Electronic Supplementary Material (ESI) for RSC Advances

Supplementary Information

Time Correlated Single Photon Counting Spectrometer Technique:

Time-resolved fluorescence decay spectra were obtained by the time-correlated single-photon-counting (TCSPC) method. A vertically polarized 400 nm (3.10 eV) laser was used to excite the sample. The emitted photons at the magic angle (54.78) were counted by a micro channel plate photomultiplier tube (MCP PMT) apparatus (Hamamatsu R3809U) after being passed through the monochromator. The signal was fed through a constant fraction discriminator (CFD), a time-to-amplitude converter (TAC) and a multichannel analyzer (MC, Oxford Corporation U.K). Repetitive laser pulsing and emitted photon collection produces a histogram of voltage (time) against counts. The histogram represents the measured decay. For recording the lamp profile, a scatterer was placed instead of the sample and the same procedure was repeated. The response time of this instrument is around < 1 ns.

The measured fluorescence decay is the convolutions of true fluorescence decay, excitation function and the instrument response function. The fluorescence kinetic parameters (lifetime, amplitudes etc.) are obtained by deconvoluting the excitation and the instrument response function from the measured fluorescence decay. The data analysis was carried out by the software provided by IBH (DAS-6) which is based on reconvolution technique using iterative non-linear least square methods. The global analysis of fluorescence decays were carried out using the PTI global analysis software.

Laser Flash Photolysis Analysis:

Life time values were also determined by observing the time dependence of the luminescence decay using a Czerny-Turner monochromator with a stepper motor control and a Hamamatsu R-928 photomultiplier tube. A third harmonic of an Nd:YAG laser wavelength 355 nm (8 ns pulses & 3.50 eV) as a excitation source -was directed toward the sample using prisms. The signals were captured using a Hewlett-Packard 54201A with 100 MHz digital storage oscilloscope. The oscilloscope is optically triggered using the photodiode. The data were analyzed through computer using the software provided by IBH.

X-ray Diffraction pattern for bare and hybrid system:

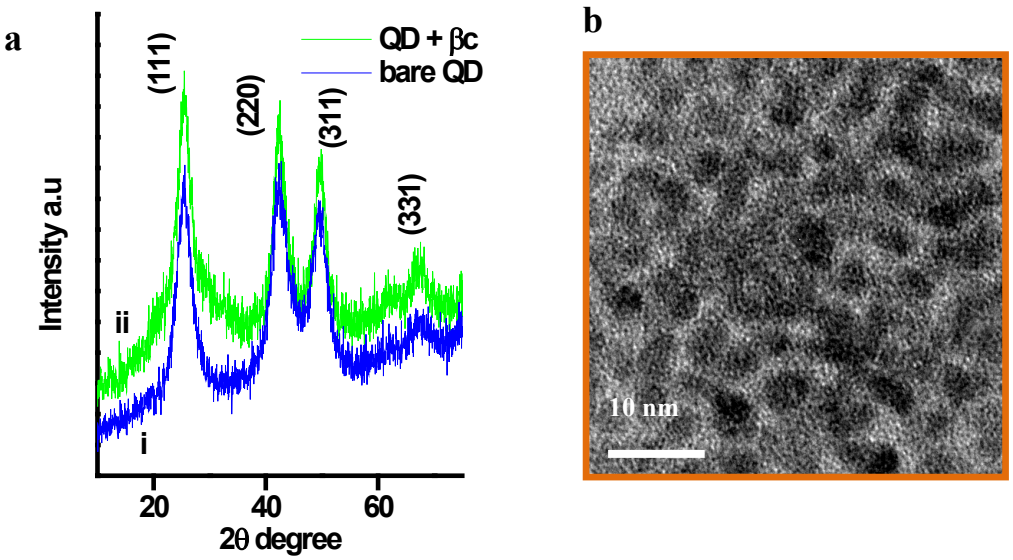

Fig S1. (a) X – ray diffraction patterns of (i) bare CdSe QDs and (ii) CdSe QD-βC hybrid sample. **(b)** HRTEM image of bare CdSe QD sample.

Absorption and PL emission from pure beta carotene in hexane solution:

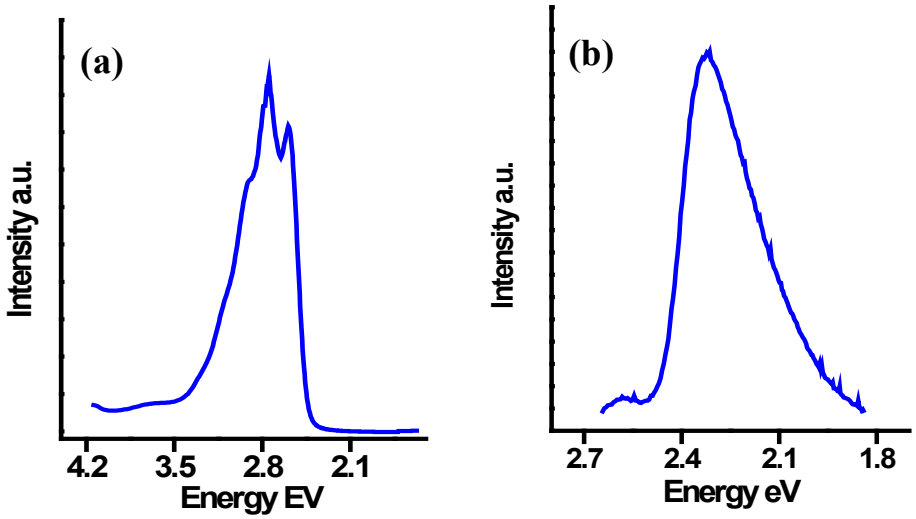

Fig S2. (a) Absorption and (b) Emission spectrum of beta carotene in hexane solution.

Note: As the emission spectrum of carotene molecule is overlapping with absorption maximum of CdSe QD at 2.0 eV, energy transfer is possible.

X-ray Diffraction pattern for bare and hybrid CdSe/ZnS QD system:

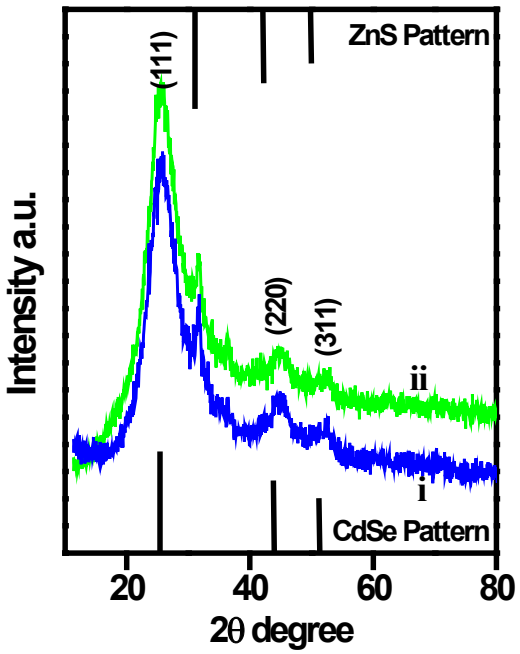

Fig S3. X – ray diffraction patterns of (i) bare CdSe/ZnS QD and (ii) CdSe/ZnS QD-βC hybrid sample.

Transient Absorption Spectra for CdSe/ZnS core/shell QD:

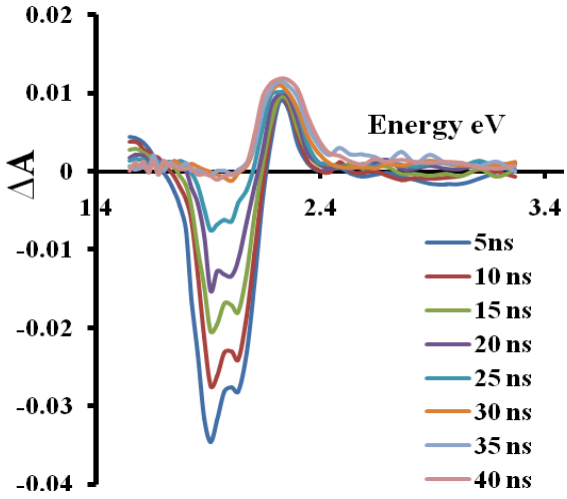

Fig S4. Transient absorption spectra for CdSe/ZnS core/shell QD.

Excitation energy dependent PL for CdSe/ZnS –βC hybrid system:

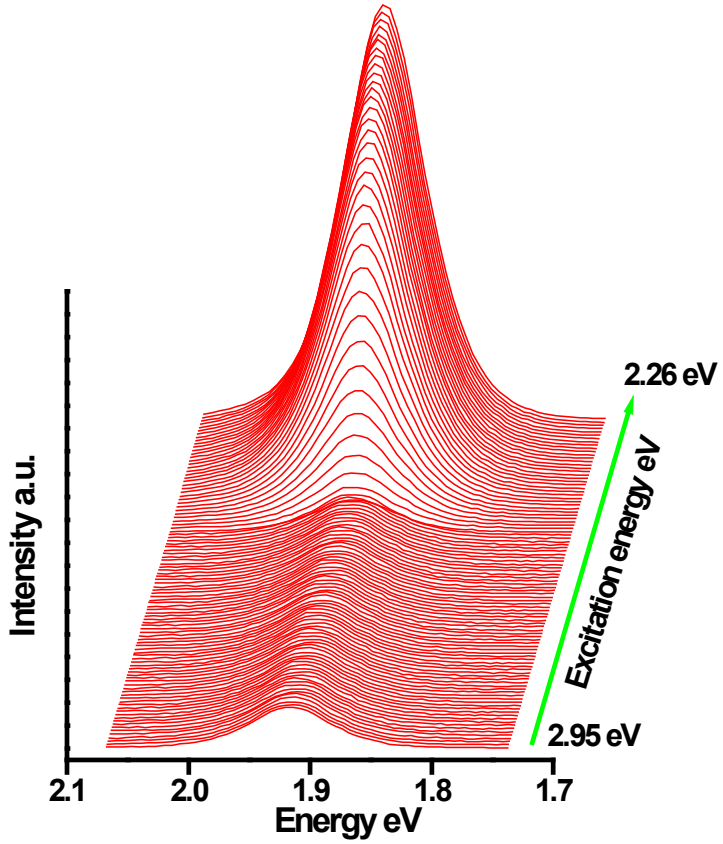

Fig S5. Excitation energy dependent PL for CdSe/ZnS - βC hybrid system.

Table ST1: Life time value of electrons in bare QD and hybrid sample measured at 2.48 and 1.97 eV.

Sample	Emission eV	τ_1 ns	τ_2 ns	τ_3 ns	Average Life Time ns
Core shell QDs	2.48	2.09(18%)	3.55(34%)	17.1(48%)	14.82
	1.97	0.84(39%)	3.85(28%)	20.32(33%)	17.55
Core shell QDs with Bio	2.48	1.45(24%)	2.01(34%)	12.82(42%)	11.04
	1.97	1.16(40%)	6.48(17%)	23.51(43%)	21.01