

## Supporting Information

# Efficient visible-light-driven photocatalytic hydrogen production using CdS@TaON core-shell composites coupled with graphene oxide nanosheets

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## **1. Experimental sections**

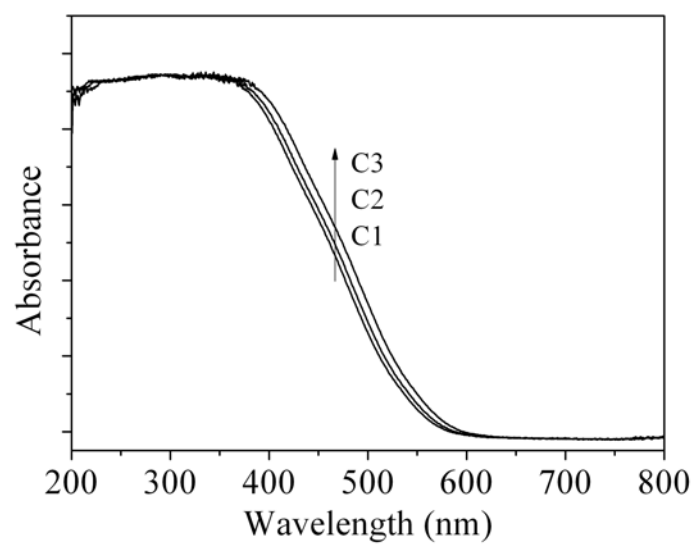
### **1.1 Preparation of C2 samples by hydrothermal route**

In a typical synthesis of the composite, a certain amount of as-prepared TaON nanoparticles and 0.25 mmol of  $\text{Cd}(\text{Ac})_2 \cdot 2\text{H}_2\text{O}$  ( $\sim 98.5\%$ , Aladdin) were dispersed in 25 mL of dimethyl sulfoxide (DMSO). The weight ratios of TaON to  $\text{Cd}(\text{Ac})_2 \cdot 2\text{H}_2\text{O}$  were 1.0%. Next, the homogeneous solution was transferred into a 30 mL Teflon-lined autoclave and held at  $180^\circ\text{C}$  for 12 h after vigorous stirring and sonication. After that, the precipitates from the mixture were allowed to cool to room temperature and collected by centrifugation, and then rinsed with acetone and ethanol several times to remove the residue of DMSO. The final product was dried in an oven at  $60^\circ\text{C}$  for 12 h. The obtained samples were labeled as C2.

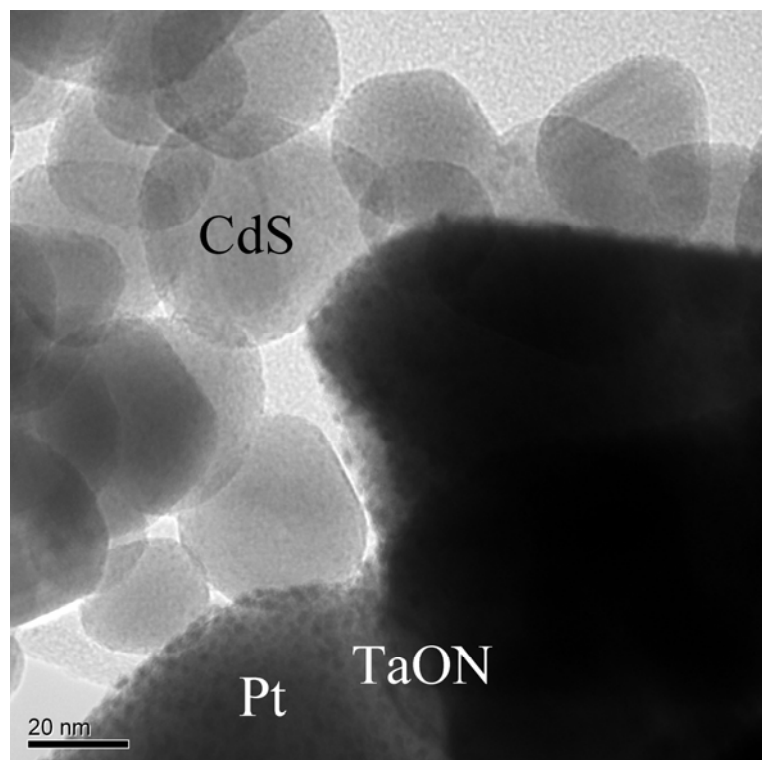
### **1.2 Preparation of C3 samples by solvothermal route**

CdS quantum dots (QDs) sensitized TaON composites were prepared in the aqueous phase with thioglycollic acid (TGA) as stabilizer described as following process: first added TGA into the  $\text{Cd}(\text{Ac})_2 \cdot 2\text{H}_2\text{O}$  solution, pH value of the suspension was adjusted to 10.5 by the addition of sodium hydroxide solution (NaOH). The Cd precursor concentration is fixed at 75 mM, TGA/Cd molar ratio is 1.2. Then a certain amount of as-prepared TaON nanoparticles were dispersed in the above-mentioned solution and the mixture was stirred at  $65^\circ\text{C}$  for 30 min after adding a certain amount of  $\text{Na}_2\text{S}$ . Aging the solution at  $65^\circ\text{C}$  for 90 min, the CdS quantum dots (QDs) sensitized TaON composites were obtained. The obtained samples were labeled as C3.

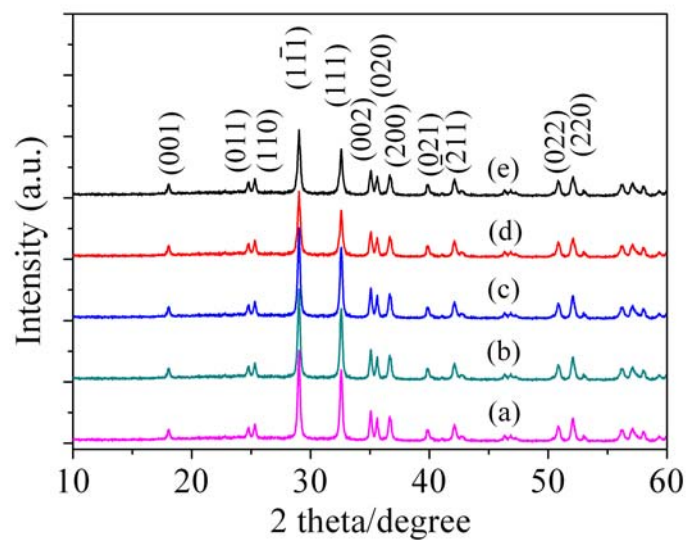
## 2. Results



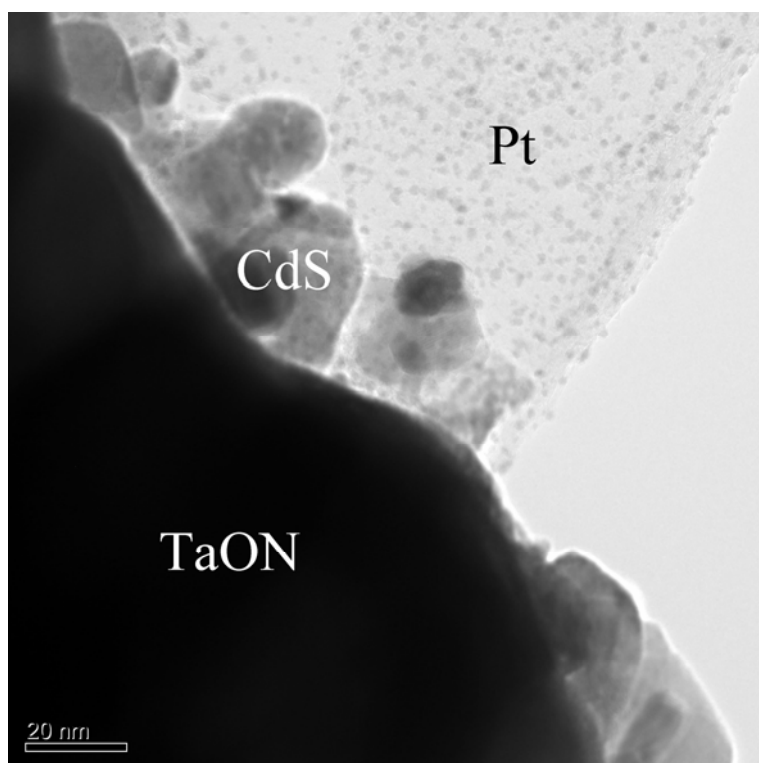
**Fig. S1.** The UV-Vis spectra of CdS@TaON composites: (a) C3; (b) C2 and (c) C1.



**Fig. S2. The TEM image of the as-prepared CdS@TaON composites with 0.4wt% Pt as cocatalyst on the TaON photocatalyst surface.**



**Fig. S3. The XRD patterns of the as-prepared GO-CdS@TaON composites using the different amount of GO: (a) GO0, (b) GO0.5, (c) GO1, (d) GO3, (e) GO10.**



**Fig. S4.** The TEM image of the as-prepared GO–CdS@TaON composites with 0.4wt% Pt as cocatalyst on the surface of GO.