

Electronic Supplementary Information

Boosting charge separation of Sr₂Ta₂O₇ by Cr doping for enhanced visible light-driven photocatalytic hydrogen generation

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Deposition of cocatalysts

Cocatalysts Pt were deposited by an impregnation method and subsequent H₂ reduction. In brief, 200 mg of the as-obtained photocatalysts were poured into a small beaker, and then 2 mL of H₂PtCl₆ aqueous solution (10 mg mL⁻¹) was added under ultrasonic conditions and held for 5 min. After that, the beaker was placed in a thermostatic water bath, and the temperature was controlled at 353 K. Until the solution was entirely evaporated, the resulting products were put into an alumina crucible. Finally, the product was placed in a tube furnace under the reduction atmosphere (5% H₂/Ar, 200 mL min⁻¹) at 623 K for 1 h.

Preparation of working electrodes

The working electrodes were fabricated in the following steps: 20 mg photocatalyst was dispersed in 1500 μL ethanediol and 500 μL deionized water that contained 50 μL Nafion aqueous solution, and then the solution was fully stirred. Next, 100 μL of the above slurry was dropped on a fluorine-doped tin oxide (1 cm × 1 cm) conducting glass and then annealed for 2 h in a vacuum oven at 473 K.

Biexponential mode

The PL decay curves were fitted using a biexponential mode:¹

$$I(t) = A_1 \exp(-t/\tau_1) + A_2 \exp(-t/\tau_2),$$

The average fluorescent lifetime of as-prepared photocatalysts are estimated by the equation:

$$\tau = \frac{A_1 \tau_1^2 + A_2 \tau_2^2}{A_1 \tau_1 + A_2 \tau_2}$$

where A₁, A₂ and y₀ are amplitude coefficient. τ₁ and τ₂ are the lifetimes corresponding to different recombination pathways.

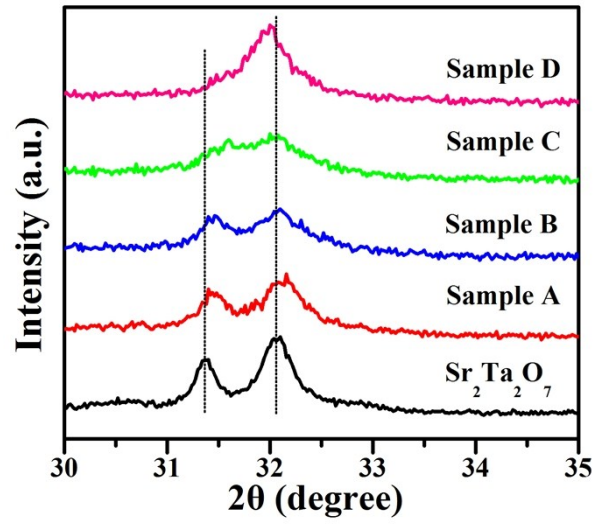


Fig. S1. Magnified (002) and (022) peaks of of Sr₂Ta₂O₇ obtained by hydrothermal method and Cr-doped Sr₂Ta₂O₇ with different Cr doping content.

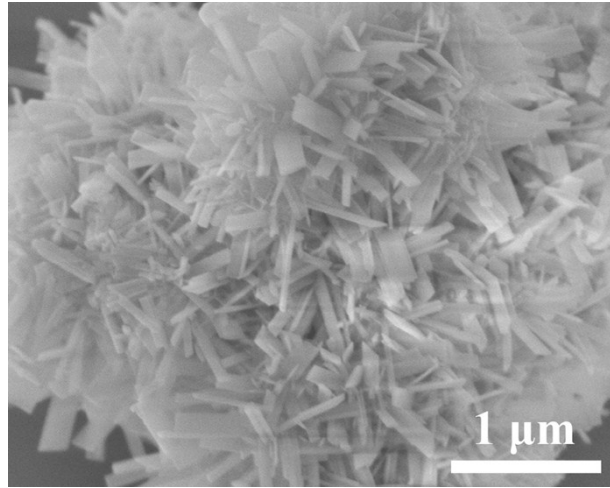


Fig. S2. SEM image of Sr₂Ta₂O₇.

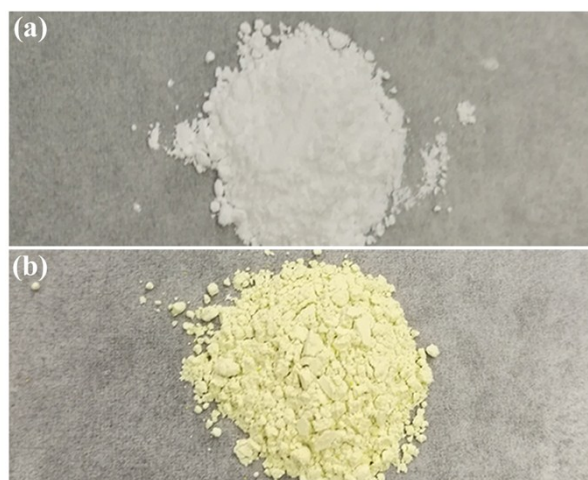


Fig. S3. Digital photograph of (a) $\text{Sr}_2\text{Ta}_2\text{O}_7$ and (b) Sample C.

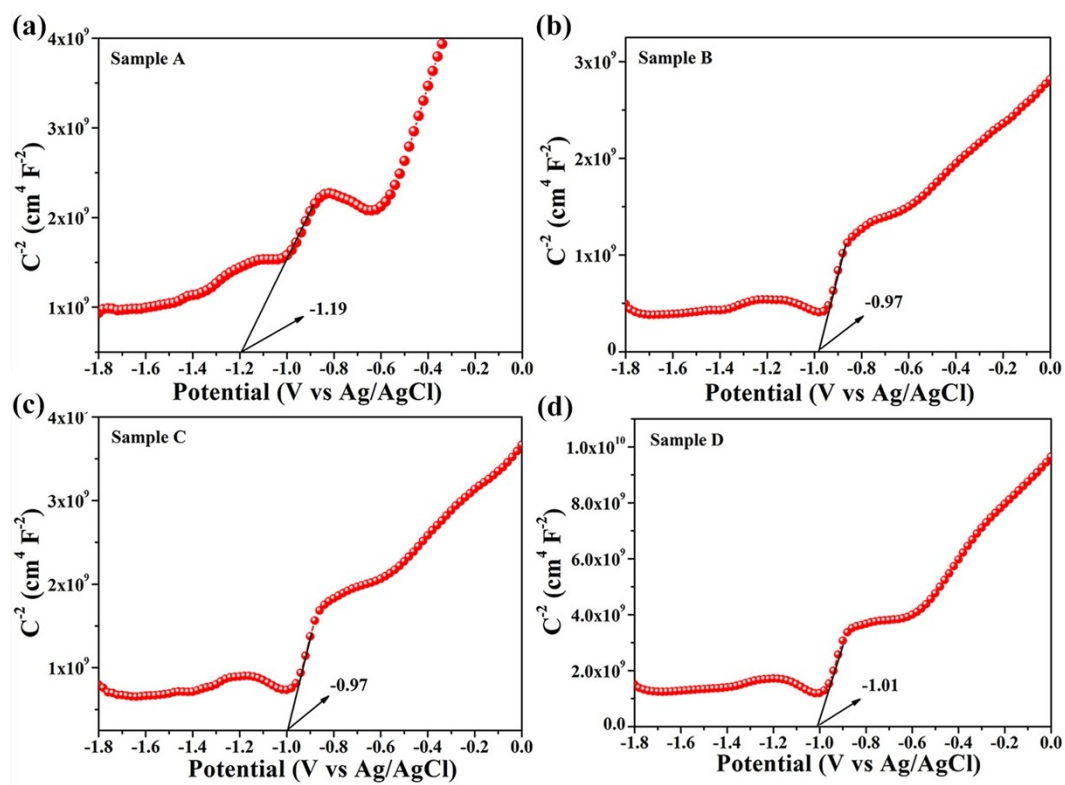


Fig. S4. Mott-Schottky curves of Sr₂Ta₂O₇ and Sample A-D.

Table S1. Photocatalytic performance comparison of our work and some of the tantalum oxynitrides under visible-light irradiation ($\lambda \geq 420$ nm)

Entry	Photocatalyst	H ₂ evolution rates ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	Sacrificial agent	Reaction Temperature	Reference
1	Cr-doped Sr ₂ Ta ₂ O ₇ Ta ₃ N ₅ @NaTaON	9.32	15 vol% methanol	279 K	Our work
2	nanocubes (1 wt% Pt cocatalyst)	~8.80	methanol	-	2
3	Pt@Ta ₃ N ₅ -WO _{2.72}	7.74	20 vol% methanol	-	3
4	Ta ₃ N ₅ /BTON (0. 3wt% Pt)	182	20 vol% methanol	Room temperature	4
5	SrTaO ₂ N nanoplates	14.75	10 vol% methanol	-	5
6	BMTON/Ta ₃ N ₅ (0. 4)(0.5 wt% Pt)	68	NaI solution (0.8 mM)	Room temperature	6

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