Supporting Information

Architecture of $CdIn_2S_4$/graphene nano-heterostructure for Solar Hydrogen Production and Anode for Lithium Ion Battery.

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Supporting S1

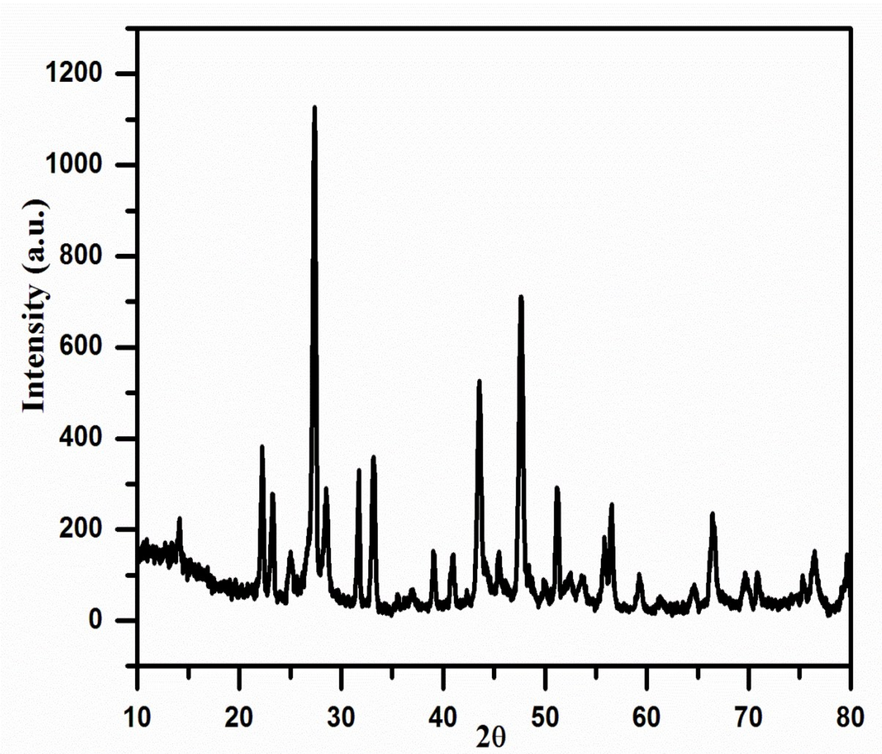

Fig. S1 XRD spectrum of sample C7.

Supporting S2

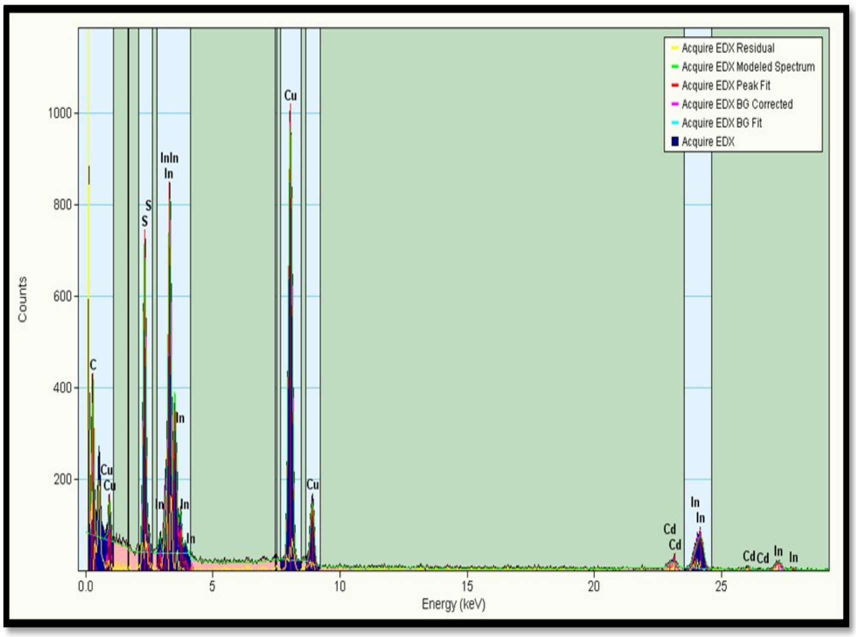

Fig. S2 EDAX of sample C4.

Supporting S3

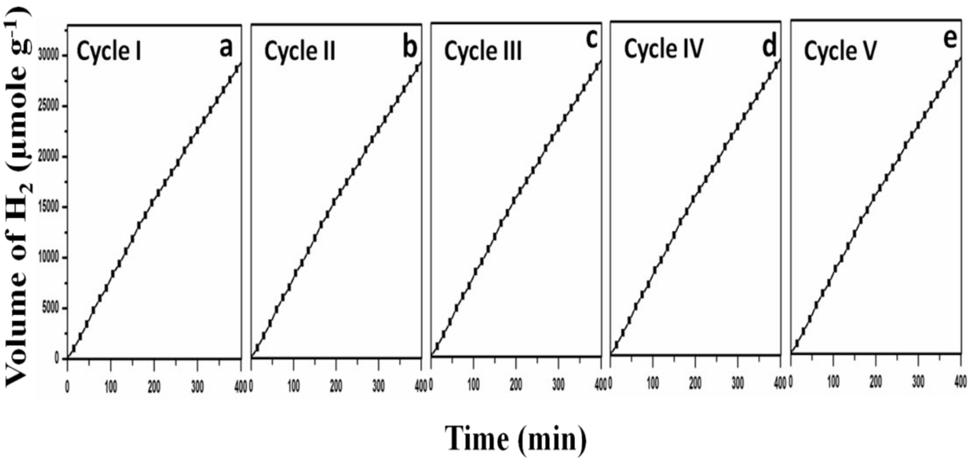

Fig. S3 Time verses volume of H_2 (µmole) evolution of recycled sample C4 (H_2S Splitting).

Supporting S4

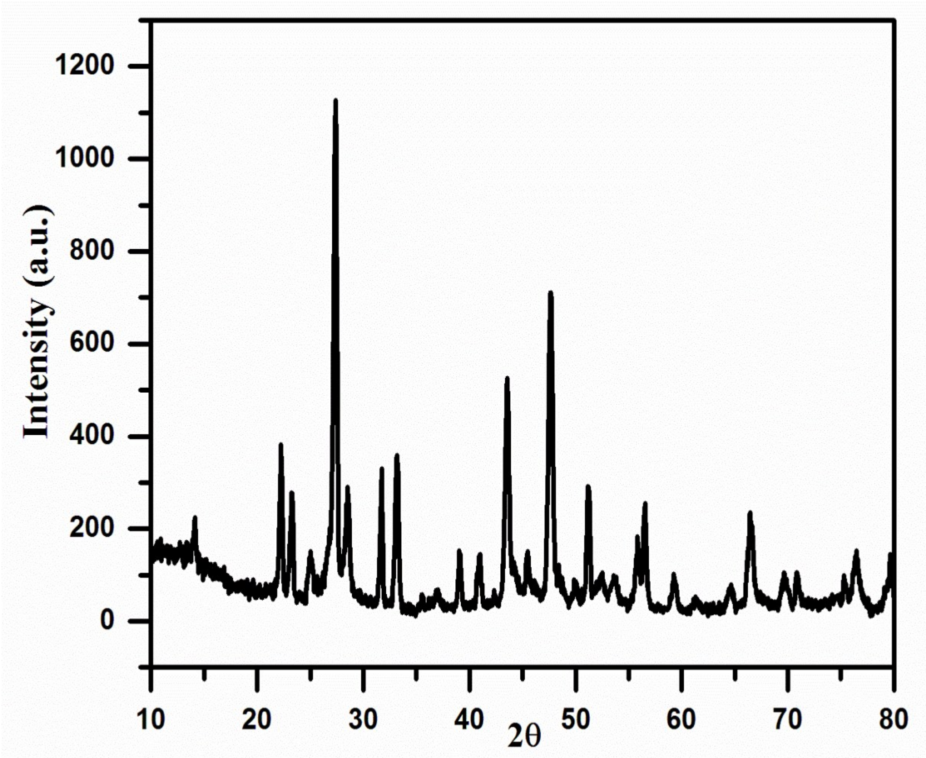

Fig. S4 XRD spectrum of samples C4 after five cycles of photocatalytic study (H_2S Splitting).

Supporting S5

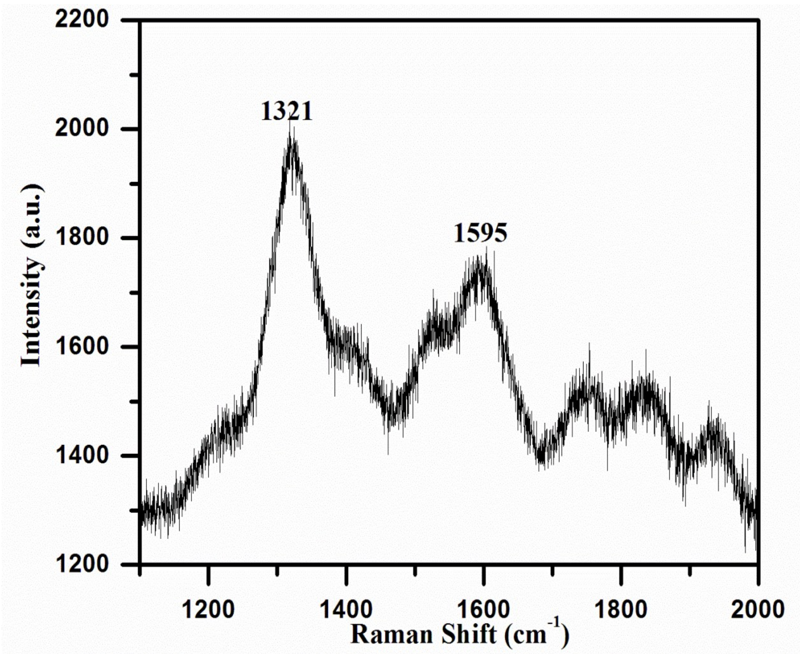

Fig. S5. Raman spectrum of sample C4 after five cycles of photocatalytic study (H_2S Splitting).

Supporting S6

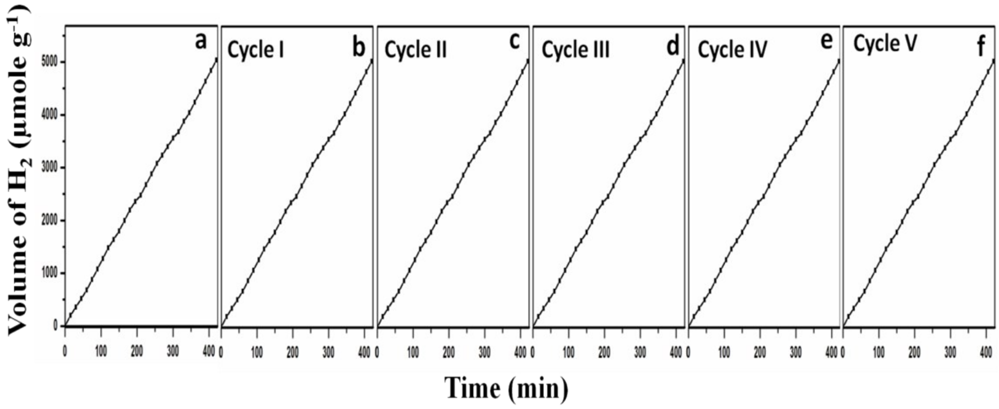

Fig. S6. Time verses volume of H_2 (µmole/g) evolution from water of sample C4 (a) fresh sample and (b-f) after five cycles of reuse of the same sample.

Supporting S7

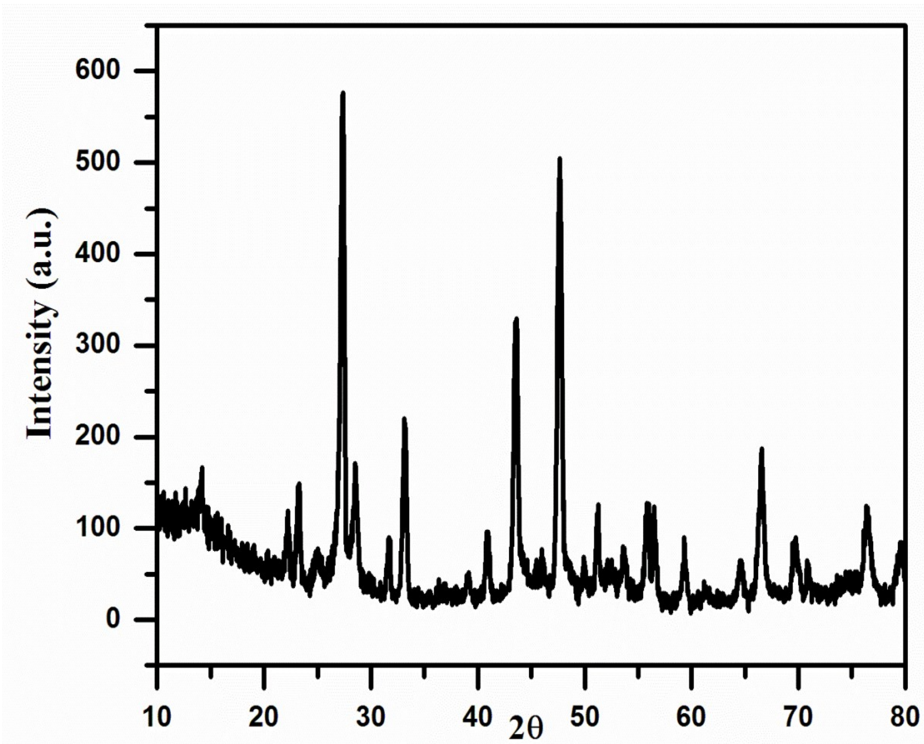

Fig. S7. XRD spectrum of samples C4 after five cycles of photocatalytic study (H_2O Splitting).

Supporting S8

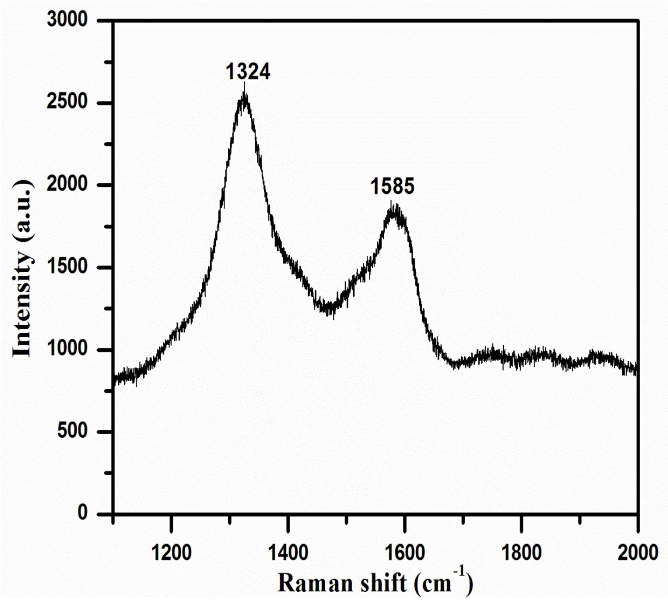

Fig. S8 Raman spectrum of sample C4 after five cycles of photocatalytic study (H_2O Splitting).

Supporting S9

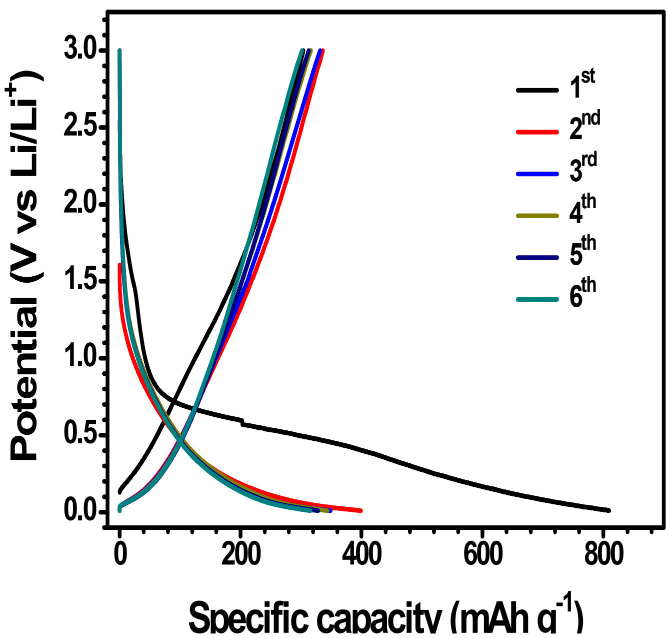

Fig. S9 Charge –discharge profile of pure graphene.

Table S1. Quantum yield of Bare $CdIn_2S_4$ is 3.34% and that of Sample C4 is 6.33%.

Photocatalyst	Amount (g)	Light Source	Apparent Quantum yield %	H_2 evolution rate (μmole h^{-1})	Reference
Bare $CdIn_2S_4$ (C1)	0.2	300 W Xenon lamp	3.34	2375	Present* Work
$CdIn_2S_4$/graphene composite (C4)	0.2	300 W Xenon lamp	6.33	4495	Present Work*
$CdIn_2S_4$ (marigold-flower like morphology)	1	450 W Xenon lamp	16.8	3476	1
$CdIn_2S_4$ (nanotubes)	1	450 W Xenon lamp	17.1	3480	1
$CdIn_2S_4$ (compact flowers)	0.5	300 W Xenon lamp	-	1007	2
$CdIn_2S_4$ (puffy flowers)	0.5	300 W Xenon lamp	-	2320	2
$CdIn_2S_4$ (Marigold flower with hollow cavity)	0.5	300 W Xenon lamp	-	3171	2
$CdIn_2S_4$ (Bipyramids grown on Marigold flower)	0.5	300 W Xenon lamp	-	3238	2

*Just with 0.2gms gives good AQE just for low intensity Lamp as compared to our earlier AFM report where 1gm sample was considered and lamp was 450 watt (more no of photons).

Table S2. Comparison of the elecrochemcial performance of Metal sulphides with $CdIn_2S_4$ and $CdIn_2S_4$/graphene.

Sr. No	Composition	Specific capacity 1st discharge/ charge (mAh g^{-1})	Capacity retention	Reference
1	$CdIn_2S_4$	842 / 602	613 mAh g^{-1} (125 cycles)	This work
2	$CdIn_2S_4$/graphene	1091 / 678	532 mAh g^{-1} (125 cycles)	This work
3	In_2S_3/graphene	1820 / 1056	522 mAh g^{-1} (100 cycles)	3
4	In_2S_3 Particles	1312 / 705	190 mAh g^{-1} (100 cycles)	4
5	In_2S_3 nanosheet	1927 / 828	450 mAh g^{-1} (40 cycles)	5
6	RGO-In_2S_3	1327 / 867	604 mAh g^{-1} (200 cycles)	6
7	ZnS/C	1021 / 482	304 mAh g^{-1} (300 cycles)	7
8	ZnS	914 / 598	204 mAh g^{-1} (200 cycles)	8
9	CuS/ Graphene	827 / 484	296 mAh g^{-1} (25 cycles)	9
10	CuS	547 / 514	472 mAh g^{-1} (100 cycles)	10

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