Supporting Information

Energy Transfer Induced by Carbon Quantum Dots in Porous Zinc Oxide Nanocomposite Films

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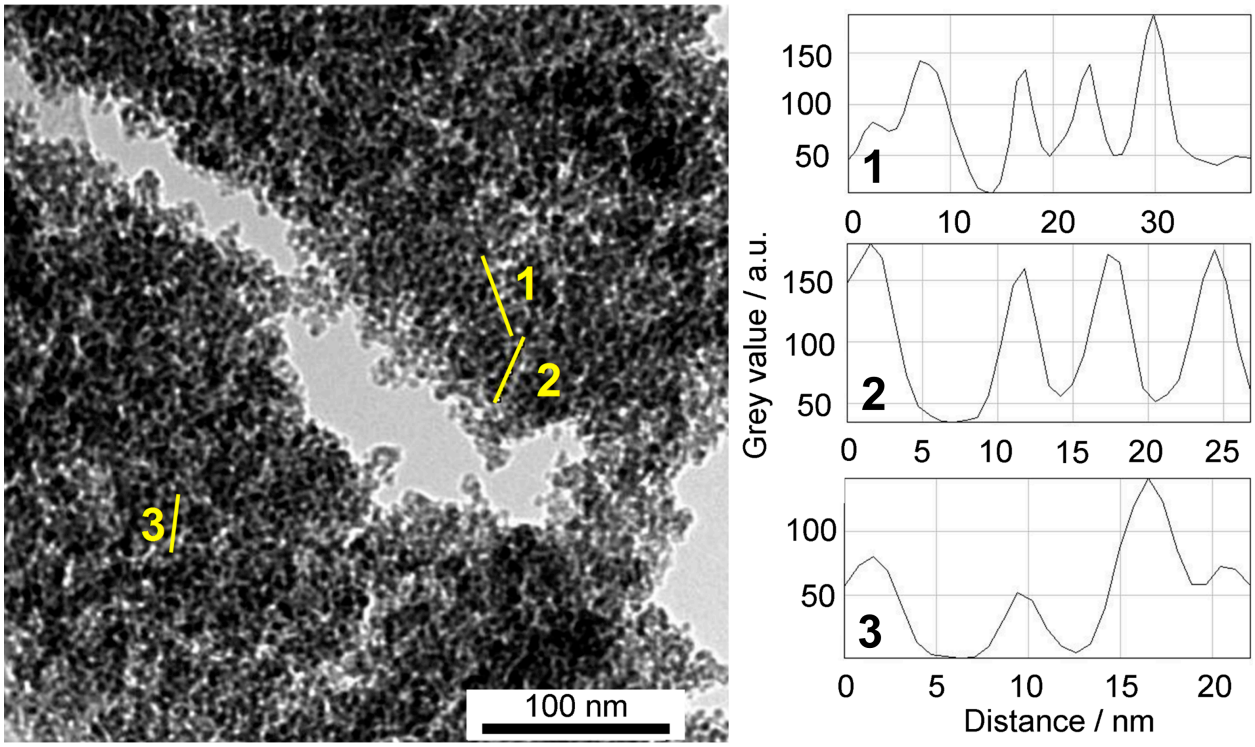

Figure S1. TEM image of ZnO film treated at 200 °C and line plot profiles of the gray scale for each position shown in yellow line.

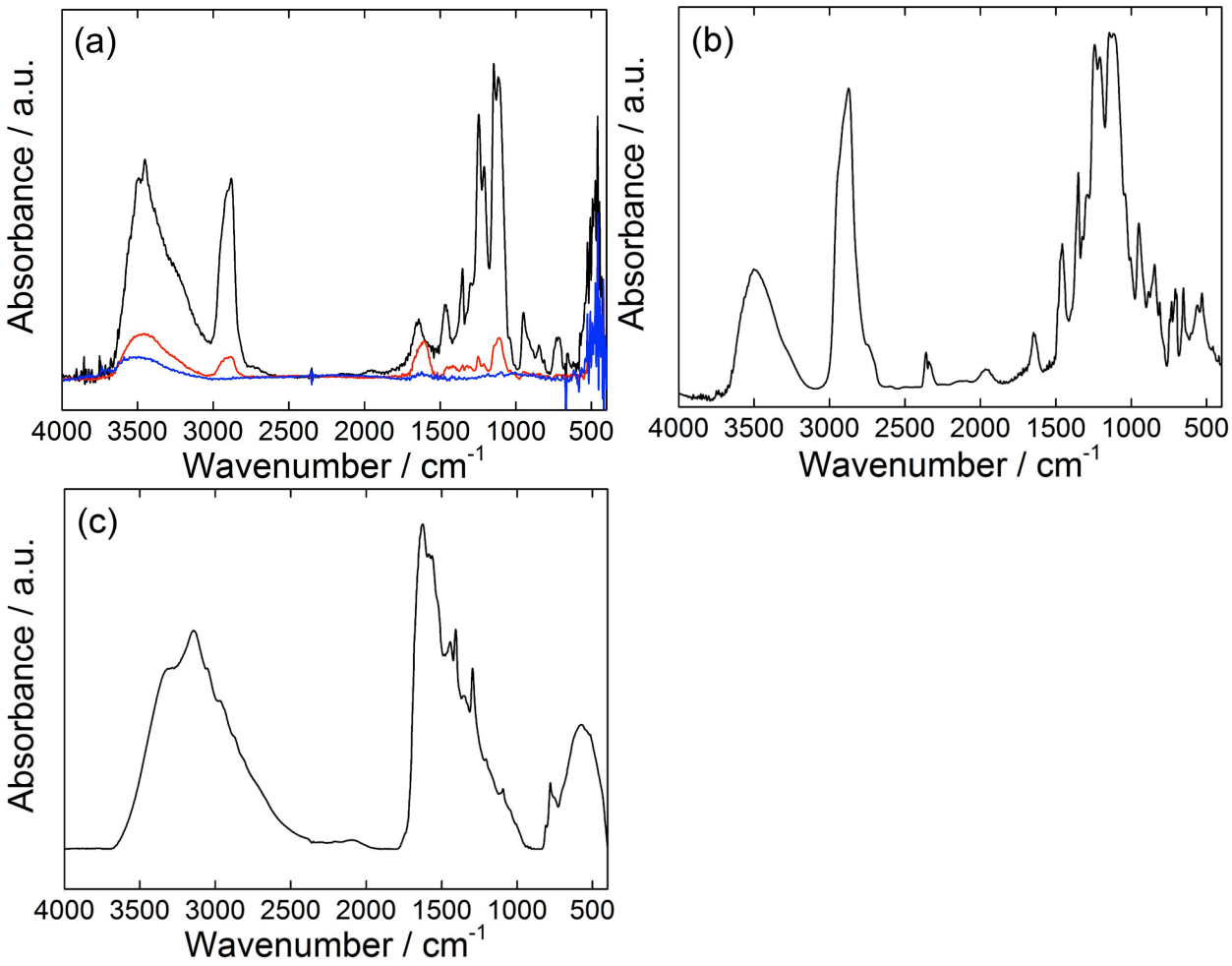

Figure S2. (a) FTIR spectra of ZnO-CQD films in the 4000-400 cm^{-1} range as a function of the thermal treatment: 100 °C (black line), 200 °C (red line), 300 °C (blue line). (b) FTIR spectrum of Zonyl fluorosurfactant casted on Si substrate. (c) ATR infrared spectrum of CQDs in powder.

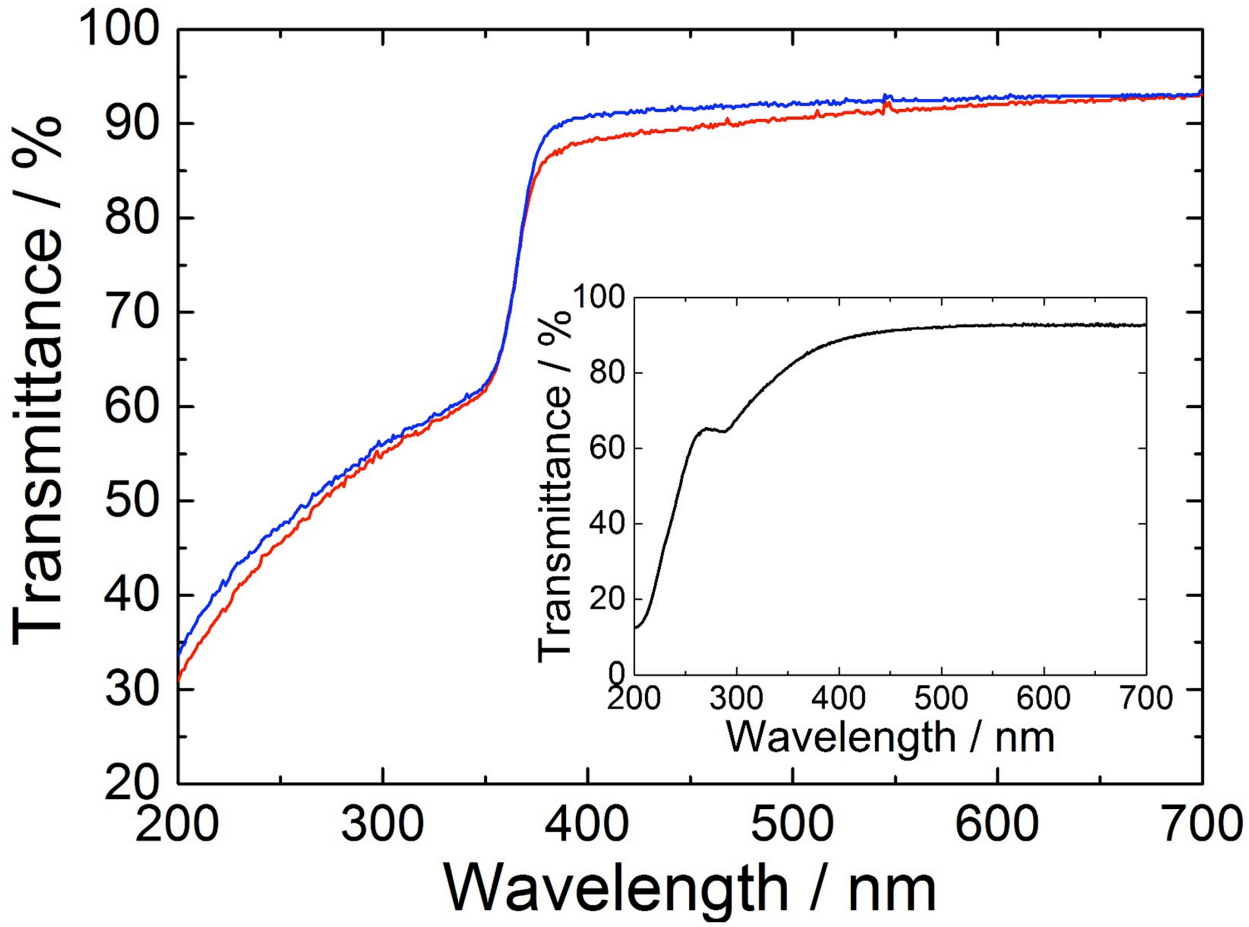

Figure S3. UV-Vis transmission spectra of ZnO-CQD (10 mg) and ZnO films treated at 200 °C (red and blue line respectively). The inset shows UV-Vis spectrum of CQDs in water (1 mg / 100 ml H_2O).

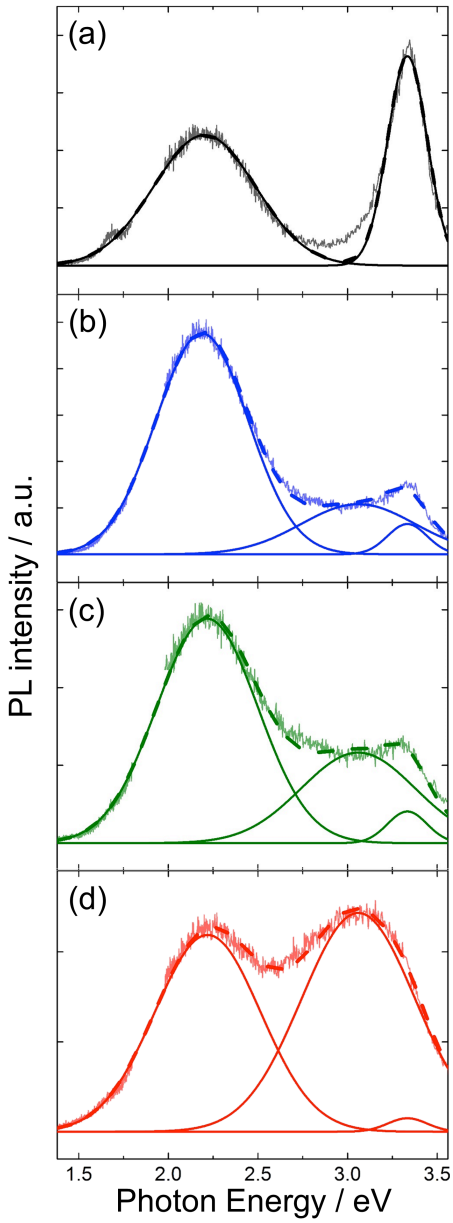

Figure S4. Photoluminescence spectra and results of curve deconvolution of ZnO (a: black line), ZnO-CQD 2.5 mg (b: blue line), ZnO-CQD 5 mg (c: green line) and ZnO-CQD 10 mg (d: red line). In case of bare ZnO, PL band of CQDs emission was not taking account. The curve deconvolutions were carried out using three Gaussian components at 3.33, 3.06, and around 2.2 eV. The peak positions of PL bands at 3.33 and 3.06 eV are assigned to the interband transition of ZnO PL and CQDs PL, respectively. The peak at around 2.2 eV is attributed to the defects band of ZnO. The dashed lines show the sum of the fitting curves.

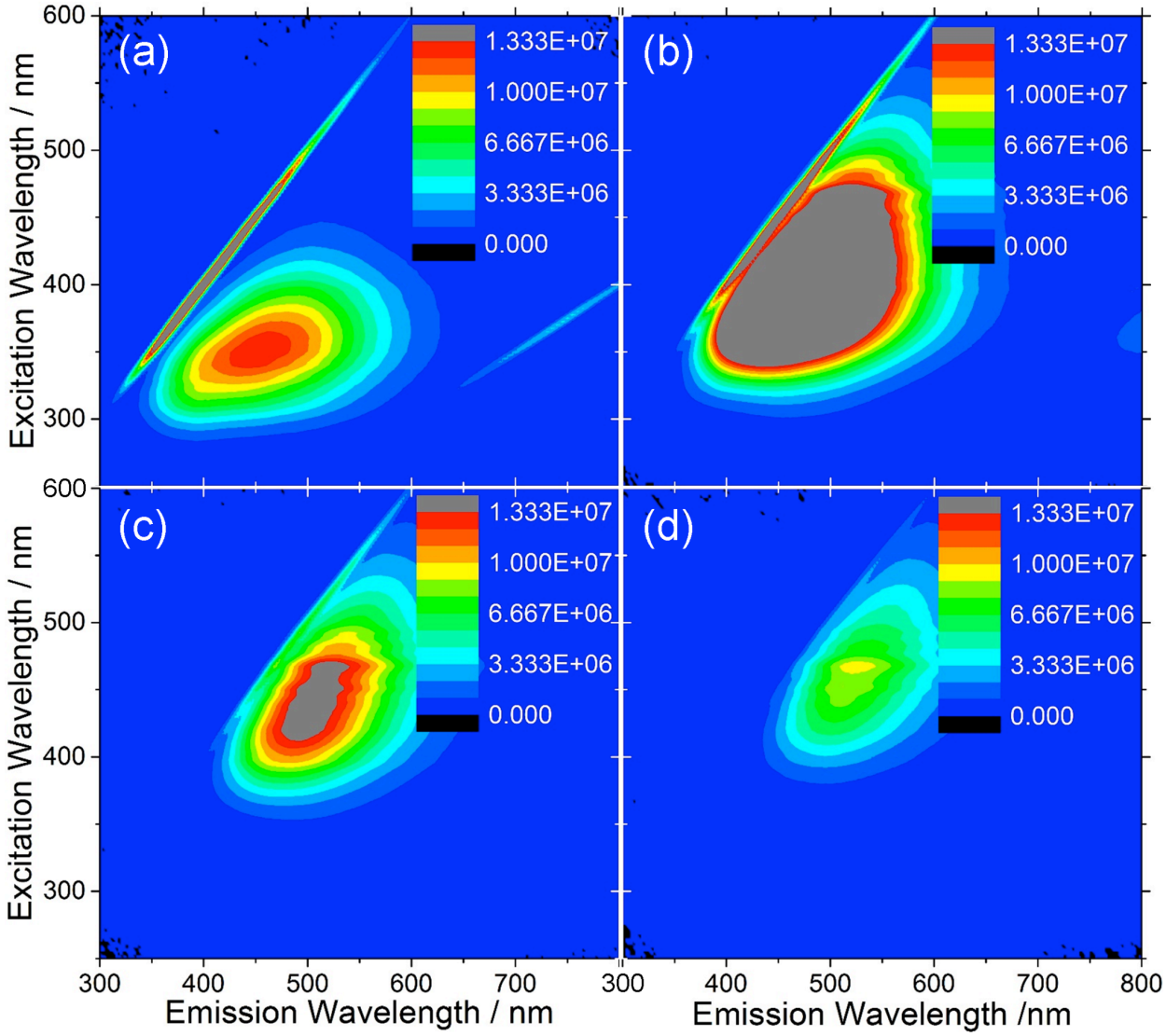

Figure S5. 3D excitation−emission−intensity maps of ZnO sols as a function of CQD concentration in 10 ml of the sol: (a) pure ZnO, (b) 2.5 mg, (c) 5 mg, (d) 10 mg CQDs.

Table S1. Film thickness of ZnO-CQD (10 mg CQDs in 10 ml of sol) and ZnO films.

sample	model	thickness/nm	MSE
ZnO-CQD 100°C	Si with transparent film	357.1±2.8	83.9
ZnO-CQD 200°C	Si with transparent film	157.4±0.2	15.3
ZnO-CQD 300°C	Si with transparent film	147.9±0.1	9.7
ZnO 100°C	Si with transparent film	323.2±0.9	29.5
ZnO 200°C	Si with transparent film	123.6±0.1	6.6
ZnO 300°C	Si with transparent film	129.6±0.1	7.0