Electronic Supplementary information

Enhanced Photocatalytic Activity of Indium doped Cadmium Sulphide Dispersed on Zirconia

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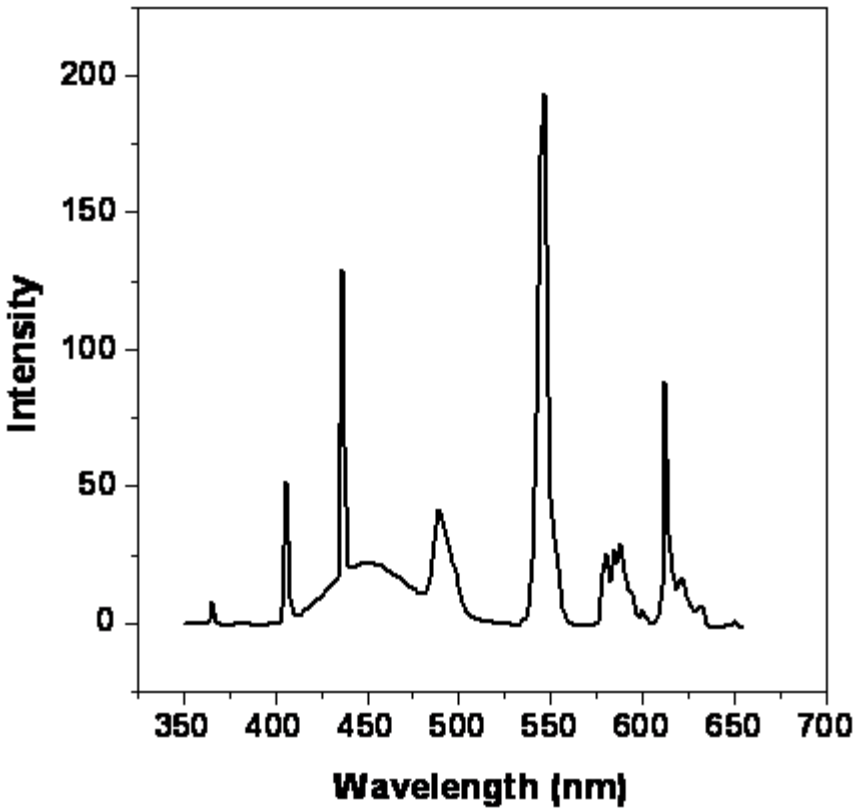
Details of the photocatalytic reactor and irradiation chamber

Photocatalytic activity was studied in a tubular quartz reactor of length 13 cm and diameter 2 cm closed with a teflon stopcock. It was also provided with a side tube closed with silicone rubber septum through which gas mixture could be removed for analysis. Samples were irradiated in a circular chamber of internal diameter 44 cm and height 46 cm fixed with eight ordinary day light fluorescent lamps (Wipro, 36 watts each, emissive length of the tube ~37 cm and radius 1.5 cm) vertically and symmetrically on the walls. Spectrum of the lamp consisted of fluorescent emission predominantly in the visible region along with a UV contribution of ~3%. The reactor was placed at the centre of the circular irradiation chamber vertically.

Figure S1 Emission profile of the fluorescent lamp used for photocatalysis.



Apparent quantum efficiency calculation for photocatalytic reaction using fluorescent lamp

Total light intensity incident at the sample position was measured using a gentec power meter (model Solo 2 (R2)). The power meter was placed at the center where the reactor was placed for irradiation and the intensity was measured by keeping only one lamp on. This was multiplied by the number of lamps as all lamps were identical. It was also corrected for the difference in the area of the sensor of the power meter and the reactor surface area, assuming uniform intensity distribution. The fraction of light intensity in the wavelength region between 350 to 550 nm only was considered for the calculation of quantum efficiency because all the catalyst samples showed strong absorption below 550nm. To calculate this, the emission profile of the lamp was recorded using a fluorimeter (Hitachi F-4500) in the wavelength range of 350-650nm. The incident light intensity in the range of 350-550nm (E_m) was obtained by multiplying the total incident

intensity with the ratio of the area in 350-550nm range to the total area of the emission profile.

Since this is a polychromatic light, energy of a single photon was considered as the weighted average energy (E_a) of all the photons in the range of 350-550nm. For this, contribution of photon of each wavelength λ_i (i varying from 350-550nm) towards the total energy was calculated as

$$E_i(\lambda i) = \frac{I_{\lambda i}}{I_{total}} \times \frac{hc}{\lambda_i}$$

where $I_{\lambda i}$ is the intensity at wavelength λi and I_{total} is the sum of intensities of all photons in the wavelength range of 350to 550nm obtained from the emission profile of the lamp.

The weighted average energy of single photon (E_a) is calculated as

$$Ea = \sum_{\lambda i=350}^{550} E_i(\lambda_i)$$

Apparent quantum efficiency calculation for photocatalytic reaction using xenon arc lamp

The experiment was carried out in a tubular quartz reactor (2cm diameter) using 50 mg of sample suspended in a mixture of 6.5 ml of Na_2S and 6.5 ml Na_2SO_3. The mixture was kept under constant stirring and was irradiated from one side using a collimated beam of ~ 1cm diameter. To determine the photocatalytic activity as a function of wavelength, different cut-off filters were used and the number of incident photons was measured using a gentec power meter (model Solo 2 (R2)). The apparent quantum efficiency is plotted in the middle of two cut-off wavelengths and the quantum efficiencies are calculated using the number of photons between two successive cut-off wavelengths and the difference in the hydrogen yield between these two successive cut-off wave lengths as proposed by Maeda et al. (Maeda, K.; Teramura, K.; Lu D.; Takata, T. ; Saito, N.; Inoue Y.; Domen, K. *Nature* **2006**, *440*, 295).

Fig S2. 1LO and 2LO peak regions of CdS, CdS-Zr and CdInS-Zr

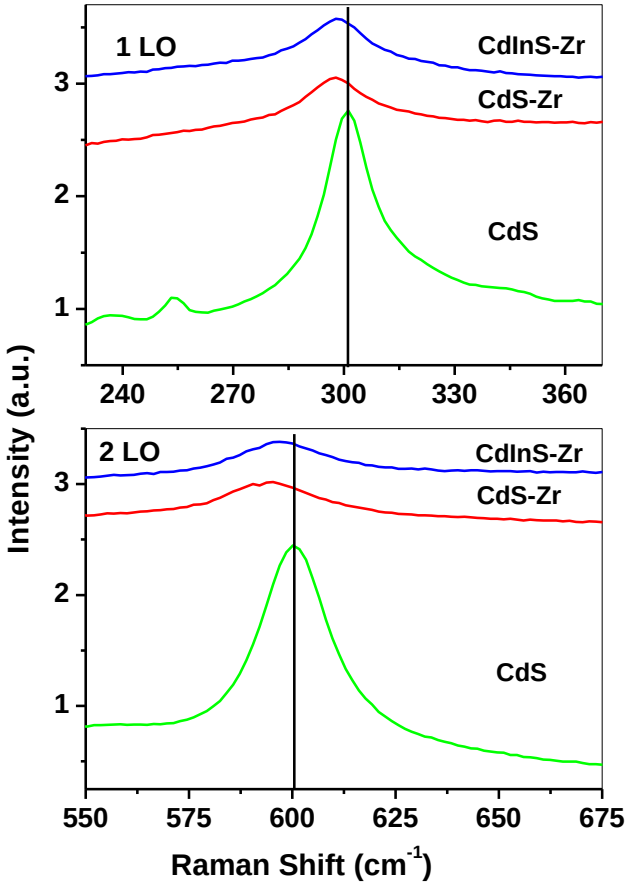


Fig S3 Decay curves corresponding to the 700 nm emission from CdS, CdS-Zr and CdInS-Zr samples

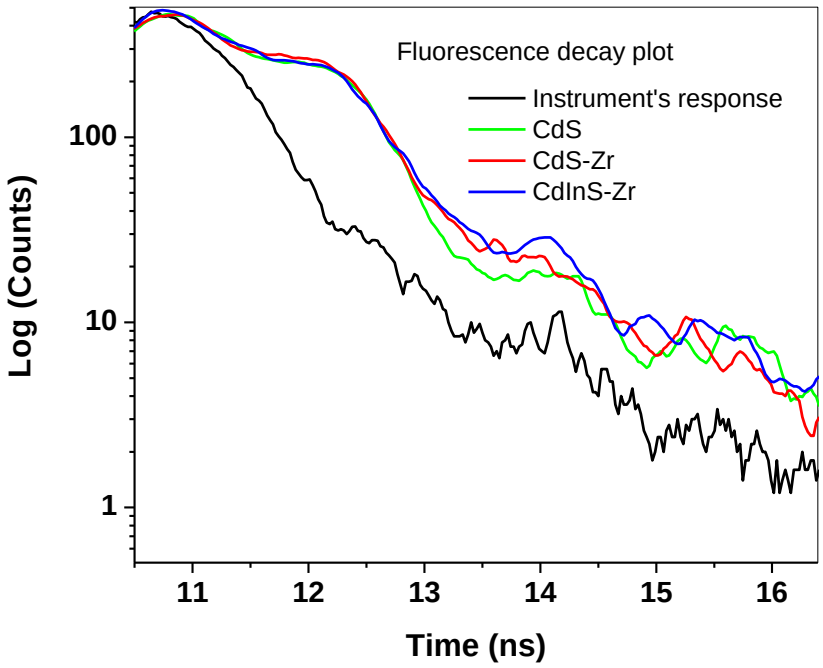


Fig S4 Absorption of radiation by CdInS and CdInS-Zr in Na2S and Na2SO3 aqueous suspensions at different wavelengths