

Photocatalytic Properties of Semiconductor SnO₂/CdS Heterostructure Nanocrystals†

Arik Kar, Simanta Kundu and Amitava Patra*

Electronic Supporting Information

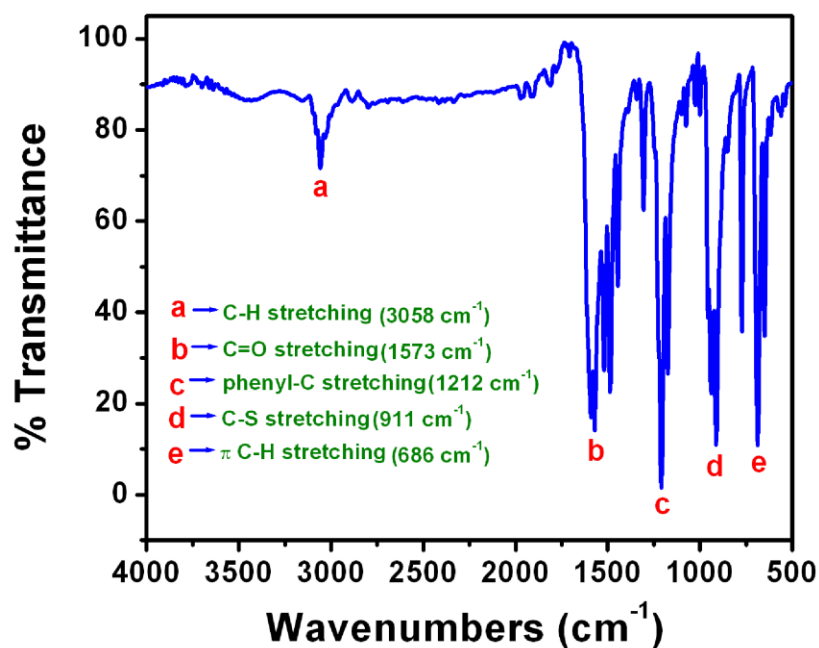


Figure S1 FTIR spectrum of the cadmium thiobenzoate complex.

Figure S1 depicts the FTIR spectra of the cadmium thiobenzoate complex. A weak peak at around 3058 cm⁻¹ is assigned to C-H bond stretching frequency. The strong peaks at 1590 and 1573 cm⁻¹ is due to carbonyl (C=O) bond stretching. The prominent bands at 1490, 1450 and 1307 cm⁻¹ are assigned as C-C stretching vibration.¹ Two very strong peaks at 1212 and 1177 cm⁻¹ are due to stretching frequencies of phenyl-C bond. Again two strong peaks at 939 and 911 cm⁻¹ are also assigned to C-S bond stretching the strong signal at 775 and 686 cm⁻¹ are coming due to π C-H of monosubstituted benzene ring and finally a weak peak at around 653 cm⁻¹ is assigned to the bending vibration modes of O-C-S bond. Analysis suggests the successful synthesis of cadmium thiobenzoate complex which is consistent with previous work.¹ This cadmium thiobenzoate complex is used as the single source precursor for cadmium sulphide.

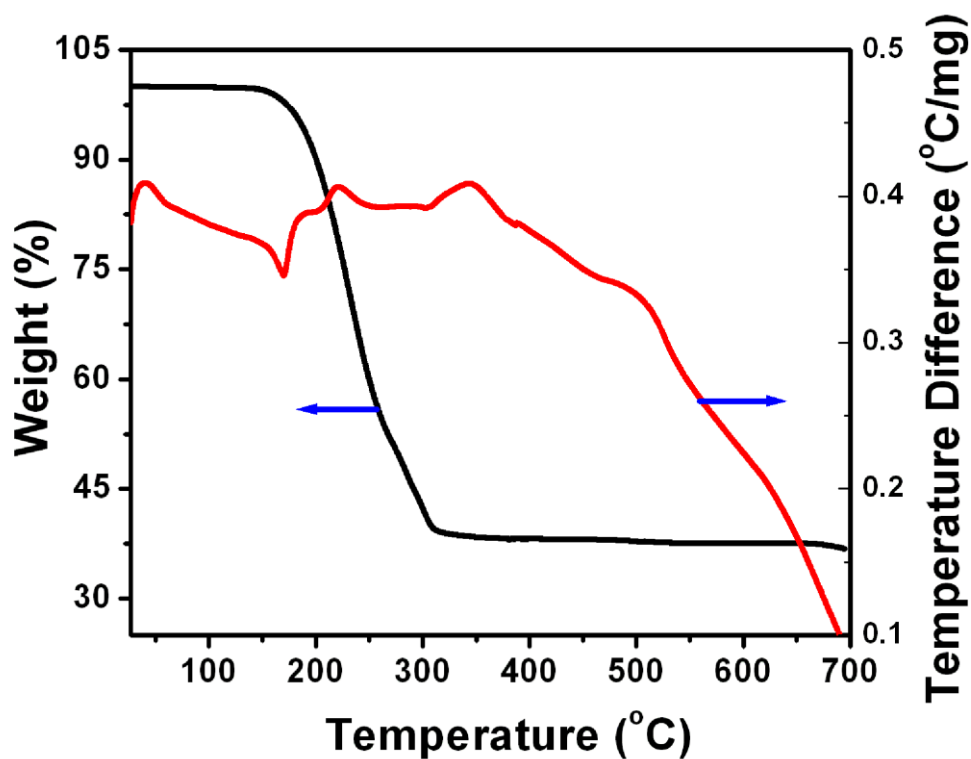


Figure S2 TGA-DTA curve of the cadmium thiobenzoate complex.

Figure S2 shows the TGA and DTA data of the complex cadmium thiobenzoate. On the TGA curve, the main weight loss appeared to be removal of water and unhydrolysed organic species. In the temperature range between 100 and 300°C, the weight losses are 97% and 39%, respectively. The weight loss is completely constant after 300°C which remains almost same at higher temperature, signifying that the organic residues were completely eliminated beyond 300°C. As seen from the DTA curve, it is clear that the crystallization temperature region are around at 170°C. It reveals that cadmium thiobenzoate complex starts to decompose at 100°C. Therefore, we heated the sample at 120°C for 6 hrs in vacuum oven. Finally, we wash the synthesized CdS nanoparticles for several times to remove impurities and finally it was dried under vacuum. No impurity peaks are found in the XRD patterns which confirm the formation of pure CdS nanocrystals.

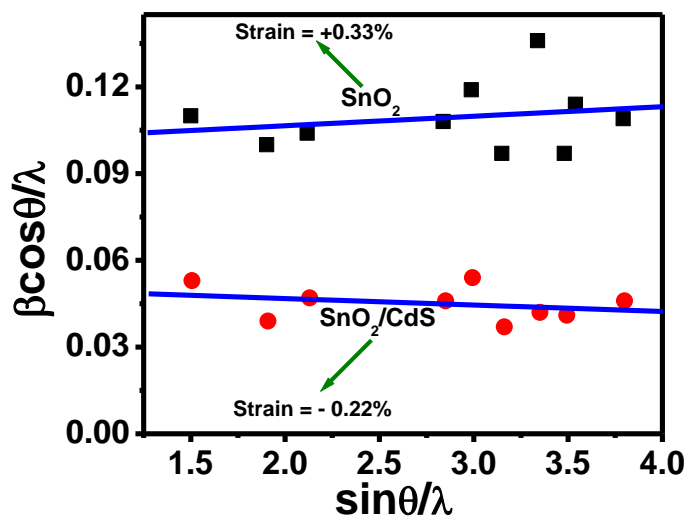


Figure S3 Plot of $\beta \cos \theta / \lambda$ against $\sin \theta / \lambda$ for pure SnO_2 nanorod and the SnO_2/CdS heterostructure.

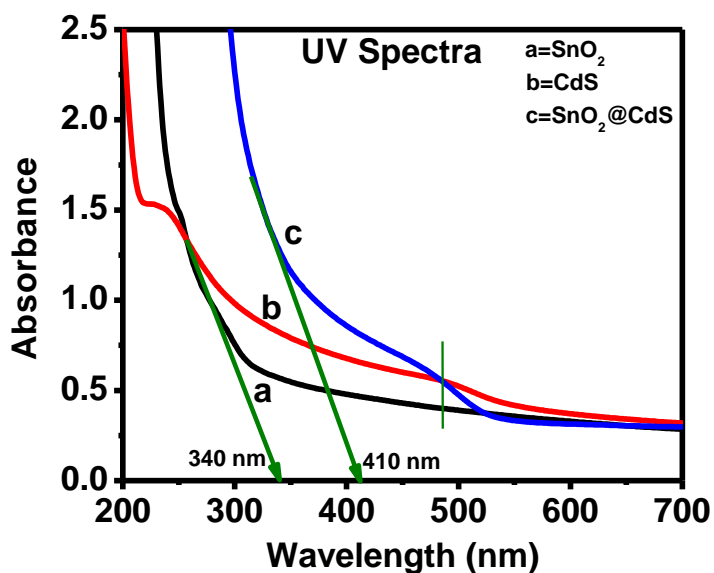


Figure S4 UV-vis spectra of SnO_2 nanorod, CdS nanoparticle and SnO_2/CdS heterostructure.

Figure S4 shows the UV-vis spectra of SnO_2 nanorod, CdS nanoparticle and SnO_2/CdS heterostructure. The UV-vis absorption band at 340 nm for SnO_2 nanorod corresponds to the band gap 3.64 eV of SnO_2 . For CdS nanoparticles, the UV-Vis absorption band at 480 nm corresponds to the band gap 2.60 eV of CdS. It is seen from figure S4, the SnO_2/CdS heterostructure exhibit a new absorption band in the region around 470-510 nm in comparison with that of the SnO_2 nanorod. It is

obvious that the new absorption band comes from the CdS nanoparticle.² In SnO₂/CdS heterostructure, the core SnO₂ has a much higher absorbance in approximately 410 nm (band gap 3.02 eV), which may indicate an increment of surface electric charge of the oxide in the heterostructure.³

References

1. V. V. Savant, J. Gopalakrishnan and C. C. Patel, *Inorganic Chemistry*, 1970, **9**, 748-751.
2. B. Zhang, J. Mu and D. Wang, *Journal of Dispersion Science and Technology*, 2005, **26**, 371-373.
3. H. Sun, S.-Z. Kang and J. Mu, *Journal of Dispersion Science and Technology*, 2009, **30**, 384-387.