# $CdS/TiO_2$ Nanostructures Synthesized via SILAR Method for Enhanced Photocatalytic Glucose Conversion and Simultaneous Hydrogen Production under UV and Simulated Solar Irradiations

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The thermogravimetric (TGA) measurement was carried out on a TGA Q5000 (TA Instruments) for indicating the weight loss as a function of temperature. The TGA curve was recorded under air at temperature ramp from 30 to 1000 °C with the heating ramp of 5 °C $min^{-1}$. Figure S1 show the TGA curve of anatase $TiO_2$, $20CdS/TiO_2$, CdS nanoparticles. The weight losses below 200 ºC were attributed to the loss of absorbed water on surface of nanocomposites. A temperature range of 200-300 ºC, it shows no big loss difference with a decrease of weight of 6% so it was attributed to reduce organic compound. But comparing between $20CdS/TiO_2$ and CdS, it can observe that the mass increase at temperature range of 300-700 ºC corresponding to the increase in CdS mass. It is an indication of the formation of cadmium sulfate ($CdSO_4$) through the following reaction (equation 1). The weight loss between 750-1000 °C could be attributed to the decomposition of $CdSO_4$.

$$CdS(g) + 2O_2 \rightarrow CdSO_4 \quad (1)$$

According the TGA result, it could be confirmed that the suitable calcination condition (200ºC) which determine in this work not effect to the formation of CdS.

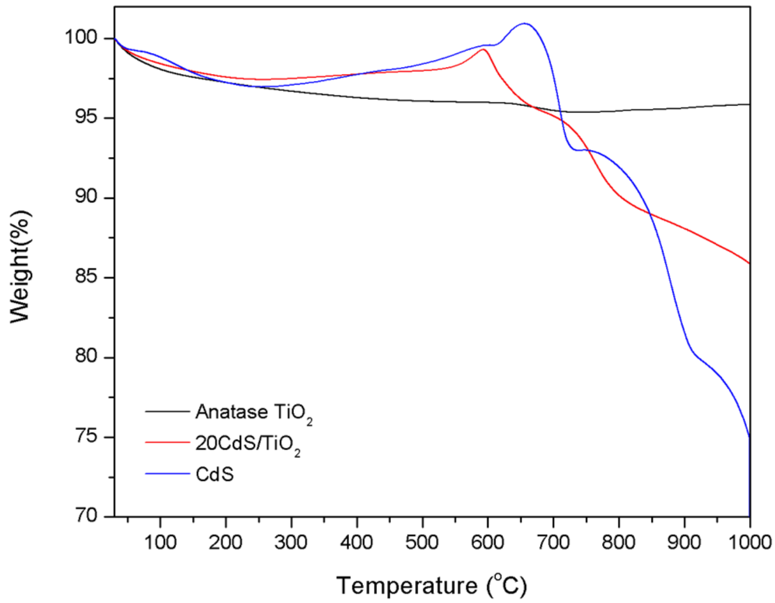


**Fig. S1** TGA curve of anatase $TiO_2$ NPs, 20 $CdS/TiO_2$ NPs, CdS NP

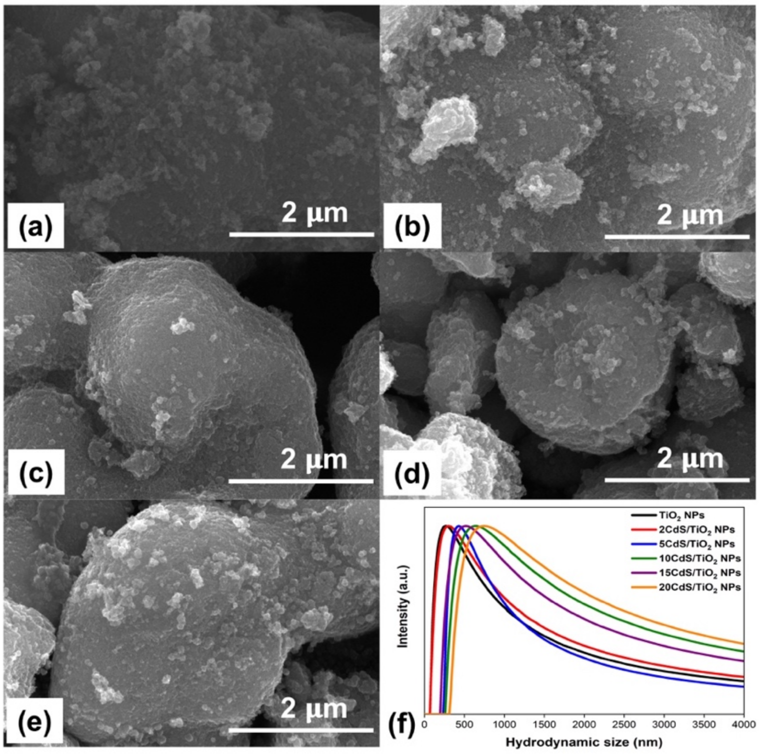


**Fig. S2** SEM image of (a) $2CdS/TiO_2$ NPs, (b) $5CdS/TiO_2$ NPs, (c)$10CdS/TiO_2$ NPs, (d) $15CdS/TiO_2$ NPs, (e) $20CdS/TiO_2$ NPs at magnification of 80k (scale bar = 2 μm), and (f) DLS particle size distribution of samples.

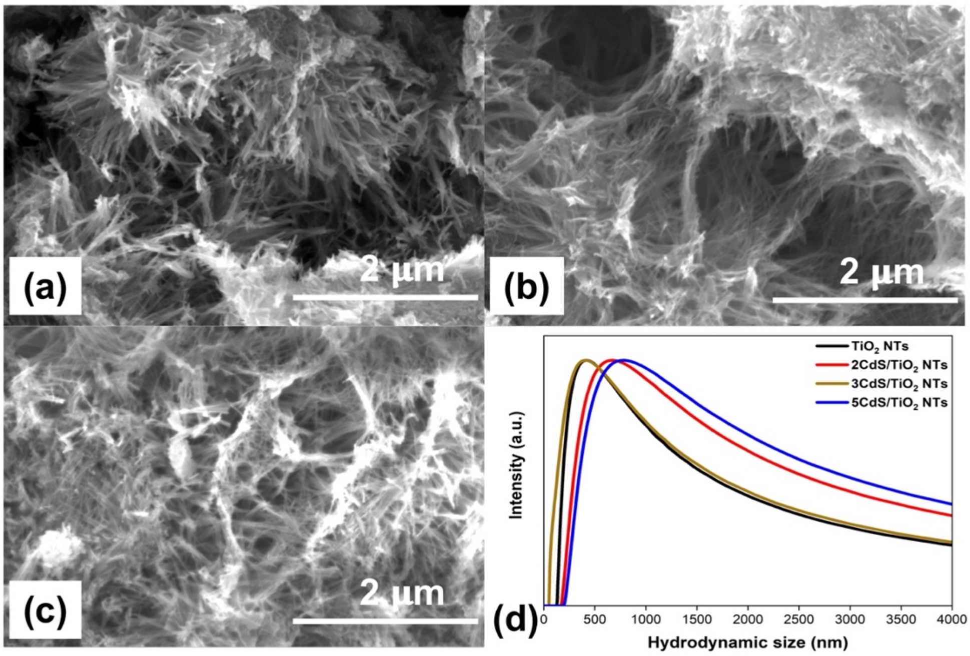


**Fig. S3** SEM image of (a) 2CdS/$TiO_2$ NPs, (b) 3CdS/$TiO_2$ NPs, (c) 5CdS/$TiO_2$ NPs at magnification of 80k (scale bar = 2 μm), and (d) DLS diameter size distribution of samples.

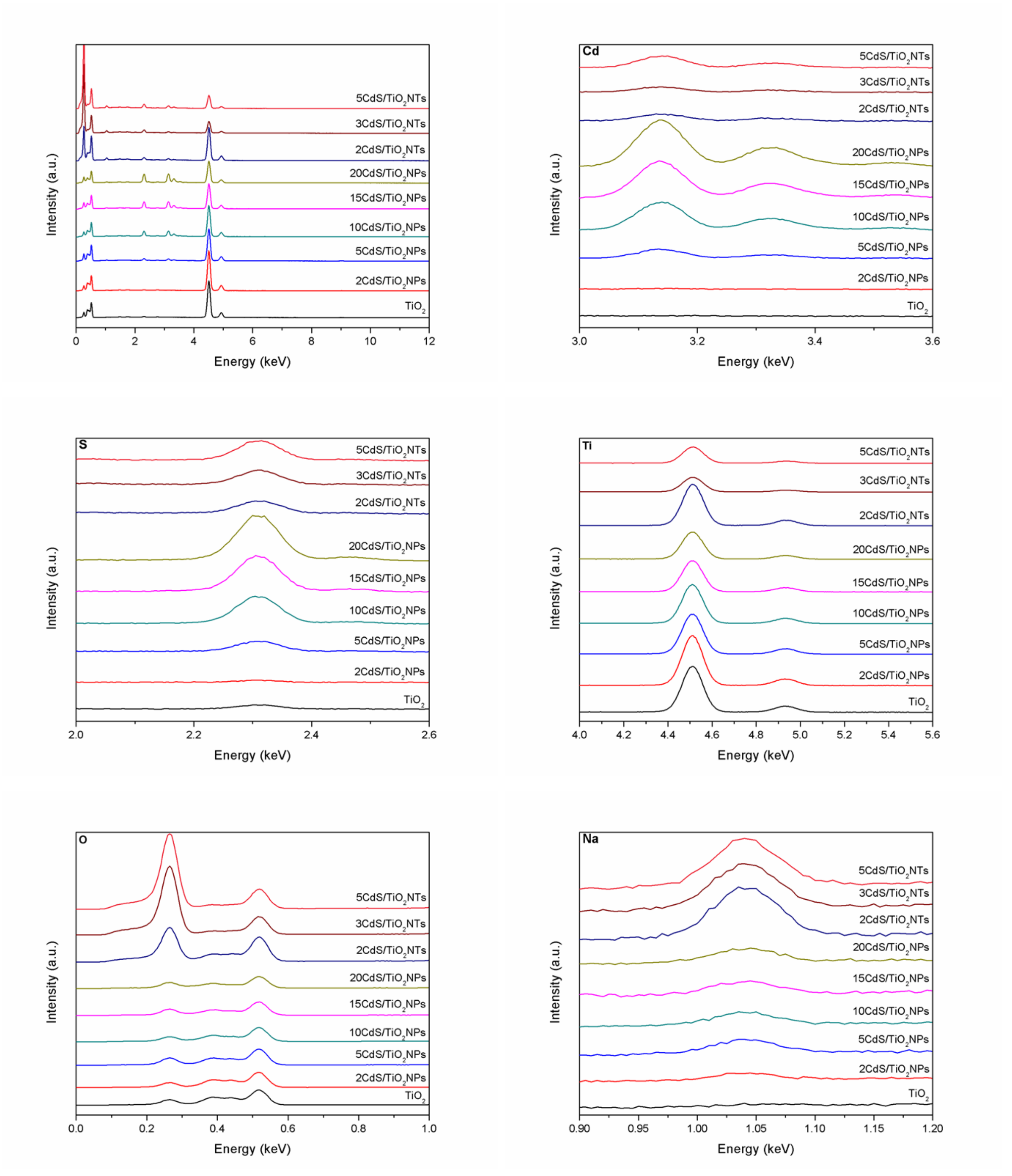


**Fig. S4** EDX spectra of $TiO_2$ NPs, $TiO_2$ NTs, CdS/ $TiO_2$ NPs, CdS/$TiO_2$ NTs with different CdS cycle.

**Table S1.** The energy band-gap of $TiO_2$ NPs, $TiO_2$ NTs, CdS/$TiO_2$ NPs, and CdS/$TiO_2$ NTs with different CdS cycles.

| Photocatalyst | Band gap (eV) |
|---|---|
| $TiO_2$ NPs | 3.15 |
| 1CdS/$TiO_2$ NPs | 3.18 |
| 2CdS/$TiO_2$ NPs | 3.15 |
| 3CdS/$TiO_2$ NPs | 3.00 |
| 5CdS/$TiO_2$ NPs | 2.36 |
| 10CdS/$TiO_2$ NPs | 2.22 |
| 15CdS/$TiO_2$ NPs | 2.10 |
| 20CdS/$TiO_2$ NPs | 2.00 |
| $TiO_2$ NTs | 3.11 |
| 1CdS/$TiO_2$ NTs | 3.19 |
| 2CdS/$TiO_2$ NTs | 2.40 |
| 3CdS/$TiO_2$ NTs | 2.38 |
| 5CdS/$TiO_2$ NTs | 2.22 |

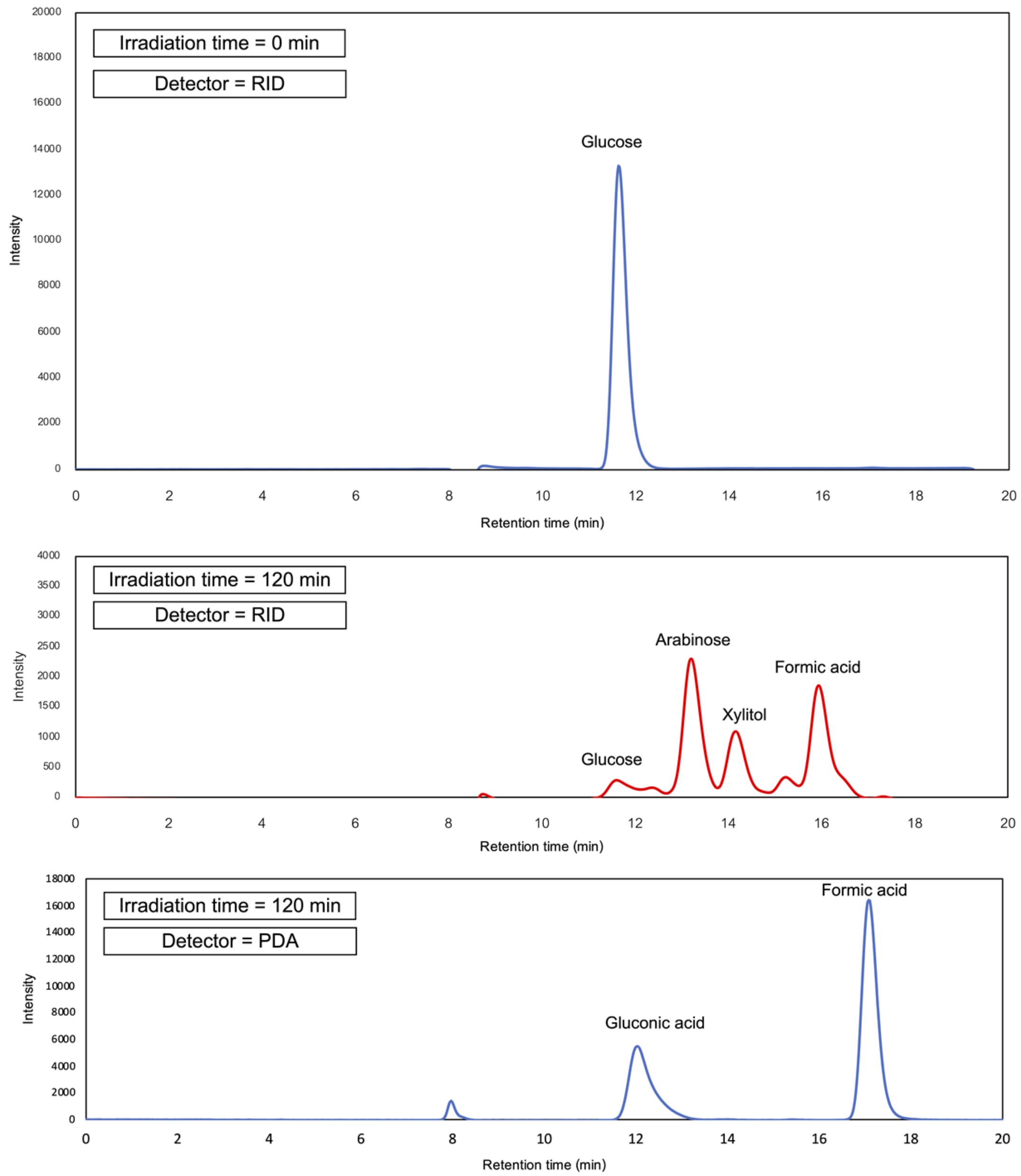


**Fig. S5** HPLC chromatogram of products from photocatalytic glucose conversion.

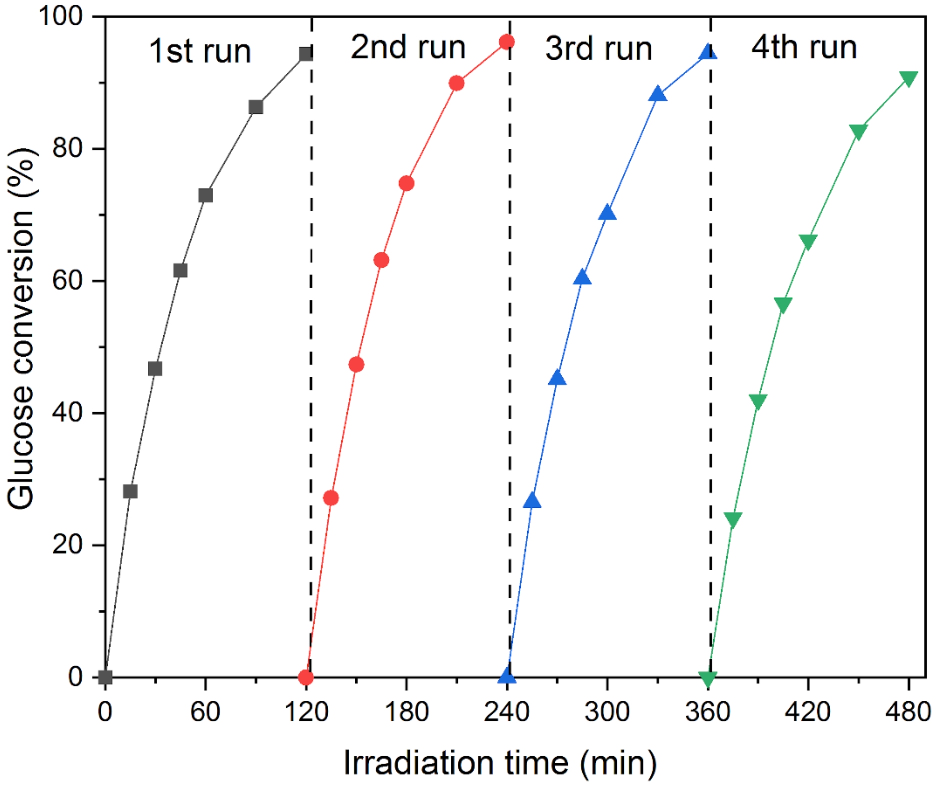


**Fig. S6** Stability and recycle of 1CdS/$TiO_2$ nanotubes for four consecutive cycles.

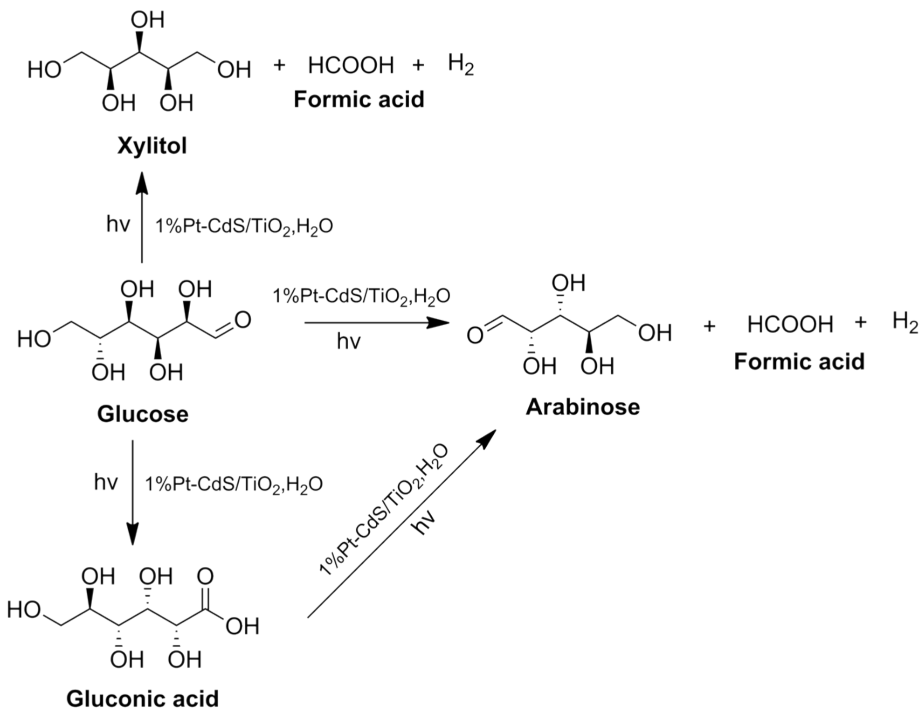


**Fig. S7** The possible reaction routes for glucose conversion.