogen production reported in literature.

Catalyst	Light source	Catalyst amount	Sacrificial reagent	H ₂ production	Ref.
Au@Zn ₃ V ₂ O ₈	sunlight	5 mg	5 % Ethanol	7.50 mmol g ⁻¹ h ⁻¹	Present study
BiVO ₄ /Ti ₃ C ₂	≠	≠	-	0.15 mmol g ⁻¹ h ⁻¹	[1]
CeO ₂ /CeVO ₄ /V ₂ O ₅	≠	≠	-	0.18 mmol g ⁻¹ h ⁻¹	[2]
Cr:Cu ₃ V ₂ O ₈	≠	≠	5 % NaI	0.28 mmol g ⁻¹ h ⁻¹	[3]

Table S4: Recyclability test for most active photocatalysts ($\text{Au}_{1.0}@\text{Zn}_3\text{V}_2\text{O}_8$).

Photocatalyst ($\text{Au}_{1.0}@\text{Zn}_3\text{V}_2\text{O}_8$)	Time (h)						H_2 generation mmol g^{-1}
	1	2	3	4	5	6	
1 st run	3.59	10.56	17.83	25.40	33.14	41.14	mmol g^{-1}
2 nd run	3.58	10.30	17.50	24.80	32.30	40.20	≈
3 rd run	3.41	10.16	17.34	24.07	31.64	39.14	≈

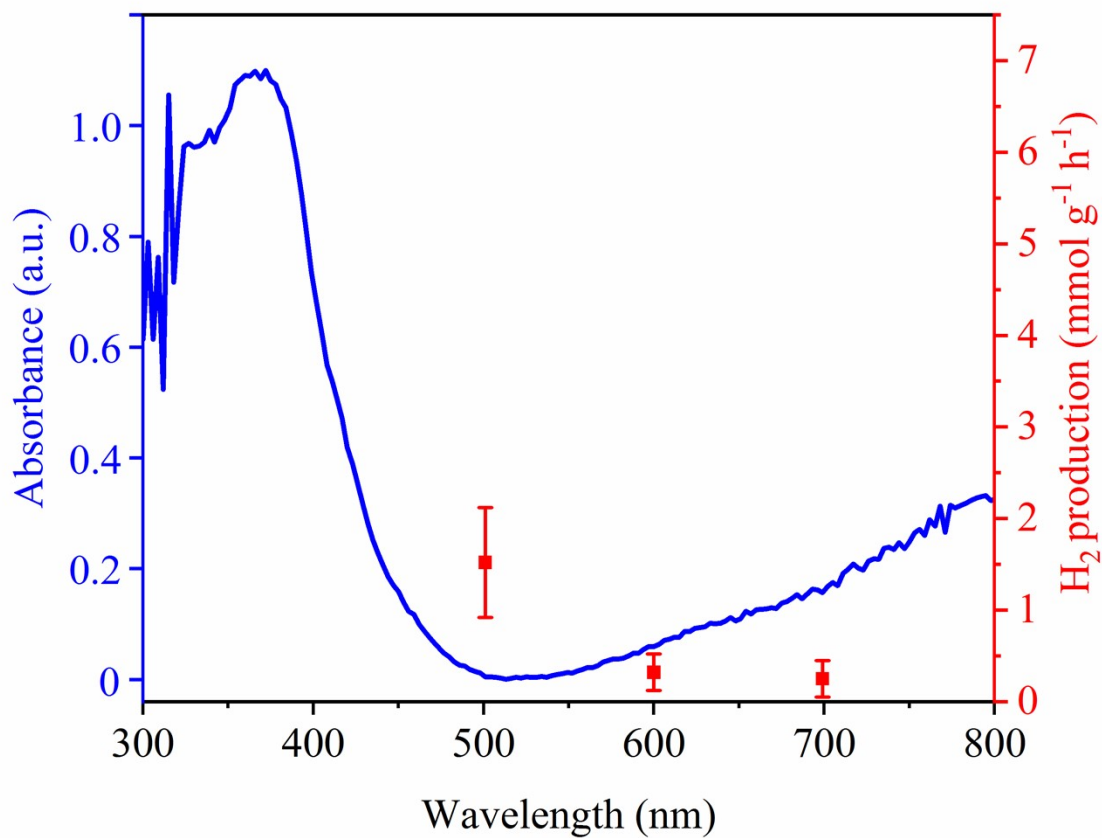


Figure S1: Visible light induced SPR effect of Au metal contents over $\text{Zn}_3\text{V}_2\text{O}_8$ for H_2 productions.

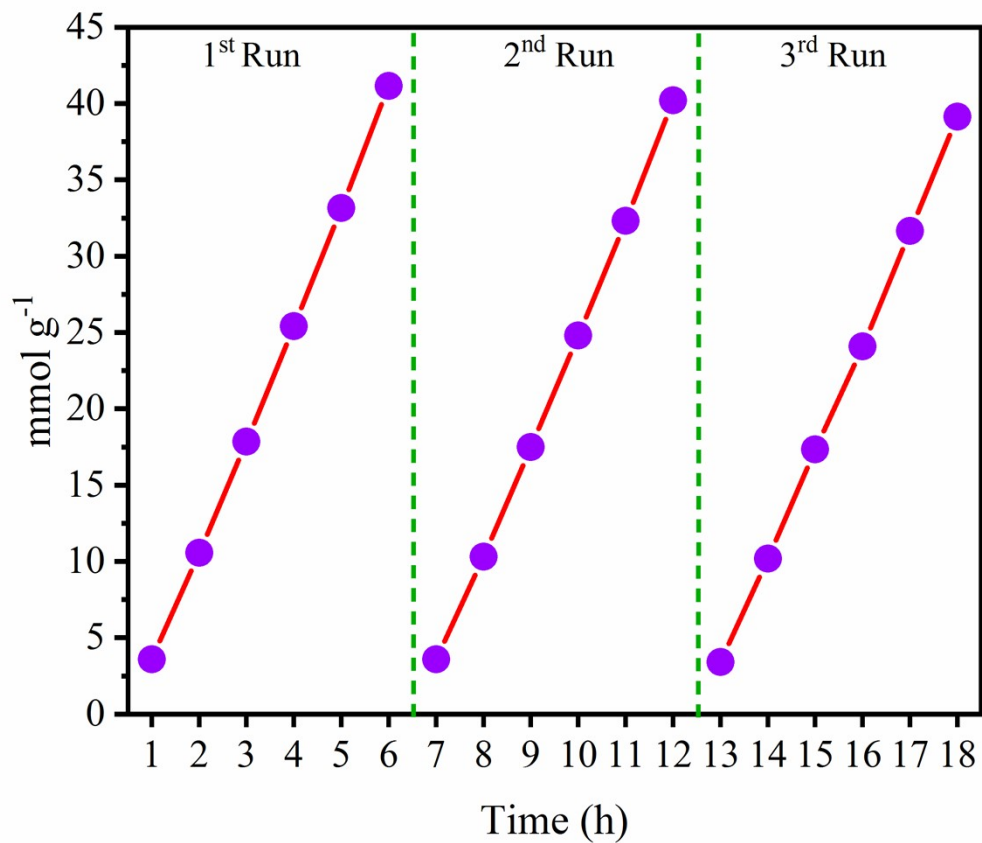


Figure S2: Recyclability test of Au@Zn₃V₂O₈ photocatalysts.

Reference:

1. Li, Y., et al., *2D/2D heterostructure of ultrathin BiVO₄/Ti₃C₂ nanosheets for photocatalytic overall Water splitting*. Applied Catalysis B: Environmental, 2021. **285**: p. 119855.
2. Cui, X., et al., *Self-generating CeVO₄ as conductive channel within CeO₂/CeVO₄/V₂O₅ to induce Z-scheme-charge-transfer driven photocatalytic degradation coupled with hydrogen production*. International Journal of Hydrogen Energy, 2019. **44**(43): p. 23921-23935.
3. Cárdenas Morcoso, D., *Chromium-doped copper vanadate films (Cr: Cu₃V₂O₈) as photoanodes for water splitting*. 2017.