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Supplementary Information

Stable Hydrogen Generation from Ni and Co based co-catalysts supported CdS PEC Cell

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Section I

Morphological characterization

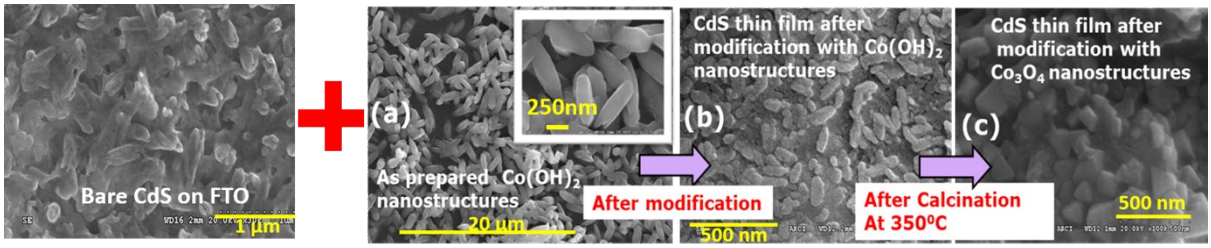

Figure SI 1. FESEM of **(a)** As synthesized $Co(OH)_2$ nano-rice structures; And CdS thin films modified with **(b)** $Co(OH)_2$; **(c)** Co_3O_4.

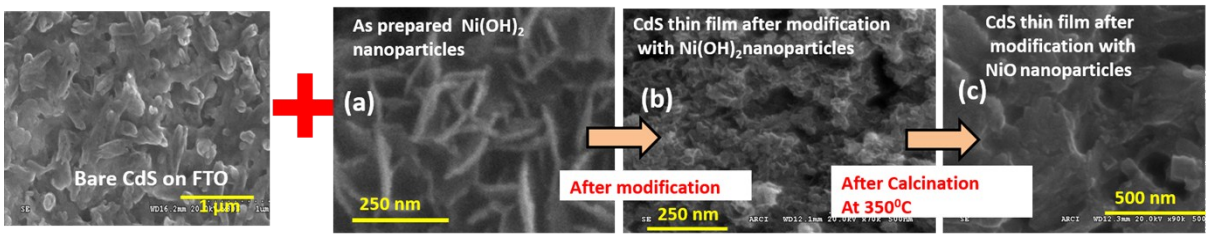

Figure SI 2 (a) SEM of **(a)** As synthesized $Ni(OH)_2$ nano-sheets structures; And CdS thin films modified with **(b)** $Ni(OH)_2$; **(c)** NiO.

Survey spectra of M-OH and M-O(M=Ni, Co) modified CdS films

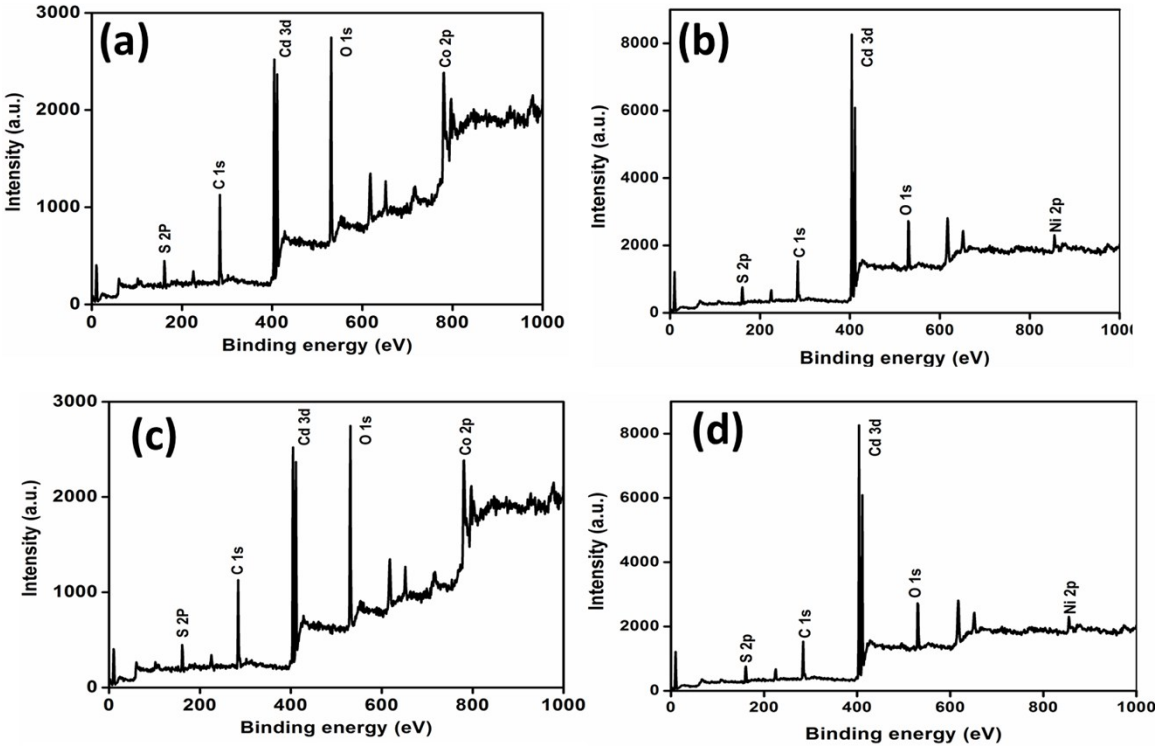

Figure SI 3 (a) XPS survey spectra of (a) $Co(OH)_2$, **(b)** $Ni(OH)_2$, **(c)** Co_3O_4 and **(d)** NiO modified CdS films.

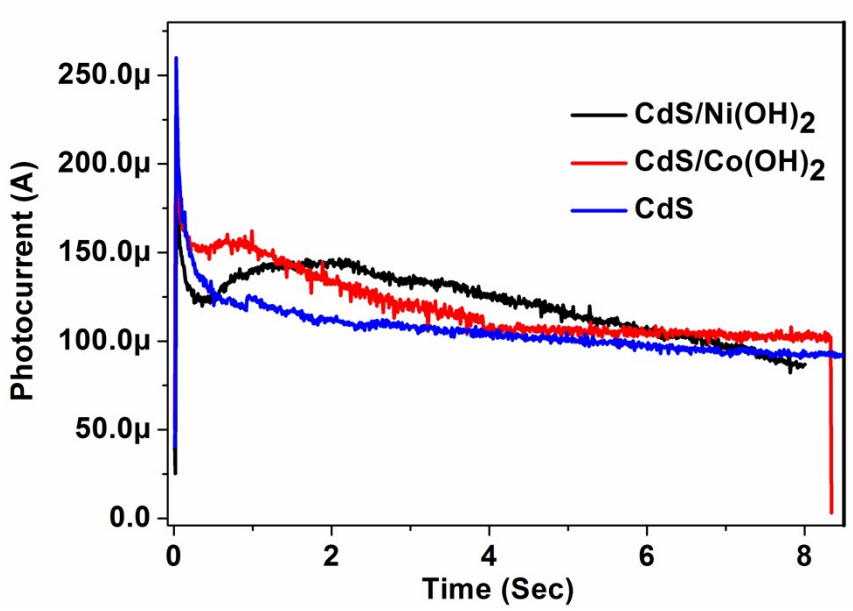

Figure SI 4 Comparision of time dependent choronoamperometric measurement of ***M***-OH modified CdS photoanodes

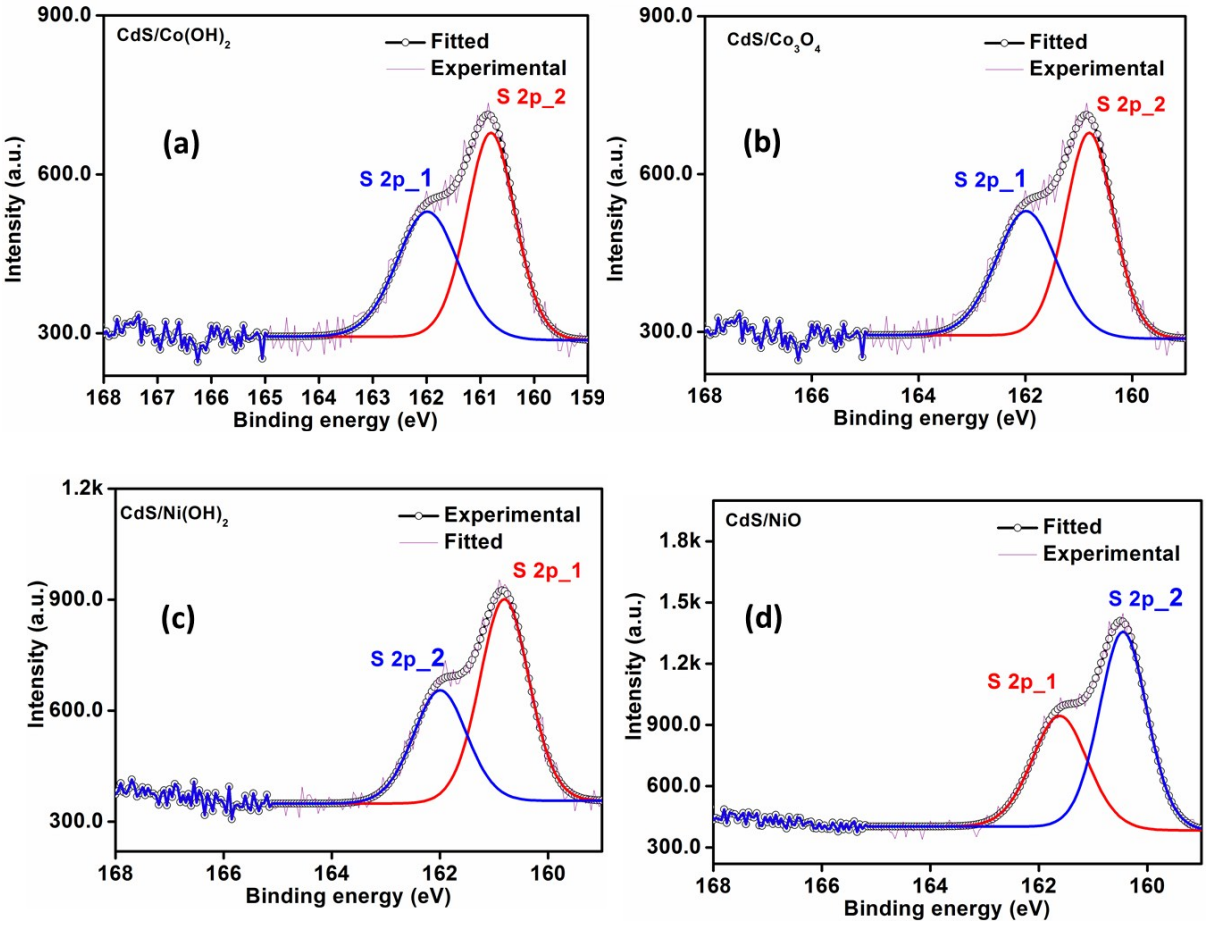

Figure SI 5 XPS spectra of S 2*p* of **(a)** $CdS/Co(OH)_2$ **(b)** CdS/Co_3O_4 **(c)** $CdS/Ni(OH)_2$ **(d)** CdS/NiO electrodes before PEC measurements.

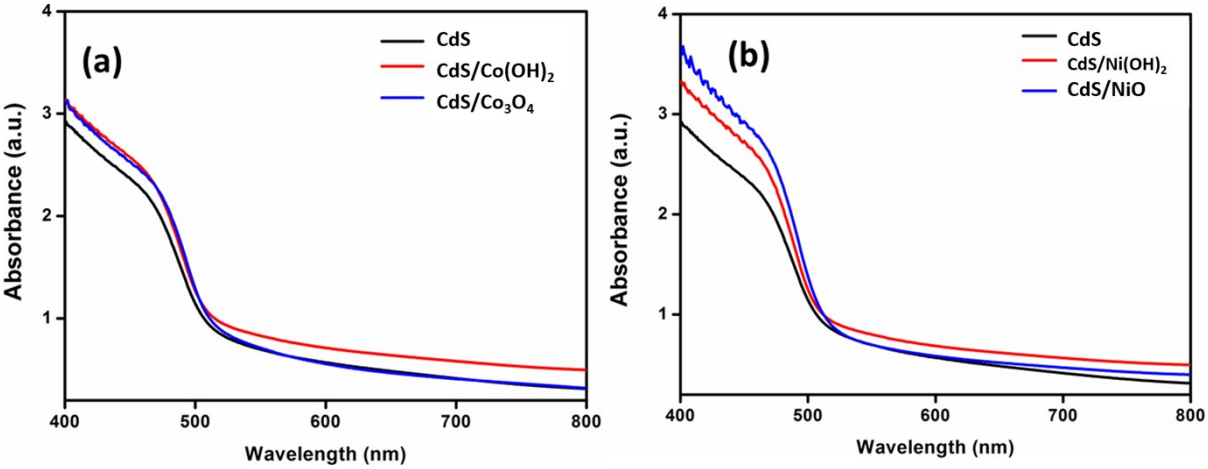

Figure SI 6 Absorption spectra of (a) $Co(OH)_2$ and Co_3O_4 modified CdS thin films (b) $Ni(OH)_2$ and NiO modified CdS thin films.

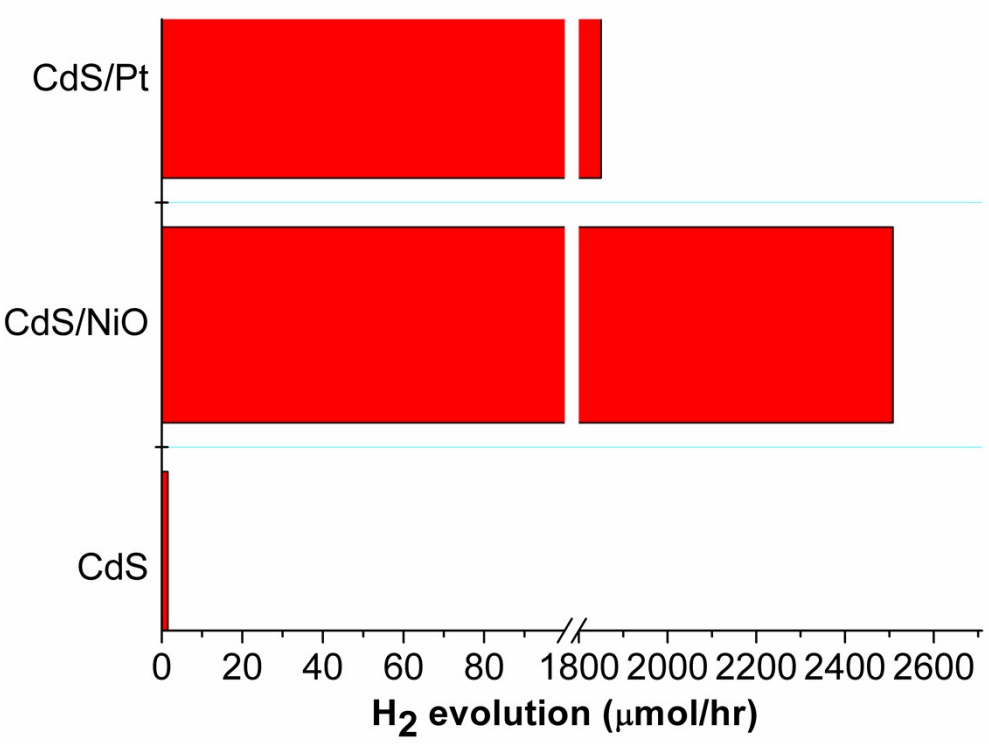

Figure SI 7. Hydrogen evolution rates of CdS, CdS/NiO and CdS/Pt.

Section II

Estimation of Incident photon to current conversion efficiency

In order to carry out Incident-Photon-Current-Conversion Efficiency (IPCE) measurements, an Oriel monochromator capable of generating wavelengths in the range of 200-900nm was used.Photoanode performance can be analyzed by studying the Incident photon-to-current efficiency **(IPCE**) which is given by the relation:

$$\mathbf{IPCE} = \frac{\mathbf{1240 * I}}{\boldsymbol{\lambda} * \mathbf{P}} \mathbf{x100\%}$$

Where, I the photocurrent density in $mAcm^{-2}$, P is power of source in $mWcm^{-2}$ and λ is wavelength in nm.