

Supplemental Information

Enzymatic Synthesis of Supported CdS Quantum Dot/Reduced Graphene Oxide Photocatalysts

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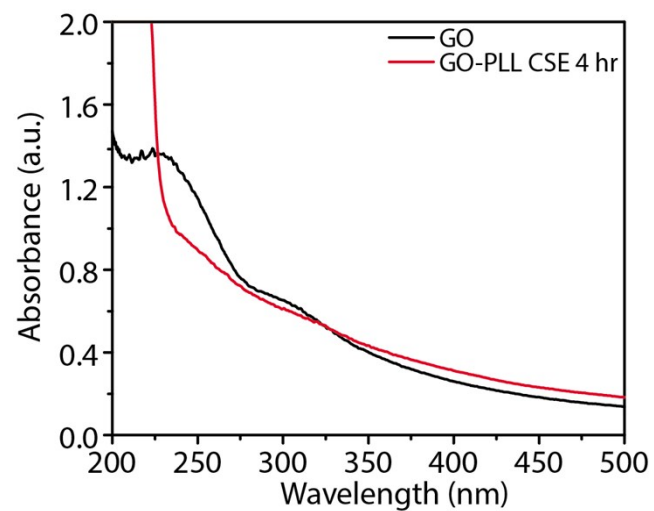


Figure S1. UV-Vis absorption of GO incubated with PLL and CSE in the absence of L-cysteine, showing no reduction.

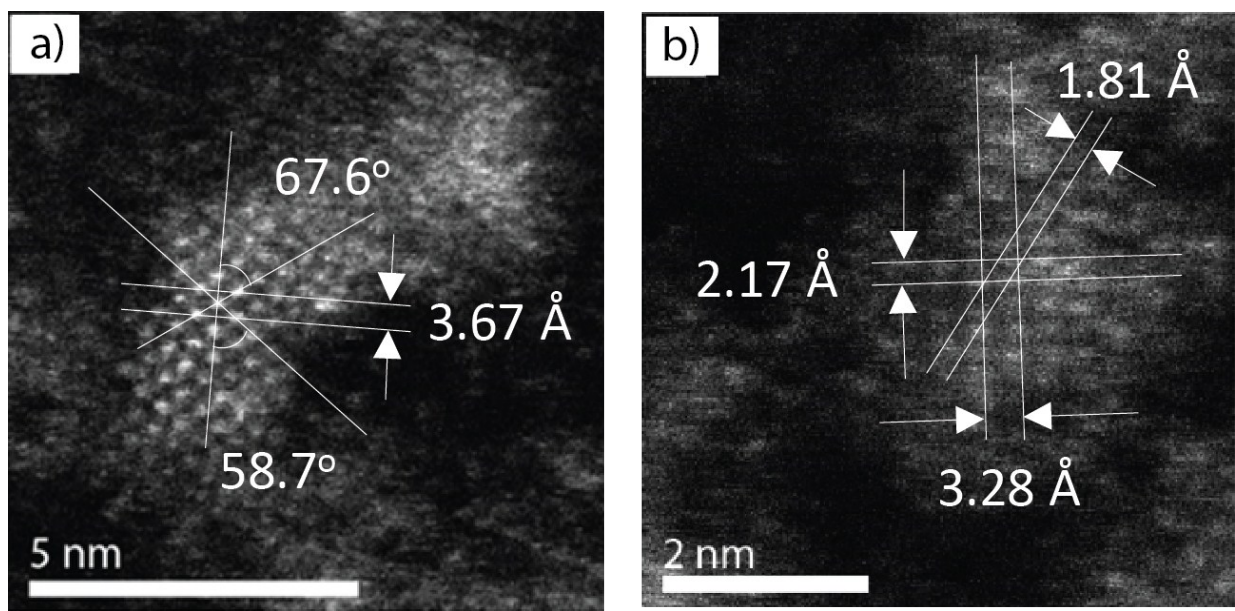


Figure S2. Annotated atomic resolution HAADF-STEM images of the particles shown in a) Figure 3b) and b) Figure 3c) that match both the CdS wurtzite or zincblende-type structures.

Table S1. Lattice matching parameters for particles shown in Figure S2a) showing matching that is consistent with both the wurtzite or zincblende type structures of CdS.

Nanocrystal Identification as either Wurtzite or Zincblende CdS in Figure S2a)							
Wurtzite [101] projection				Zincblende [110] projection			
	Measured	Matching	Error		Measured	Matching	Error
(0-10)	d=3.67 Å	3.64 Å	0.37%	($\bar{1}11$)	d=3.67 Å	3.42 Å	6.82%
(-101)	d=3.12 Å	3.22 Å	-2.86%	(002)	d=3.12 Å	2.97 Å	5.19%
(-212)	d=1.77 Å	1.79 Å	-1.56%	(Error! 20)	d=2.17 Å	2.10 Å	3.33%
<1,2>	67.6°	63.8°	5.96%	($\bar{1}1$ Err or!)	d=1.77 Å	1.79 Å	-1.56%
<1,3>	93.4°	90°	3.76%	<1,2>	58.7°	54.4°	7.33%
-	-	-	-	<1,3>	32.7°	35.3°	-7.26%
-	-	-	-	<1,4>	104.5°	100°	4.5%

Table S2. Lattice matching parameters for particles shown in Figure S2b) showing matching that is consistent with both the wurtzite or zincblende-type structures of CdS.

Nanocrystal Identification as either Wurtzite or Zincblende CdS in Figure S2b)							
Wurtzite [210] Projection				Zincblende [211] Projection			
	Measurement	Matching	Error		Measurement	Matching	Error
(002)	d=3.28 Å	3.42 Å	-4.33%	($\bar{1}11$)	d=3.28 Å	3.42 Å	-4.33%
(1-20)	d=2.17 Å	2.11 Å	2.90%	(0Error !2)	d=2.17 Å	2.10 Å	3.12%
(1-22)	d=1.81 Å	1.79 Å	0.85%	(11Err or!)	d=1.81 Å	1.79 Å	0.85%
<1,2>	90°	90°	-	<1,2>	90°	90°	-
<1,3>	56.3°	58.42°	3.61%	<1,3>	56.3°	58.5°	-3.78%

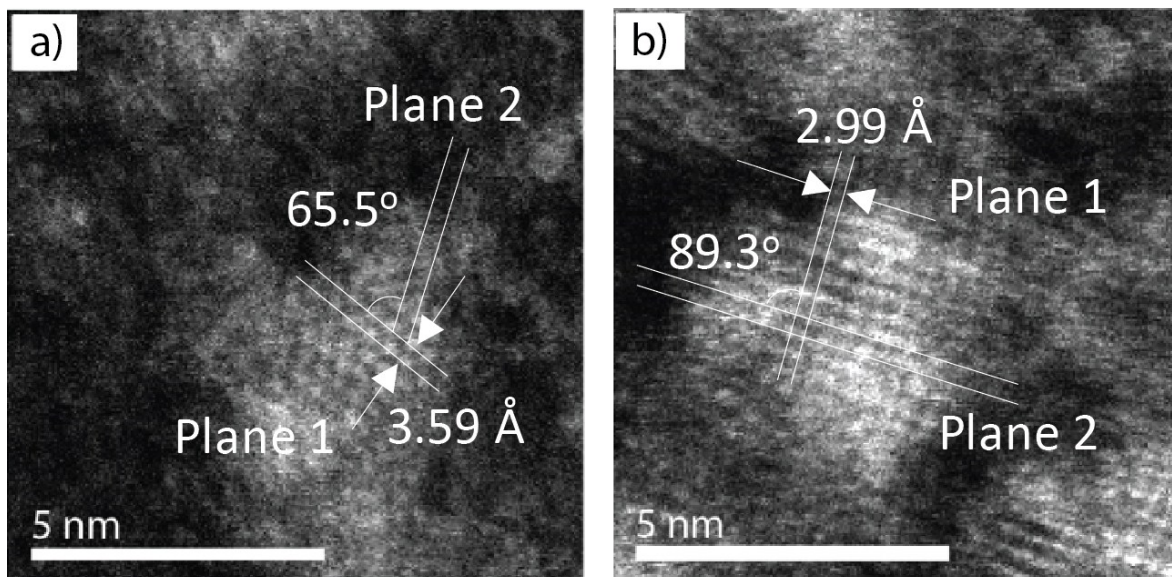


Figure S3. Annotated atomic resolution HAADF-STEM images of the particles shown in a) Figure 3e matching the CdS wurtzite structure, and b) Figure 3f) matching the CdS zincblende structure.

Table S3. Lattice matching parameters for particles shown in Figure S3 demonstrating the presence of both wurtzite and zincblende structured particles.

Nanocrystal Identification as Wurtzite CdS and Zincblende CdS in Figures S3a) and S3b)					
Figure S3a): Wurtzite [101] projection			Figure S3b): Zincblende [001] projection		
	Measurement	Matching		Measurement	Matching
(-101)	d=3.59 Å	3.64 Å ($0\bar{1}0$)	(200)	d=2.99 Å	2.97 Å (200)
(-101)	d=3.24 Å	3.22 Å ($\bar{1}01$)	(020)	d=3.07 Å	2.97 Å (020)
<1,2>	65.5°	63.8°	<1, 2>	89.3°	90°

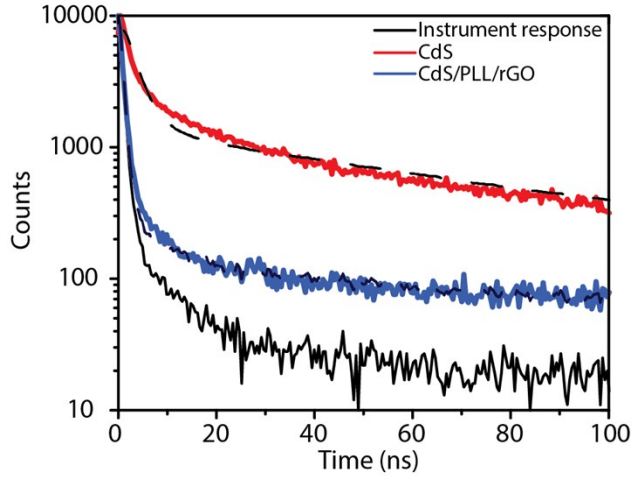


Figure S4. TCSPC of CdS and CdS/rGO. The bi-exponential fits are shown as dotted lines.

Table S3. Fitted fluorescence lifetime parameters from TCSPC results shown in Figure S4. A_1 and A_2 correspond to relative amplitudes. t_1 and t_2 correspond to lifetime.

$$F(t) = C + A_1 e^{-t/\tau_1} + A_2 e^{-t/\tau_2}$$

	A_1	t_1 (ns)	A_2	t_2 (ns)
CdS	0.30	2.5	0.70	65
CdS/rGO	0.94	0.2	0.06	68

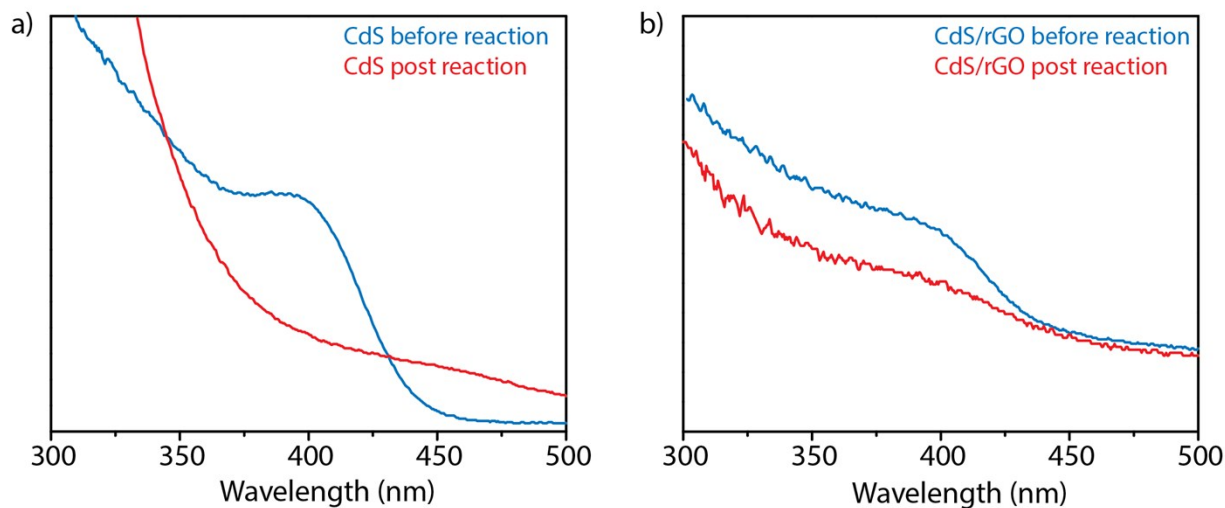


Figure S5. UV-vis absorbance spectra before and after photoreaction for a) CdS QDs and b) CdS/rGO. The absence of a post reaction peak in a) is due to agglomeration and precipitation of CdS which then falls out of solution.

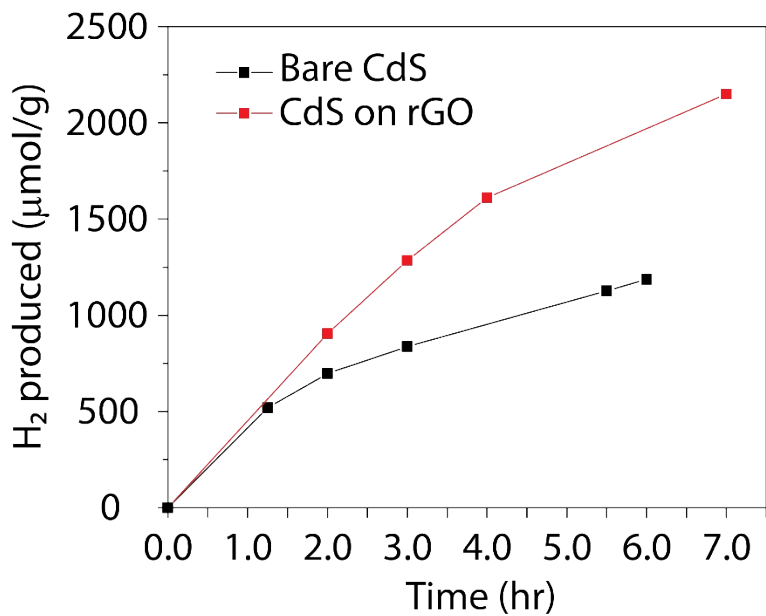


Figure S6. Hydrogen production versus time for both the optimized CdS/rGO and bare CdS nanocrystal catalyst. The bare CdS nanocrystal catalyst shows a decrease in hydrogen production after the initial two hours, while the rGO/CdS catalyst remains consistent. The connecting lines are provided to emphasize the change in hydrogen generation rate at each time point.