Photoelectrochemical (PEC) Water Splitting

Synthesis of Mn Doped CdS Nanostructures

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Introduction:

Photoelectrochemical (PEC) water splitting by sunlight irradiation has gained much attention for generation of renewable hydrogen. Controlling the properties of semiconducting materials for PEC water splitting is the main concern to achieve higher efficiency of solar light conversion.[1] Among many metal sulfides cadmium sulfide belongs to II-VI compound family is considered for number of studies for the development of CdS solar cells, due to its high absorption co efficient , stability and low cost.[2]

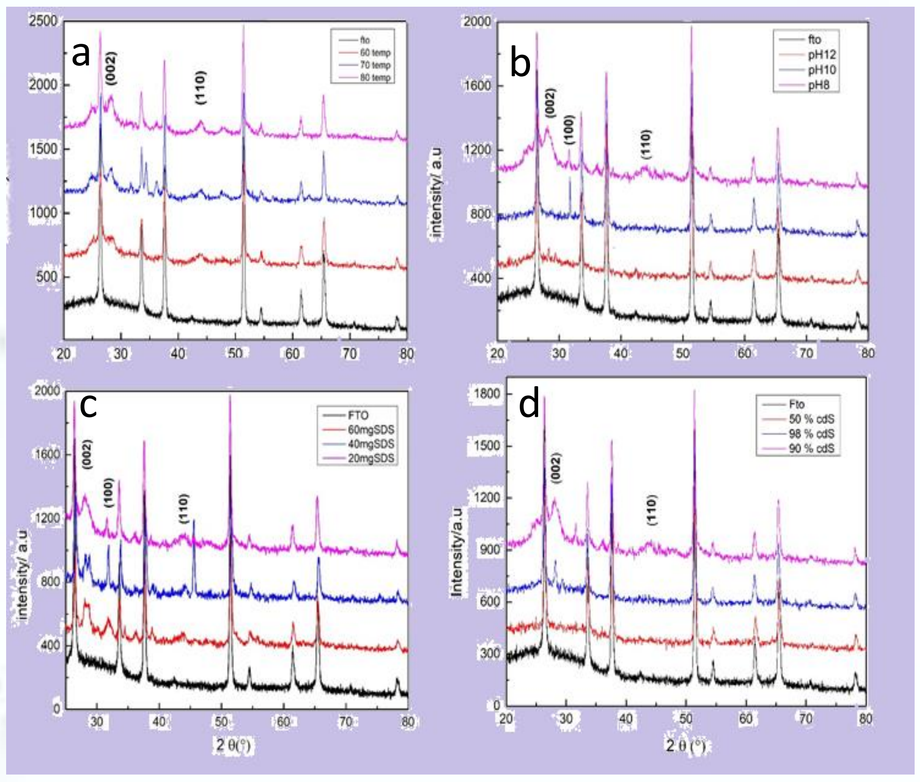
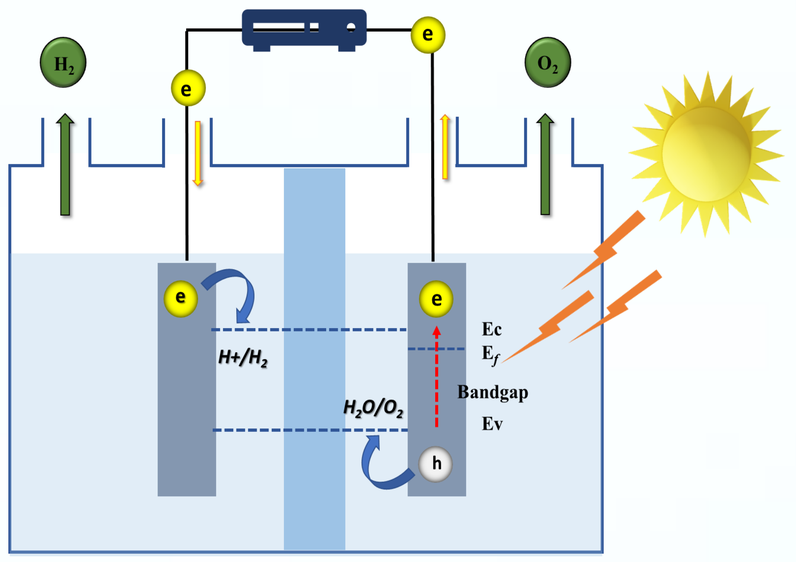


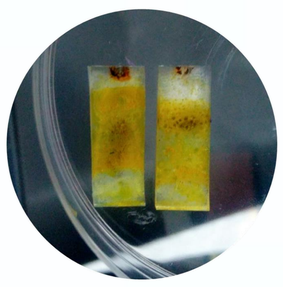
Figure 1:XRD graph a)diff temp b)diffpH c)diff SDS amount d) diff concentrations

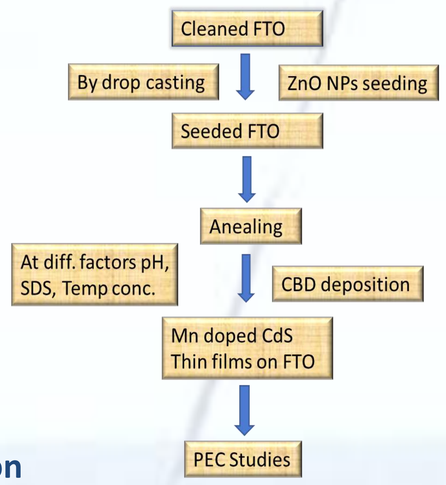
PEC H2O splitting



Experimental Set Up

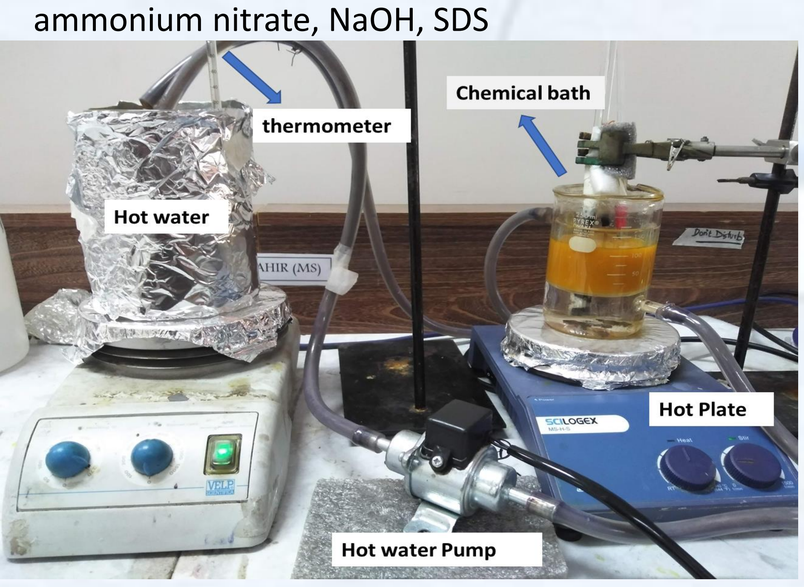
Synthesis of Mn doped CdS Nanostructures





Chemical Bath solution

Cdcl2.2H2O, Mnacetatetrihydrate, thiourea, ammonium nitrate, NaOH, SDS



Characterization

The diffraction peaks indexed as (002) and (110) at 28.18° and 43.91° respectively confirmed the formation of CdS There is no extra peak of manganese sulfide that is the evidence of Mn doping.[3]

Crystalline structure was also evident from high resolution TEM. 10-20 nm nanostructures of Mn doped CdS with high resolution fringes are evident from Fig 3.

Experimental condition	Peak position 2theta (degree)	hkl values	Crystalline Size
SDS (20mg)	28.06	002	4.37
	44.11	110	6.94
Temp (80)	28.15	002	9.51
	43.91	110	5.97
pH 8	28.06	002	5.49
	----	110	------
10 % doping	28.06	002	4.37
	44.11	110	6.94

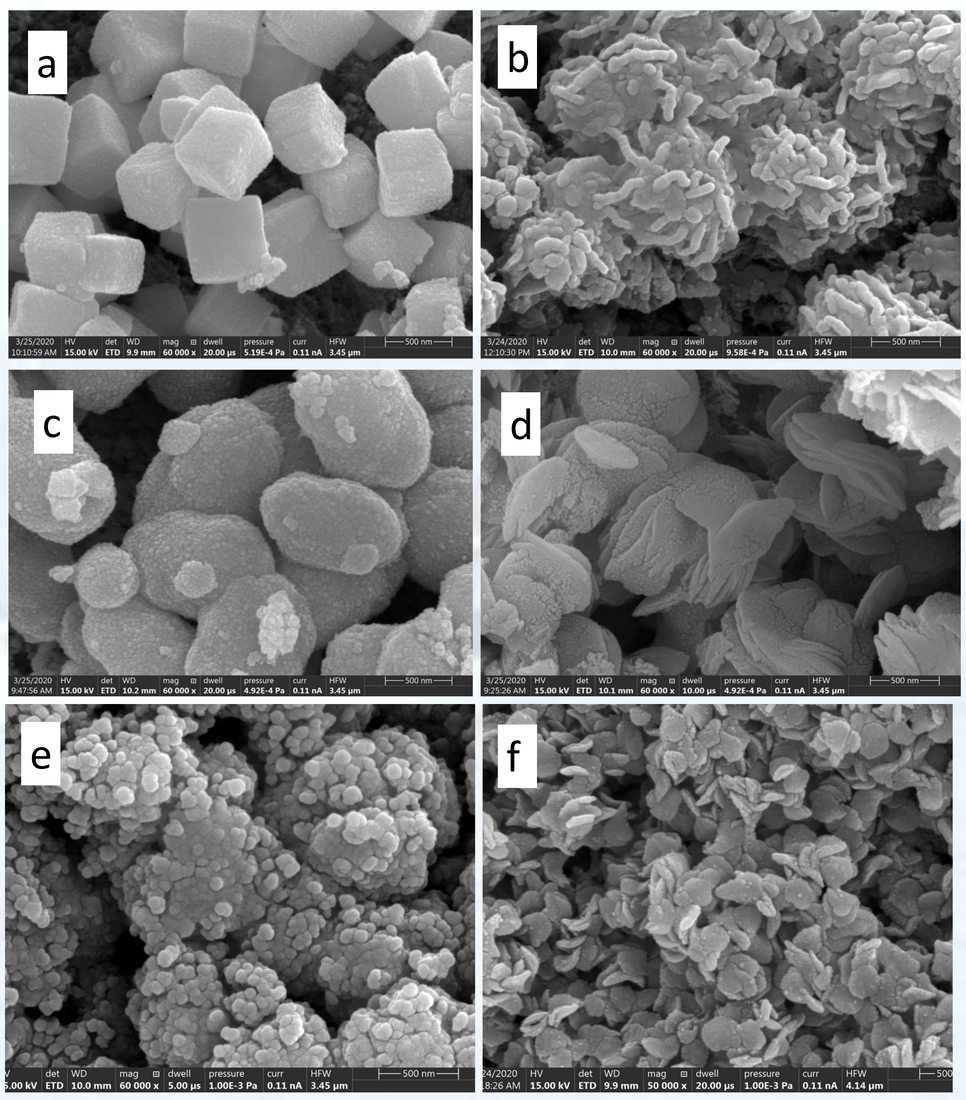


Figure 2: SEM images of Mn doped CdS (a) Nano cubes (b) Nano worms (c) nano spheres (d) Nano petals (e) Nano balls (f) Nano Plates

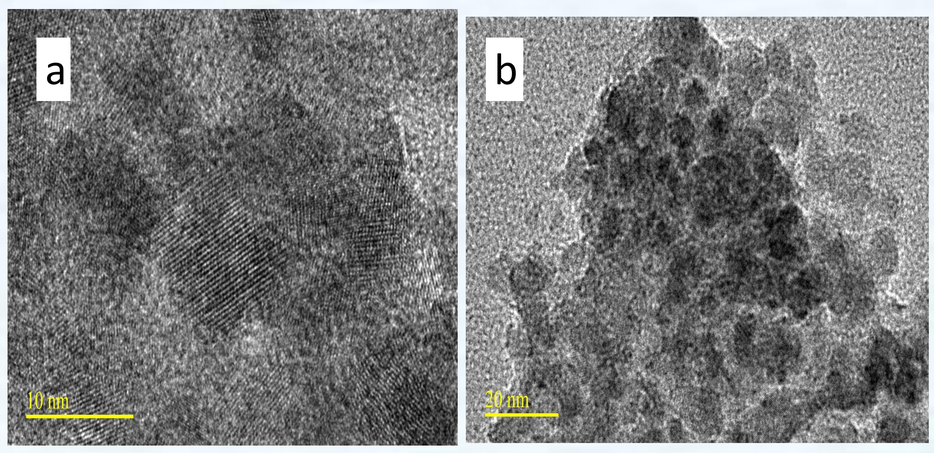


Figure 3: TEM images of Mn Doped CdS nanosturctures

PEC water splitting Results

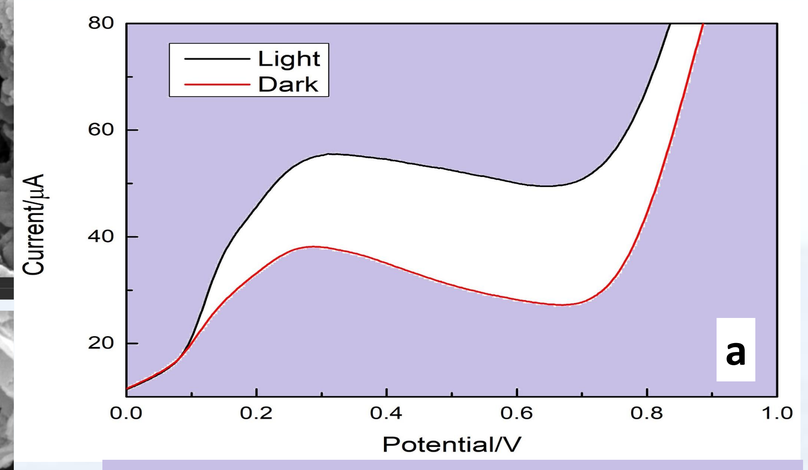


Fig 4: a) LSV b) CA graphs c) PEC stability

Conclusions:

For the first time we did comprehensive optimization of diff. morphologies of CdS, similarly first time we showed successful doping of Mn in CdS by CBD and used these nano structures for PEC water splitting.

References:

1. Hisatomi, T., Kubota, J., & Domen, K. (2014). Recent advances in semiconductors for photocatalytic and photoelectrochemical water splitting. *Chemical Society Reviews*, *43*(22), 7520-7535.
2. Demir, R., Okur, S., Seker, M., & Zor, M. (2011). Humidity sensing properties of CdS nanoparticles synthesized by chemical bath deposition method. *Industrial & Engineering Chemistry Research*, *50*(9), 5606-5610.
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Acknowledgement:

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