1) When introducing the theme of photocatalytic activity/efficiency in heterogeneous photocatalysis, the manuscript should also consider two related references that need to be discussed:


Murphy, Chem. Mater. 2015, 27, 4911

Reply: Thank you very much for the reviewer’s helpful comments. We have carefully revised the manuscript and added the relevant literatures, i.e., ref. [6] and [7]. According to the relevant literature, photocatalytic hydrogen production experiments and photon flux detection were carried out. The apparent quantum efficiency was calculated by the obtained data. The detailed steps are shown in question 2.

In recent years, semiconductor photocatalytic technology has attracted much attention due to its excellent application prospects in the fields of sewage treatment, air purification, cleaning and sterilization, and solar energy conversion. [4-6] Semiconductor photocatalysis technology is an advanced technology that uses solar energy to carry out chemical reactions in a mild environment. [7-9]


2) Connected to the previous point, the manuscript is missing work (i.e., to determine the photon flux) required to calculate the actual apparent quantum efficiency. Performing this missing measurement should allow the authors to provide a valuable piece of work.

Reply: Thank you very much for the reviewer’s helpful comments. The photocatalytic H2-production experiments were performed in a 300 mL sealed jacket beaker at ambient temperature and atmospheric pressure. In a typical photocatalytic experiment, 100 mg of Ar-TiO2 composite photocatalyst was suspended in 100 mL of aqueous solution containing methanol (20.0 V%) as sacrificial agents for trapping holes. Proper amount of H2PtCl6 aqueous solution was added in the above solution. Therefore, 3.0 wt% Pt, as a co-catalyst, was in-suit reduced during the photocatalytic hydrogen evolution reaction. Then, the reactor was bubbled with nitrogen for 30 min to completely remove the dissolved oxygen and ensured that the reactor was in an anaerobic condition. A continuous magnetic stirrer was applied at the bottom of the reactor in order to keep the photocatalyst particles in suspension status during the whole experiment. After 0.5 hours of irradiation, the chromatographic inlet was opened, and hydrogen was analyzed by gas chromatograph (GC9800, Shanghai Ke Chuang Chromatograph Instruments Co. Ltd, China, TCD, with nitrogen as a carrier gas and 5 A molecular sieve column). All glassware was carefully rinsed with deionized water prior to use. The apparent quantum efficiency (QE) was measured under the
same photocatalytic reaction conditions. A Xe lamp source (300 W, 350-780 nm) was placed 10 cm directly above the reactor to serve as a light source to initiate a photocatalytic reaction. The focus intensity of the Xe lamp source and the beaker area are approximately. They are 800 mw·cm⁻² and 30 cm² respectively. Measure and calculate QE according to equation (1): [1, 2]

\[
QE(\%) = \frac{\text{number of reacted electrons}}{\text{number of incident photons}} \times 100
\]

\[
= \frac{\text{number of evolve H}_2 \text{ molecules} \times 2}{\text{number of incident photons}} \times 100
\] (1)

H₂ precipitation experiments was carried out on Ar-TiO₂ catalyst under full-spectrum conditions. After 2.5 h, the precipitation of H₂ was 530 umol/g.h. number of incident photons: \(4.615 \times 10^{19}\). number of evolve H₂ molecules: \(3.19 \times 10^{19}\). Measure and calculate QE according to equation (1): QE=69%.


3) The experimental section needs to provide the brand and purity of chemicals, etc. In addition, please provide some image/photo/diagram that helps to describe the setup employed. This will be especially helpful to the readers trying to visualize the measurements. The caption to figures with kinetics is also missing the very important “loading” of the photocatalyst employed in each experiment.

Reply: Thank you very much for the reviewer’s helpful comments. In the previous work, we modified the catalyst with a low temperature plasma device to improve the performance of the catalyst. [1, 2]

(1) Experimental drug: (Ti(OC₄H₉)₄), AR, Macklin; Ethanol (C₂H₅OH), AR, Fuyu.
(2) Experimental device:
(3) Experimental condition: Solution concentration: 10mg/L; organic solution: 100mL; catalyst: 50mg.


4) The following 3 key papers should be listed as recent contributing articles to hybrid photocatalysts in the references listed:


**Reply:** Thank you very much for the reviewer’s helpful comments. We have added the relevant literatures, i.e., ref. [14], [15] and [30].


[15]. Chen, W.; Wang, Y.; Shangguan, W., Metal (oxide) modified (M= Pd, Ag, Au and Cu) H$_2$SrTa$_2$O$_7$ for photocatalytic CO$_2$ reduction with H$_2$O: The effect of cocatalysts on promoting activity toward CO and H$_2$ evolution. International Journal of Hydrogen Energy 2019, 44 (8), 4123-4132.