Nanostructures Inducing Distinctive Photocatalytic and Photoelectrochemical Performance via the Introduction of rGO into $Cd_xZn_{1-x}S$

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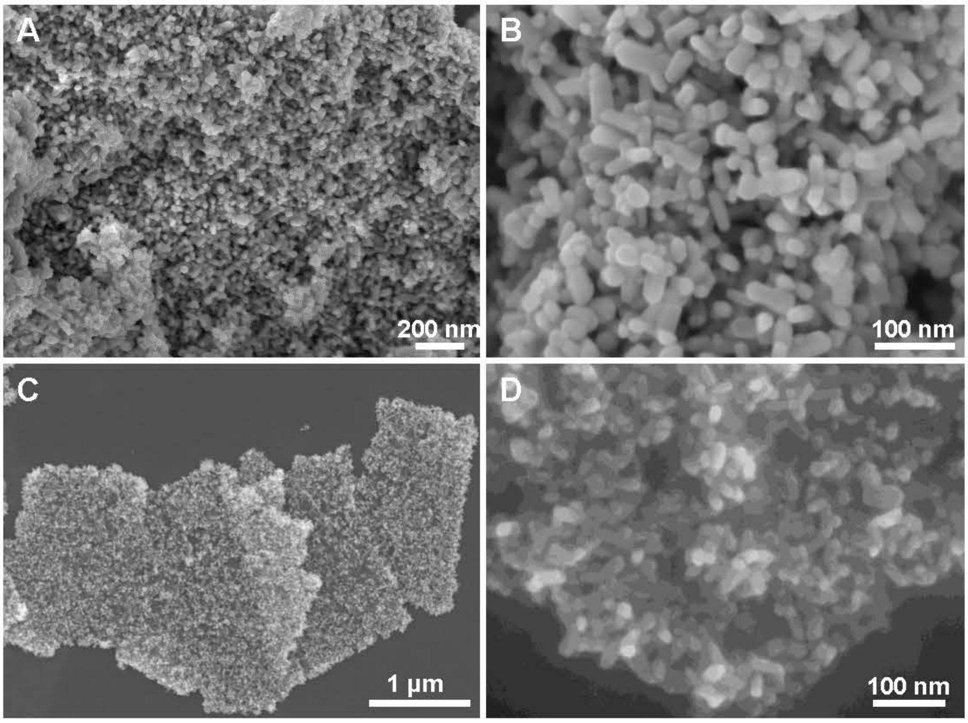

Figure S1. FESEM images with different magnification of $Cd_{0.6}Zn_{0.4}S$-DETA1.0 (A, B) and $Cd_{0.6}Zn_{0.4}S$-RGO (C, D).

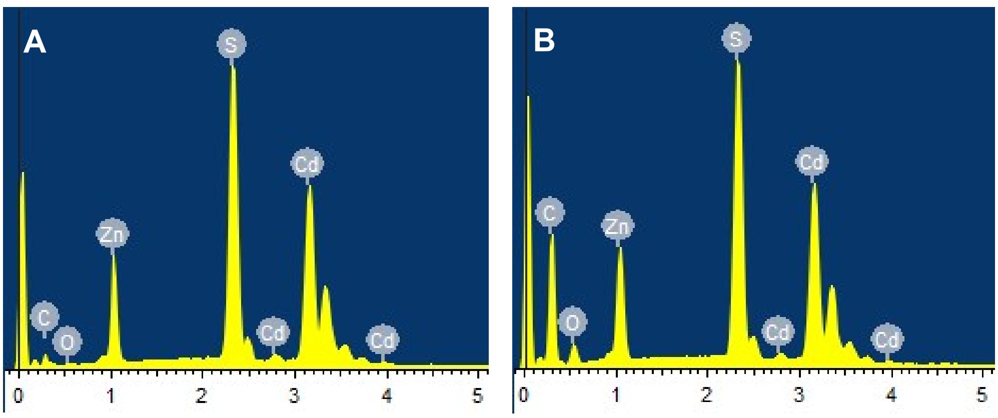

Figure S2. EDX spectra of (A) $Cd_{0.6}Zn_{0.4}S$-DETA1.0 and (B) $Cd_{0.6}Zn_{0.4}S$-RGO.

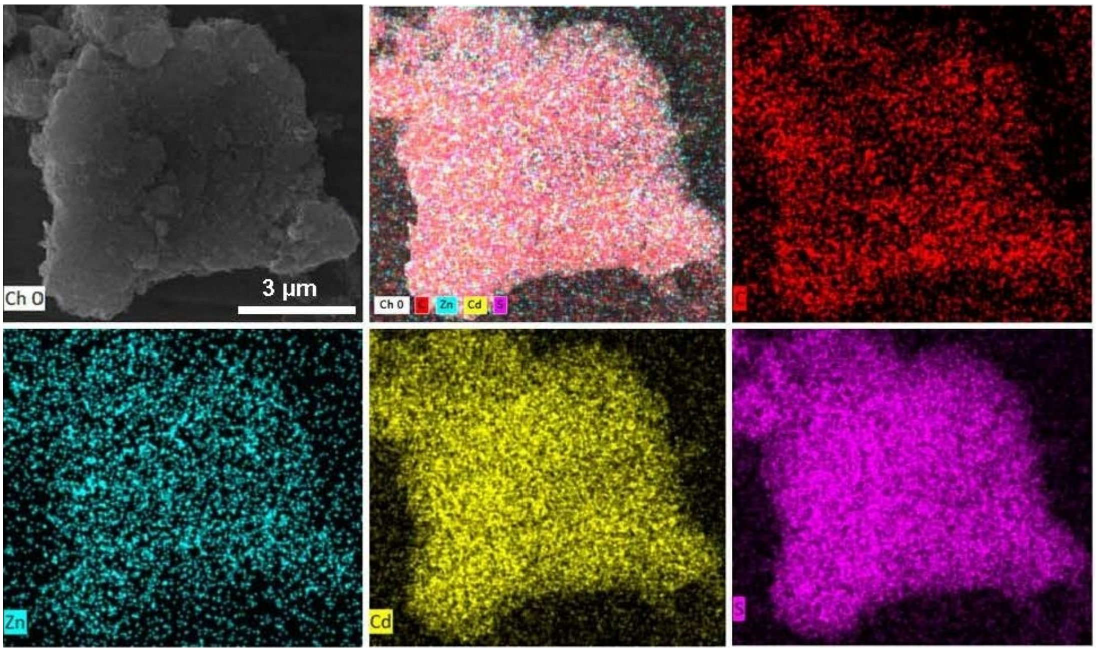

Figure S3. FESEM images of WZ-$Cd_{0.6}Zn_{0.4}S$/RGO and the corresponding C, Zn, Cd, and S elemental mappings.

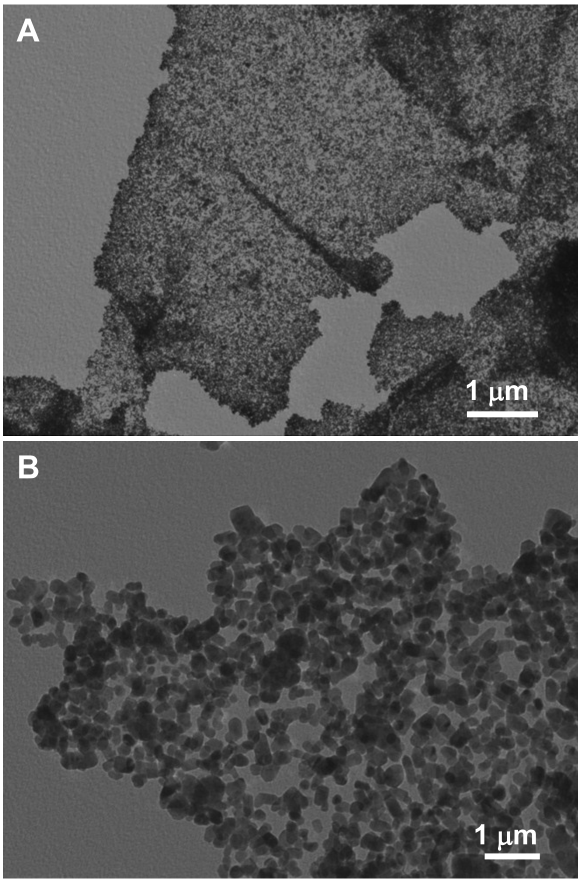

Figure S4. Different-magnification FESEM images of CdS-RGO.

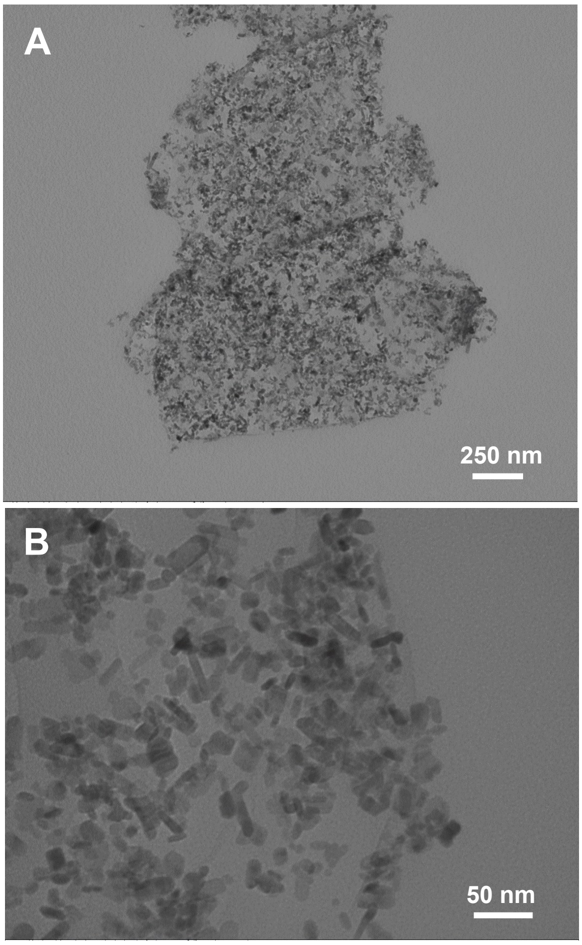

Figure S5. Different-magnification FESEM images of ZnS-RGO.

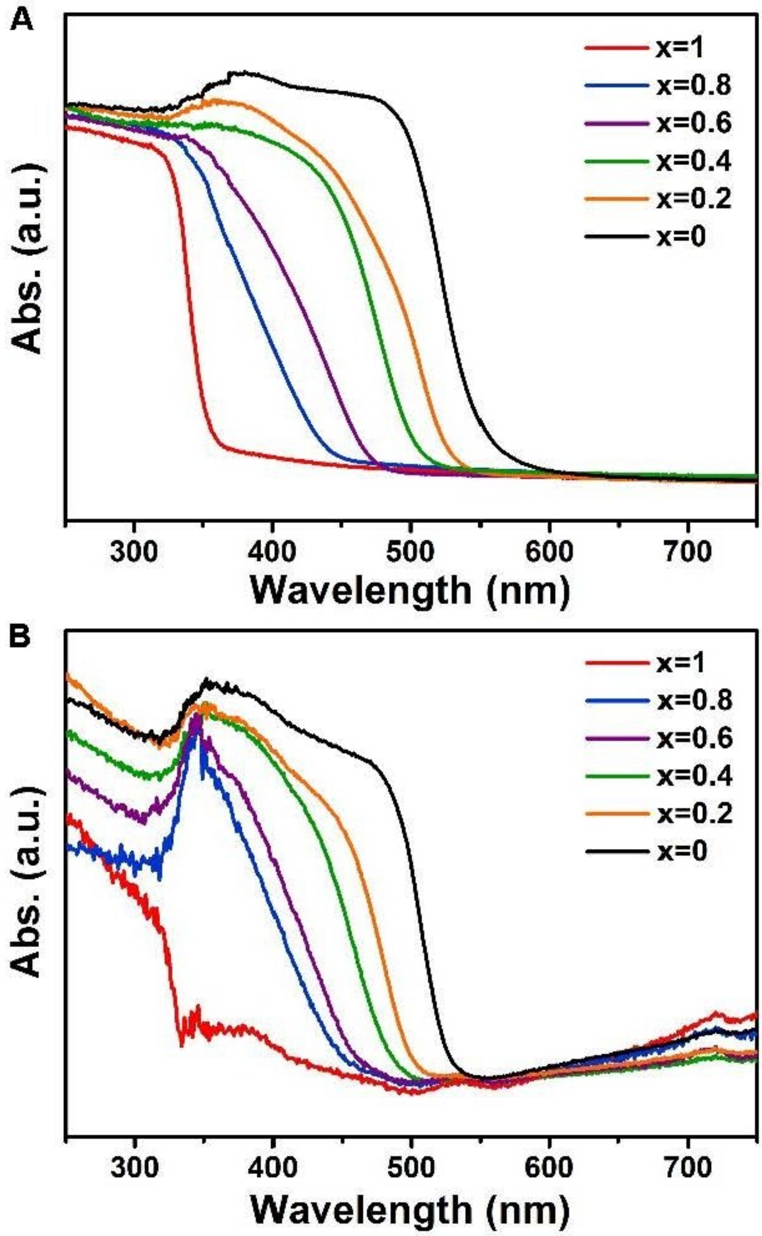

Figure S6. UV-vis diffuse reflection spectra of $Cd_{1-x}Zn_xS$ (A) and $Cd_{1-x}Zn_xS$-RGO (B) with different x values.

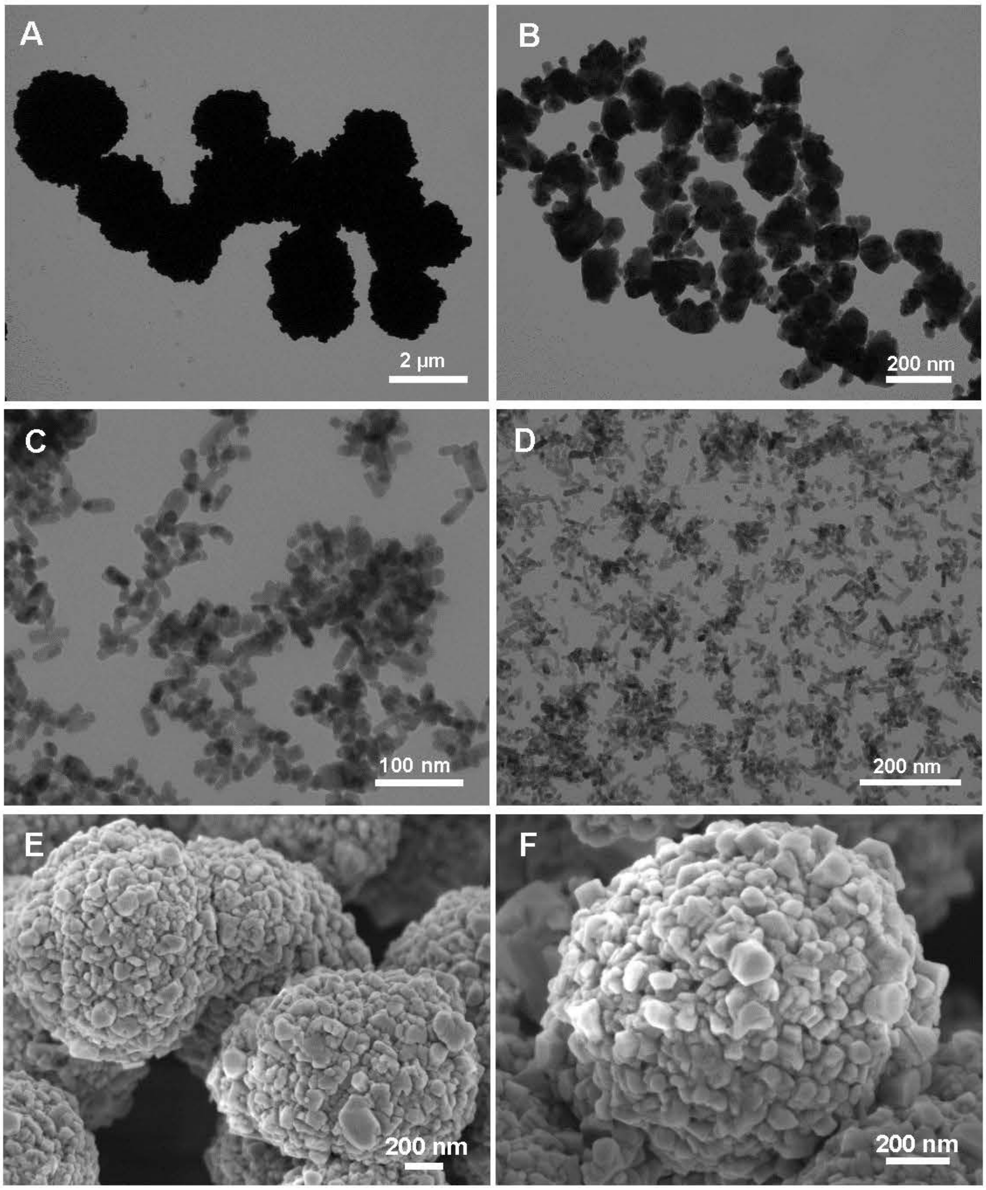

Figure S7. TEM and FESEM images of samples obtained at Cd/Zn=0.6:0.4 with different volume of DETA: (A,E,F) 0 mL, (B) 0.5 mL, (C) 1.0 mL, (D) 2.0 mL.

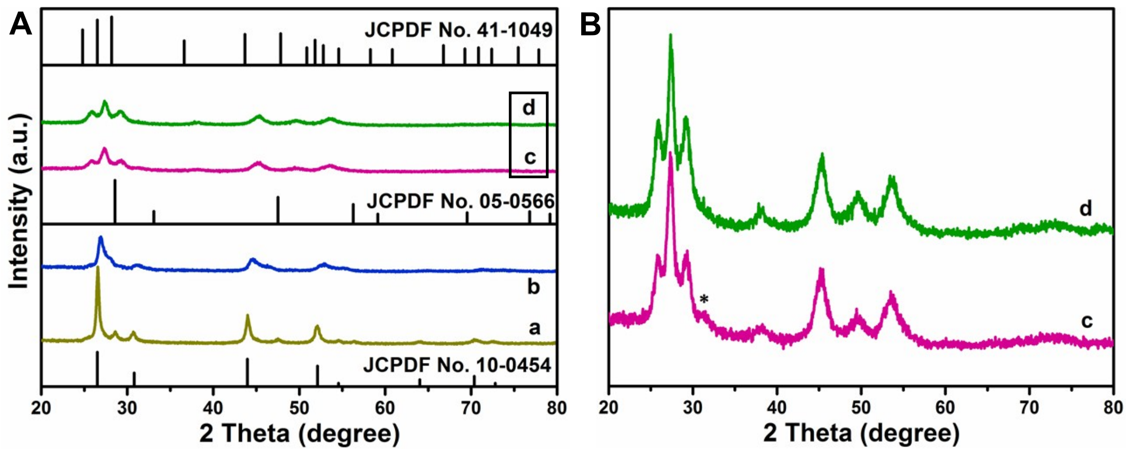

Figure S8. XRD patterns of samples obtained at Cd/Zn=0.6:0.4 with different volume of DETA: (a) 0 mL, (b) 0.5 mL, (c) 1.0 mL, (d) 2.0 mL. The three patterns of vertical lines are WZ-CdS (JCPDF 41-1049), ZB-ZnS (JCPDF 10-0454) and ZB-CdS (JCPDF 05-0566).

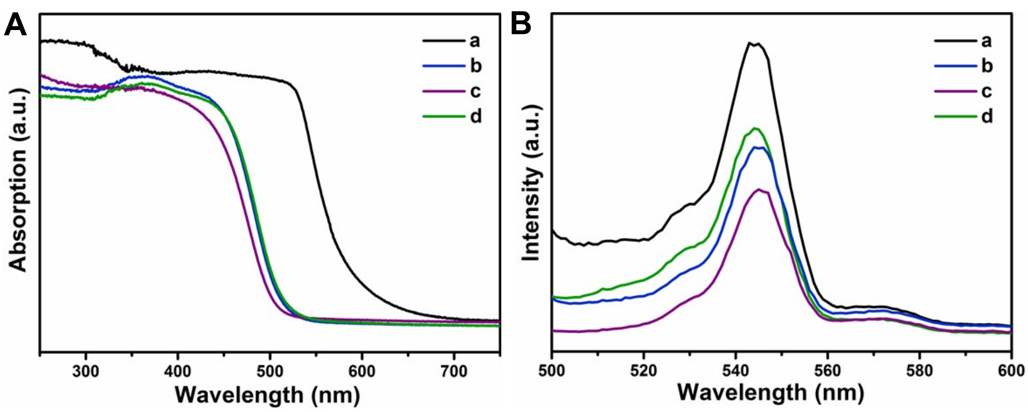

Figure S9. UV-vis diffuse reflection (A) and photoluminescence spectra (B) of samples obtained with different volume of DETA: (a) 0 mL, (b) 0.5 mL, (c) 1 mL, (d) 2.0 mL.

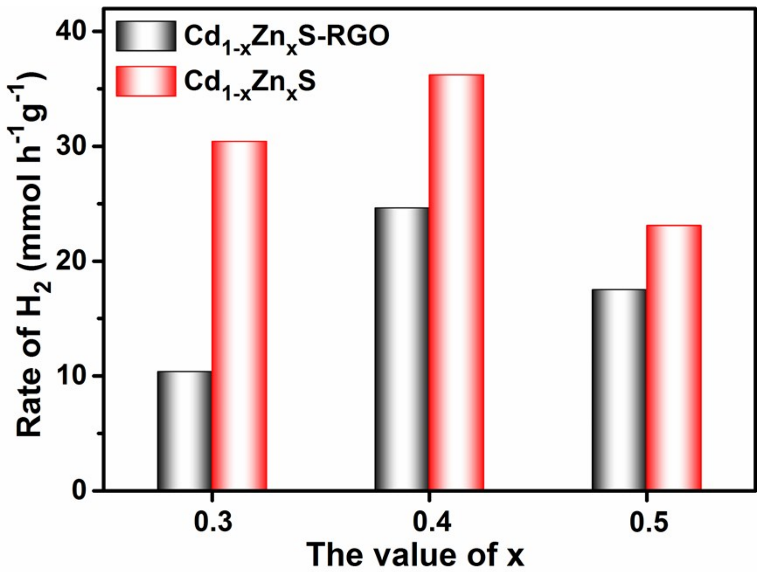

Figure S10. The hydrogen generation contrast of $Cd_{1-x}Zn_xS$ and $Cd_{1-x}Zn_xS$-RGO under visible light irradiation (x=0.3, 0.4, and 0.5).

Table S1. Comparative results of photocatalytic H_2-evolution rate of solid solution $Cd_{1-x}Zn_xS$-related photocatalysts.

Photocatalyst	Incident light (nm)	Mass (mg)	Aqueous reaction solution	H_2 evolution rate (μmol h^{-1} g^{-1})	Stability (h)	Ref.
$Cd_{0.6}Zn_{0.4}S$	⩾420	10	0.35 M Na_2S and 0.25 M Na_2SO_3	36330	20	**This work**
CdS QDs/$Zn_{1-x}Cd_xS$	＞400	50	0.1 M Na_2S and 0.04 M Na_2SO_3	2128	N/A	**1**
$Cd_{0.5}Zn_{0.5}S$	⩾420	300	0.5 M Na_2S and 0.5 M Na_2SO_3	1667	15	**2**
$Cd_{0.5}Zn_{0.5}S$	⩾430	100	0.35 M Na_2S and 0.25 M Na_2SO_3	17900	28	**3**
$Cd_{0.5}Zn_{0.5}S$-EN_{10}	⩾430	100	0.35 M Na_2S and 0.25 M Na_2SO_3	25800	28	**4**
$Zn_{0.8}Cd_{0.2}S$	⩾420	200	0.1 M Na_2S and 0.1 M Na_2SO_3	965	20	**5**
$Zn_{0.5}Cd_{0.5}S$	⩾400	50	0.44 M Na_2S and 0.31 M Na_2SO_3	7420	N/A	**6**
$Zn_{0.45}Cd_{0.55}S$	＞400	1	0.25 M Na_2S and 0.35 M K_2SO_3	30000	N/A	**7**
$Zn_{0.8}Cd_{0.2}S$-RGO	⩾420	50	0.35 M Na_2S and 0.25 M Na_2SO_3	1824	12	**8**
ZB/WZ $Cd_{0.7}Zn_{0.3}S$ Heterophase	⩾420	100	0.3 M Na_2S and 0.3 M Na_2SO_3	31300	20	**9**
$Cd_{0.9}Zn_{0.1}S$ nanotetrapods	＞420	50	0.35 M Na_2S and 0.25 M Na_2SO_3	8040	5	**10**
Zn-Cd-S (Zn_4Cd_4)	＞420	50	0.35 M Na_2S and 0.35 M Na_2SO_3	11420	12	**11**
NiS/$Zn_{0.5}Cd_{0.5}S$/RGO	⩾420	50	0.35 M Na_2S and 0.25 M Na_2SO_3	375.7	12	**12**
$Cu_{1.94}S$−$Zn_{0.23}Cd_{0.77}S$	＞420	20	0.1 M Na_2S and 0.1 M Na_2SO_3	7735	20	**13**

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