Supplementary Information

An Organometallic Route to Chiroptically Active ZnO Nanocrystals

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I Experimental Procedures

All reactions involving air-sensitive reagents were conducted under an atmosphere of dry oxygen free nitrogen gas using standard Schlenk technique.

Materials

Tetrahydrofurane (POCh), hexane (POCh) were distilled from sodium-potassium alloy. Diethylzinc (ABCR) was used as solution in dry hexane. 2-Aminoethanol (Aldrich), (1S)-2-Amino-1-phenylethanol (ABCR), (1R)-2-Amino-1-phenylethanol (ABCR), (1R,2S)-(+)-cis-1-amino-2-indanolate (Aldrich), (1S,2R)-(-)-cis-1-amino-2-indanolate (Aldrich), (R)-α,α-diphenyl-2-pyrrolidinemethanol (Aldrich), (S)-α,α-diphenyl-2-pyrrolidinemethanol (Aldrich), (2S,3R)-(+)-4-Dimethylamino-3-methyl-1,2-diphenyl-2-butanol (Aldrich), were used without further purification.

General synthesis of ZnO NCs

To a tetrahydrofurane solution of selected aminoalcohol (1.0 mmol) diethylzinc in hexane (0.5 ml, 1.0 mmol) was added dropwise and stirred at -50 ˚C for several minutes. Then the reaction mixture was allowed to warm to room temperature and stirred for 2 h and exposed to oxygen and water from air for 4-5 days. **ZnO-"0"**, **ZnO-3** and **ZnO-4** NCs were washed several times with THF to remove excess of aminoalcohol liberated during ZnO synthesis. To separate **ZnO-1** and **ZnO-2** from THF solution hexane was added. To remove excess of aminoalcohol from **ZnO-1** and **ZnO-2**, nanocrystals were dissolved in THF and participated by hexane three times.

II Characterization of ZnO-“0”

Transmission Electron Microscopy

Size, shape and morphology of the nanoparticles were examined by High-Resolution Transmission Electron Microscopy (HR TEM). Nanoparticle samples were drop-cast (THF or DMSO solution) onto 300-mesh, holey carbon-coated copper grids (Quantifoil). Afterward, the excess solvent evaporated at room temperature. Nanoparticle samples were imaged using a C_s corrected scanning transmission electron microscope (STEM, HITACHI HD2700, 200 kV). The observations were carry on in three modes: SE (images used to study morphology), HAADF STEM (Z-contrast) and HR TEM (images showing the atomic structure). A wide variety of magnifications (from x1500 up to x8000000) were used to study the microstructure of ZnO samples. The size of nanoparticles was calculated by image analyses, using ImageJ2x computer software. For image analyses a population of 100 particles was used for each sample. Average sizes and standard deviations were calculated from obtained results.

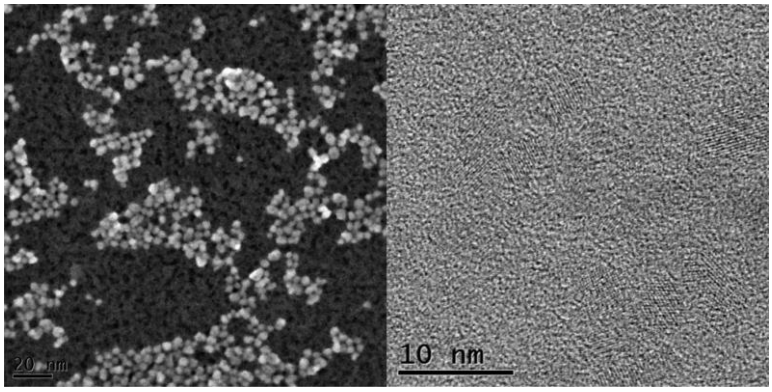

Figure S1. Representative TEM images (modes: SE left, HR TEM right) of **ZnO-“0”** dispersed in DMSO.

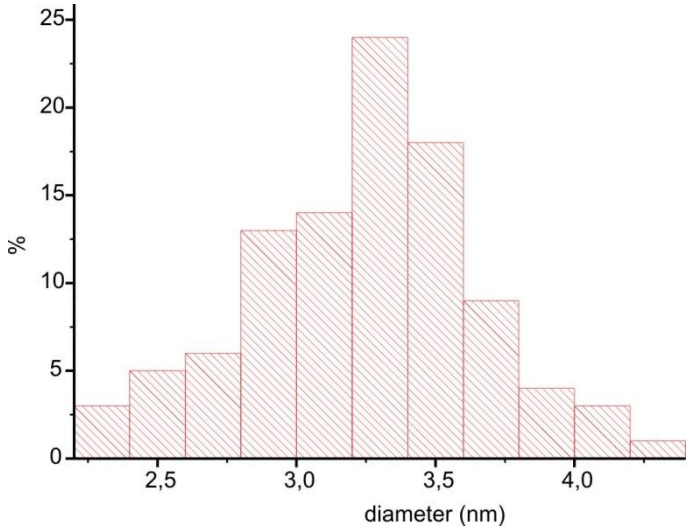

Figure S2. Size distribution of **ZnO-“0”** calculated from TEM images.

Powder X-ray diffraction

Powder XRD data were collected on a Empyrean diffractometer (PANalytical). Measurements employed Ni-filtered Cu Kα radiation of a copper sealed tube charged with 40 kV voltage and 40 mA current and Bragg-Brentano geometry with beam divergence of 1 deg. in the scattering plane. Diffraction patterns were measured in the range of 20-80 degrees of scattering angle by step scanning with step of 0.017 degree. The size of **ZnO-"0"** calculated form PXRD: 2.4±0.2 nm.

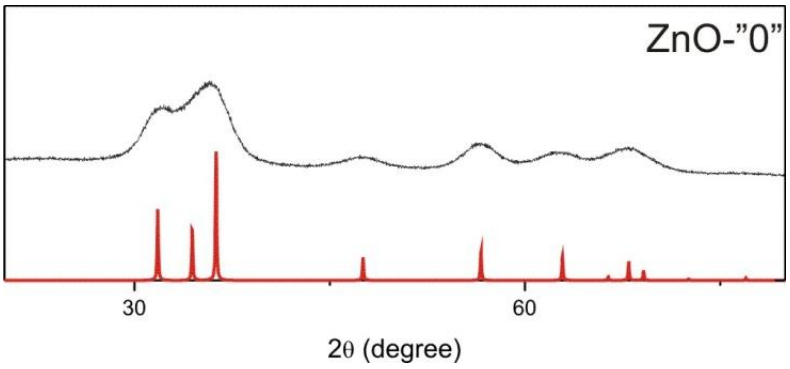

Figure S3. PXRD pattern of **ZnO-"0"**.

Dynamic light scattering

Dynamic light scattering (DLS) measurements were carried out using a Malvern Zetasizer Nano-ZS. All experiments were performed at 25˚C. The samples were filtered through 0.45 mm membrane filters prior to analysis.

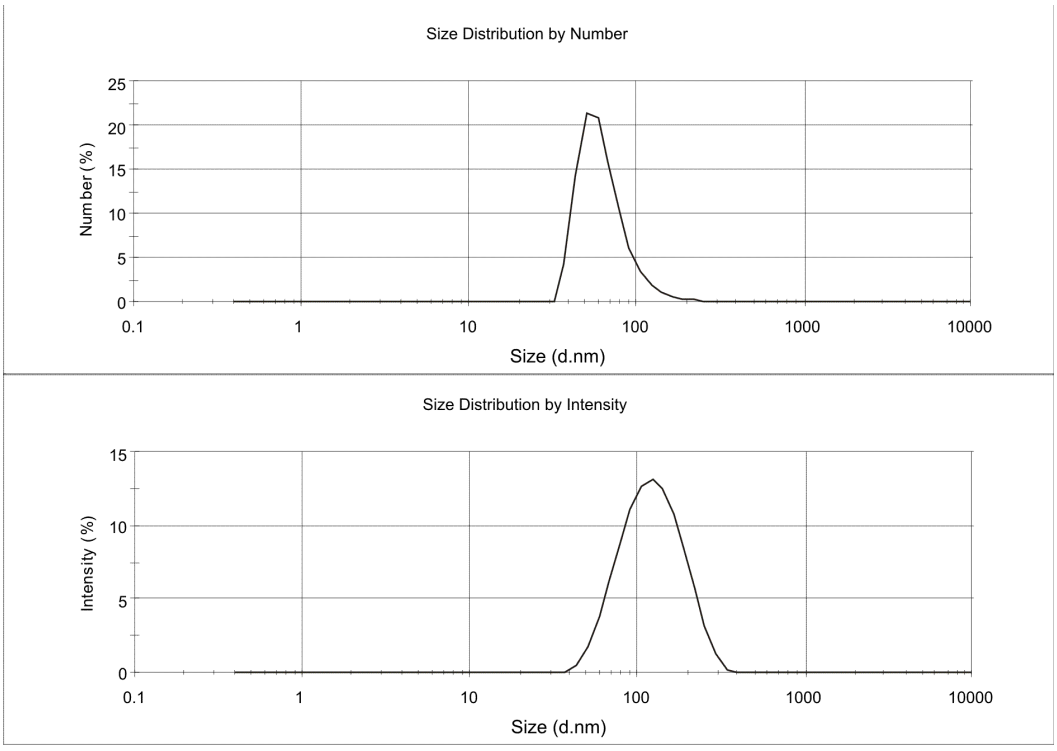

Figure S4. DLS of **ZnO-"0"** dispersed in DMSO.

UV-Vis absorption and photoluminescence

Absorption analysis was carried out by using a Hitachi U-2910 spectrophotometer, with solvents as reference. Photoluminescence spectra were recorded by using a Hitachi F-7000 fluorescence spectrometer.

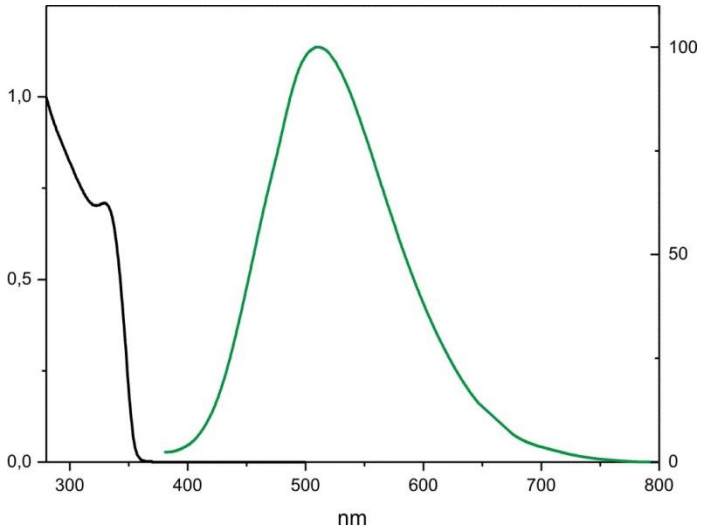

Figure S5. Normalized UV-Vis absorption (black) and photoluminescence (green) spectra of **ZnO-"0"**.

III Characterization of ZnO-1, ZnO-2, ZnO-3 and ZnO-4

Dynamic light scattering

Dynamic light scattering (DLS) measurements were carried out using a Malvern Zetasizer Nano-ZS. All experiments were performed at 25˚C. The samples were filtered through 0.45 mm membrane filters prior to analysis.

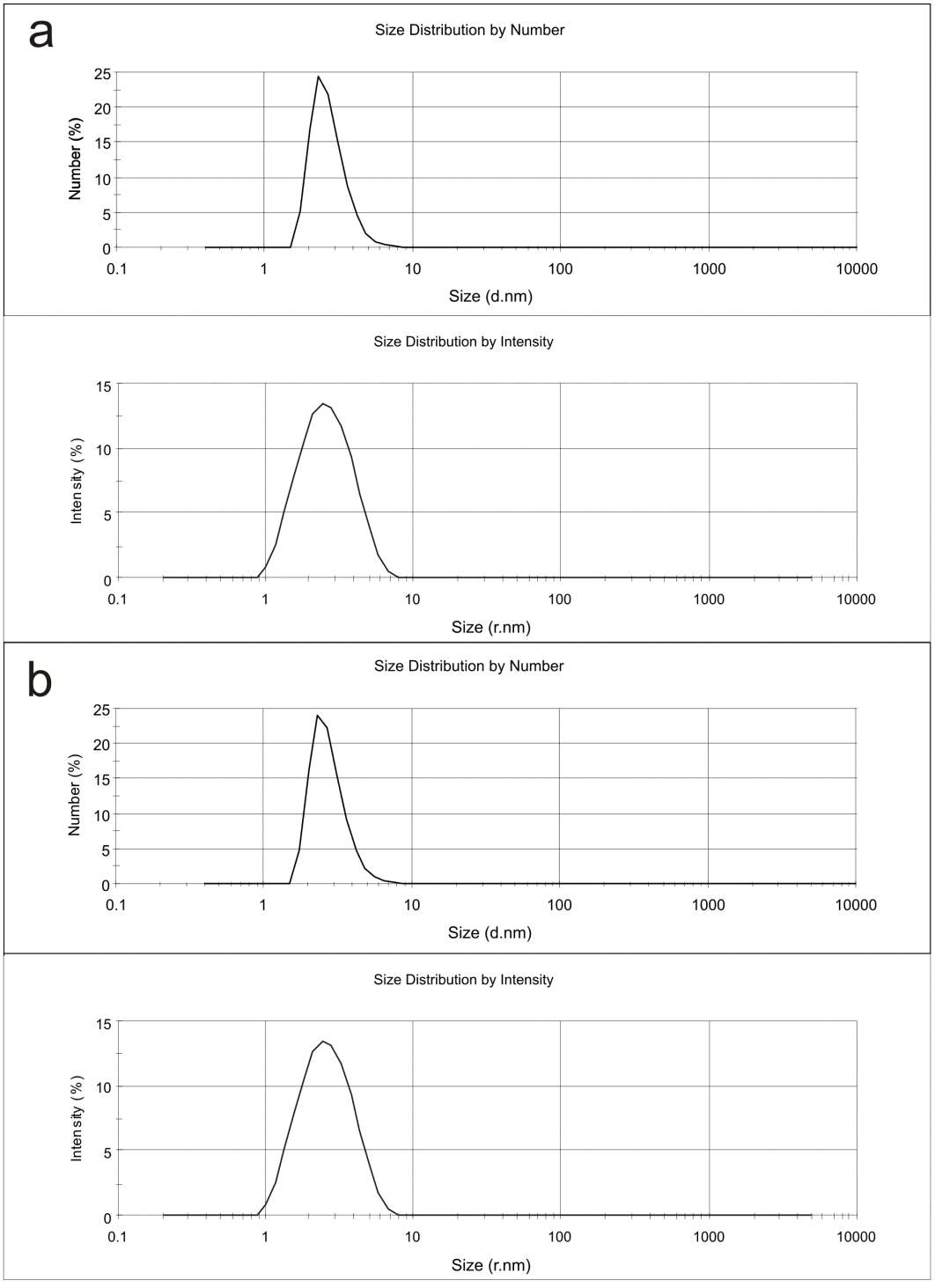

Figure S6. DLS of (a) **ZnO-1a** (b) **ZnO-1b** dispersed in THF.

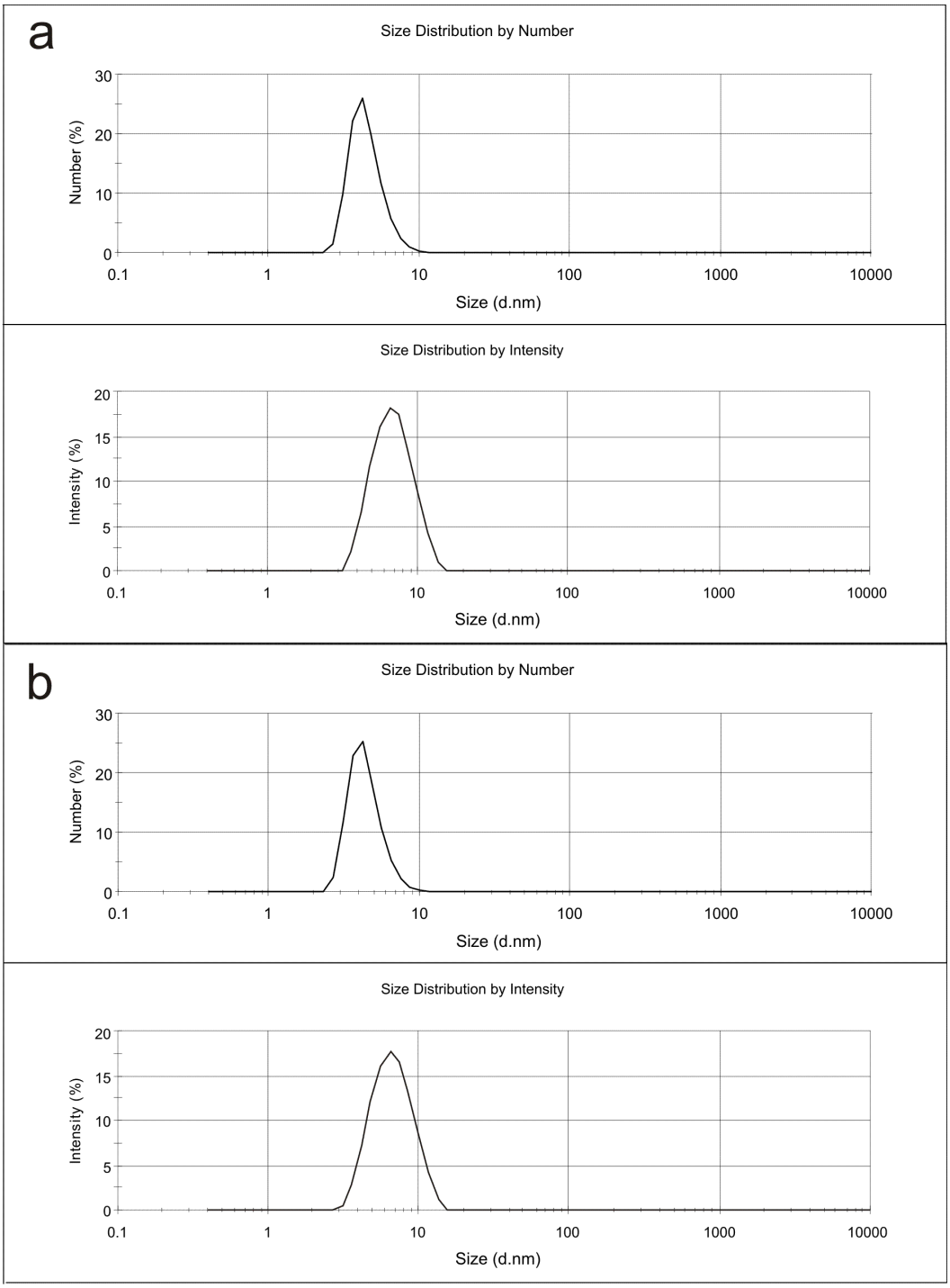

Figure S7. DLS of (a) **ZnO-2a** (b) **ZnO-2b** in dispersed THF.

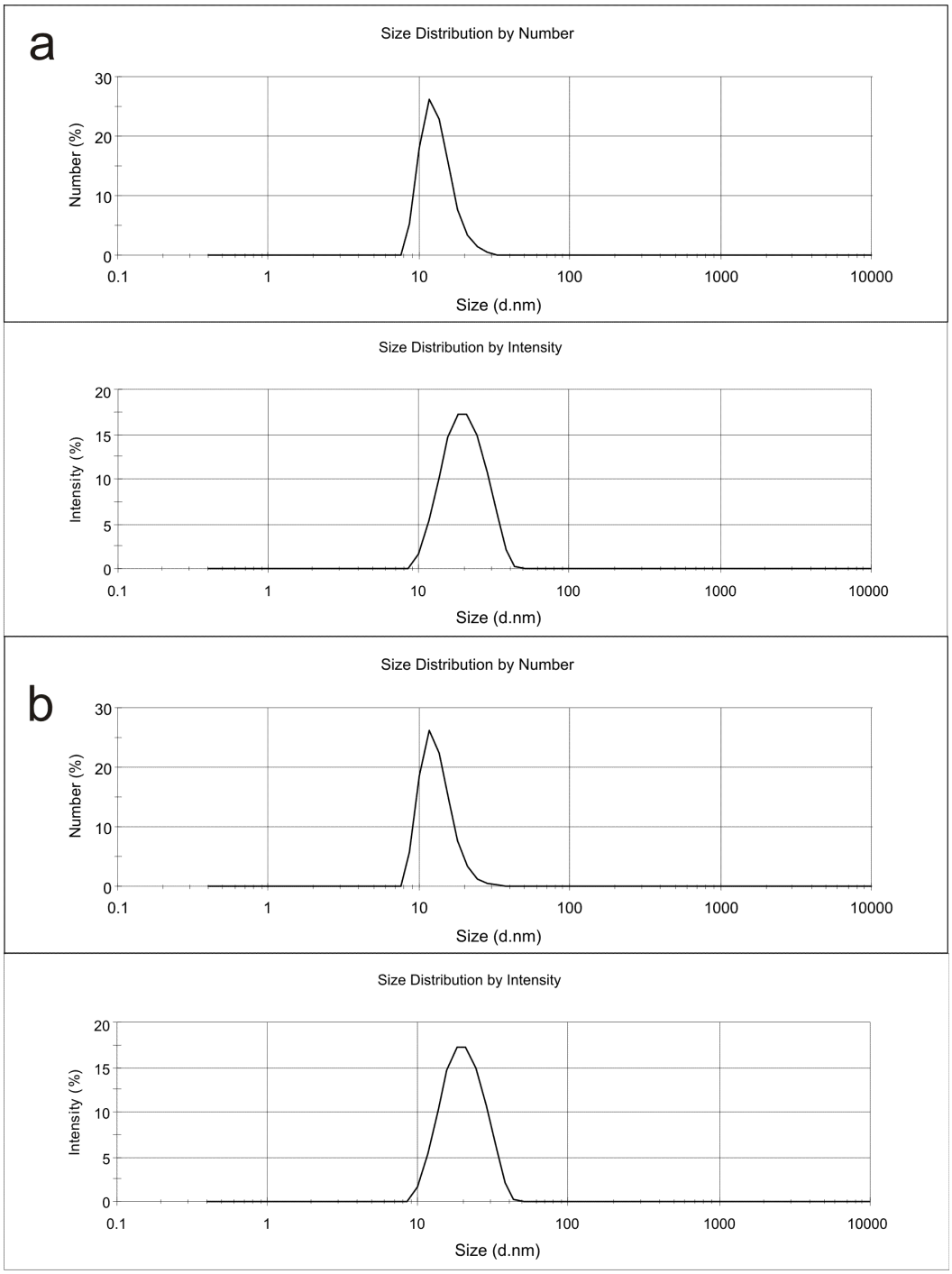

Figure S8. DLS of (a) **ZnO-3a** (b) **ZnO-3b** dispersed in DMSO.

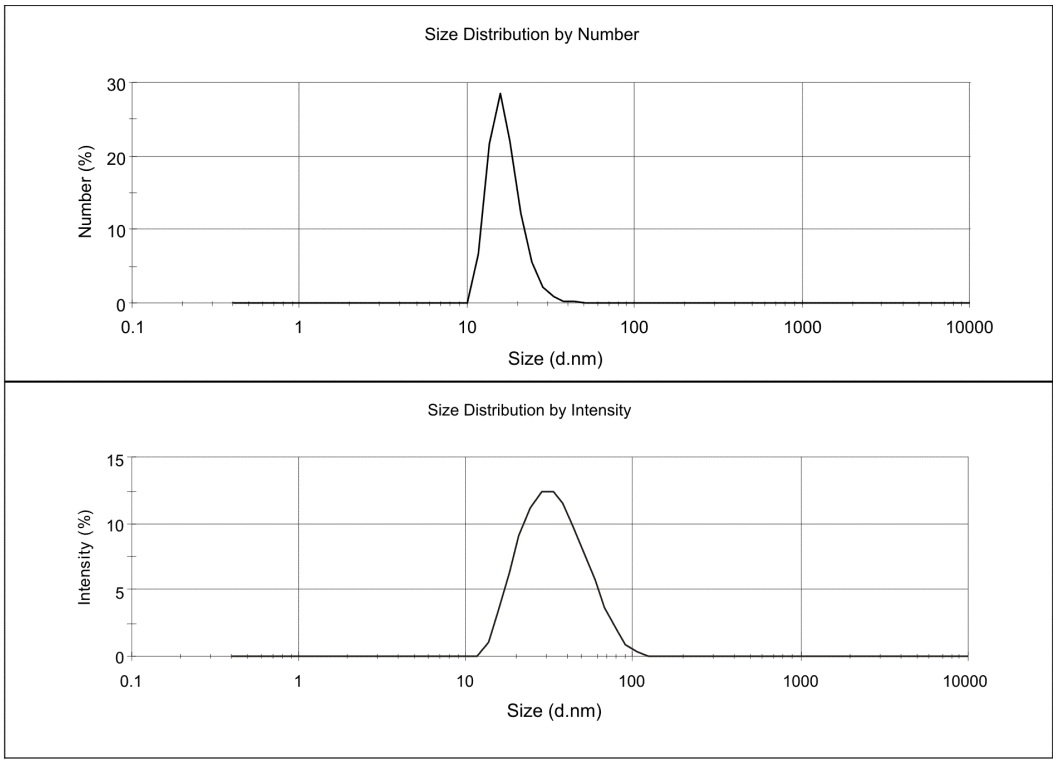

Figure S9. DLS of **ZnO-4** dispersed in DMSO

Transmission Electron Microscopy

Size, shape and morphology of the nanoparticles were examined by High-Resolution Transmission Electron Microscopy (HRTEM). Nanoparticle samples were drop-cast (THF or DMSO solution) onto 300-mesh, holey carbon-coated copper grids (Quantifoil). Afterward, the excess solvent evaporated at room temperature. Nanoparticle samples were imaged using a C_s corrected scanning transmission electron microscope (STEM, HITACHI HD2700, 200 kV). The observations were carry on in three modes: SE (images used to study morphology), HAADF STEM (Z-contrast) and HR TEM (images showing the atomic structure). A wide variety of magnifications (from x1500 up to x8000000) were used to study the microstructure of ZnO samples. The size of nanoparticles was calculated by image analyses, using ImageJ2x computer software. For image analyses a population of 100 particles was used for each sample. Average sizes and standard deviations were calculated from obtained results.

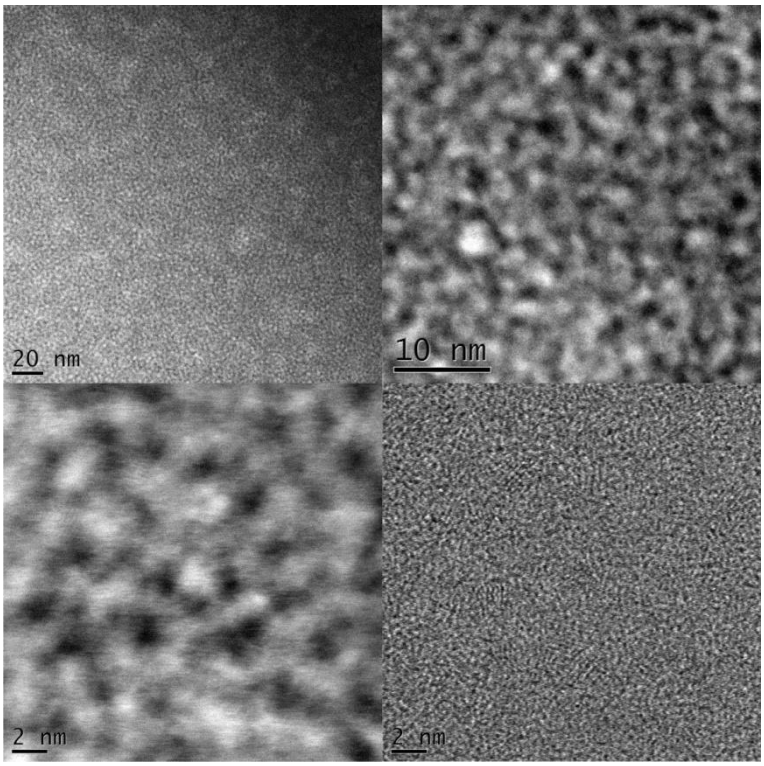

Figure S10. TEM images (modes: HAADF STEM and HR TEM bottom-right) of **ZnO-1a** in THF.

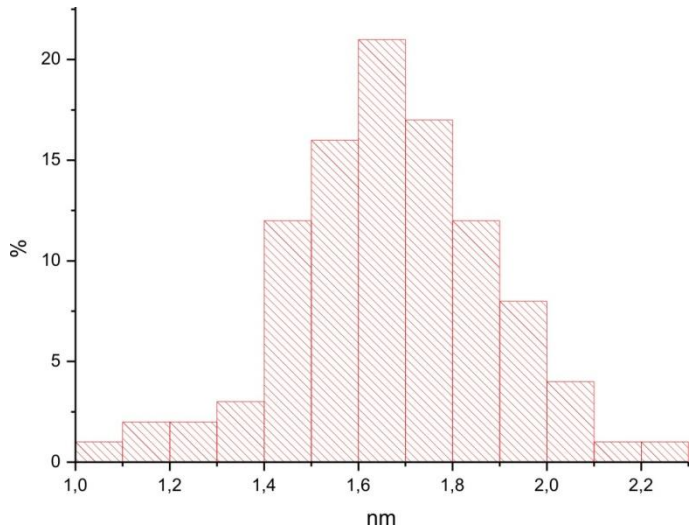

Figure S11. Size distribution of **ZnO-1a** calculated from TEM images.

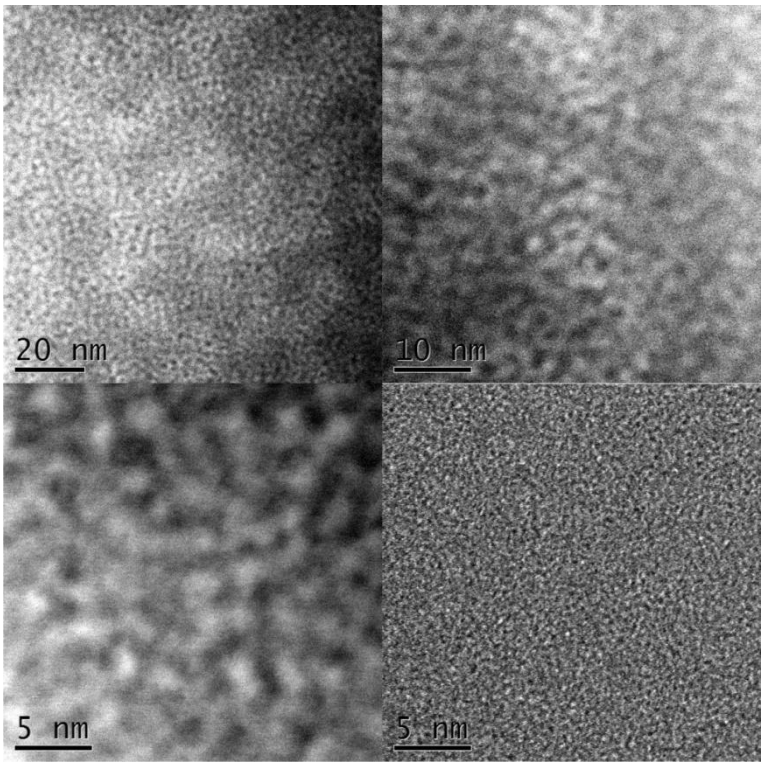

Figure S12. TEM images (modes: HAADF STEM and HR TEM bottom-right) of **ZnO-1b** in THF.

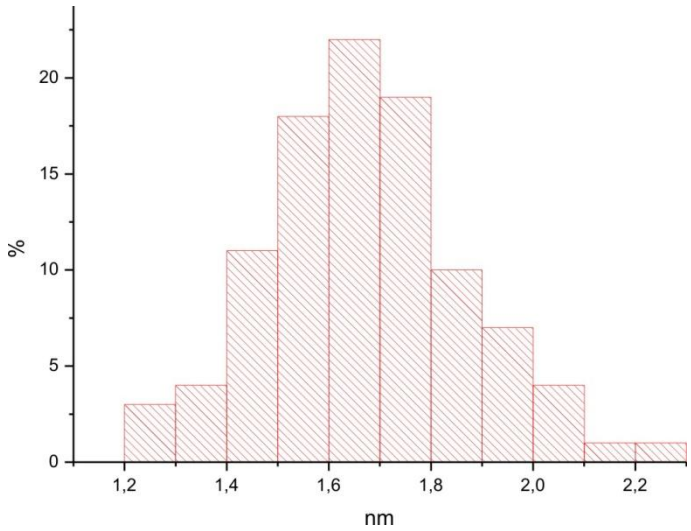

Figure S13. Size distribution of **ZnO-1b** calculated from TEM images.

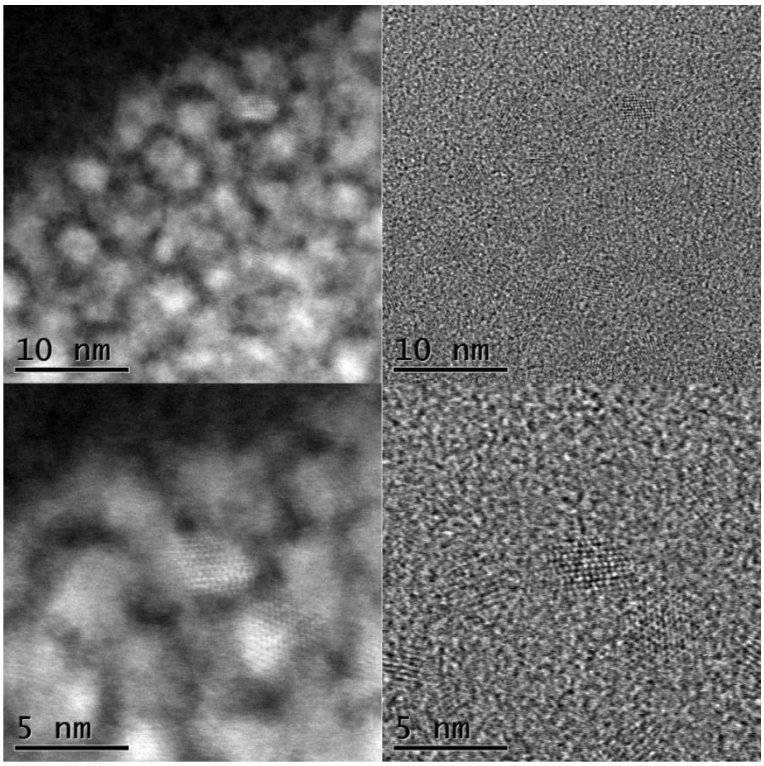

Figure S14. TEM images (modes: HAADF STEM left, HR TEM right) of **ZnO-2a** in THF.

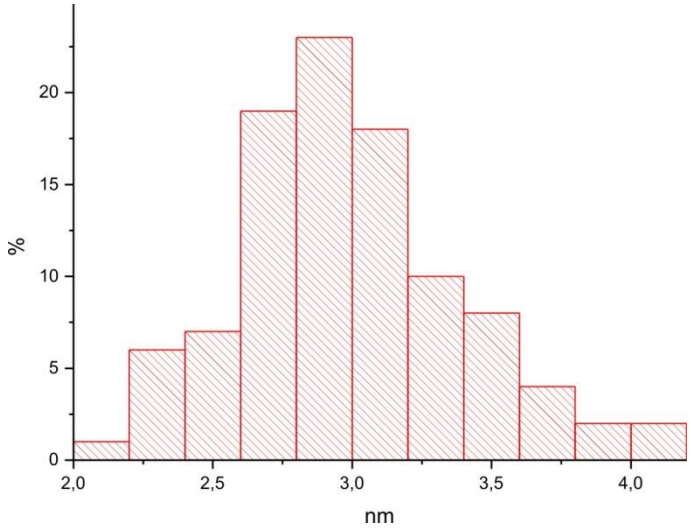

Figure S15. Size distribution of **ZnO-2a** calculated from TEM images.

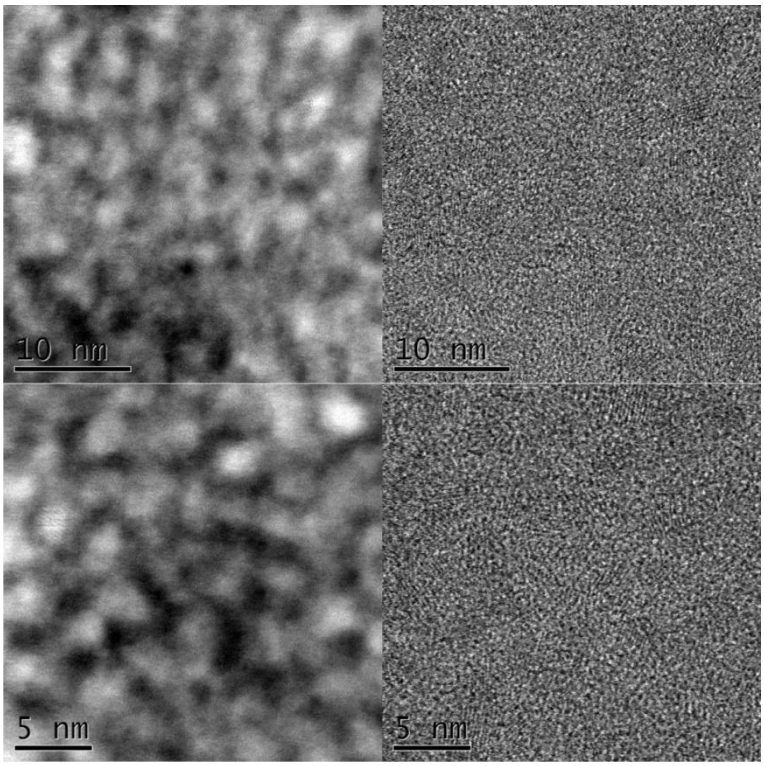

Figure S16. TEM images (modes: HAADF STEM left, HR TEM right) of **ZnO-2b** in THF.

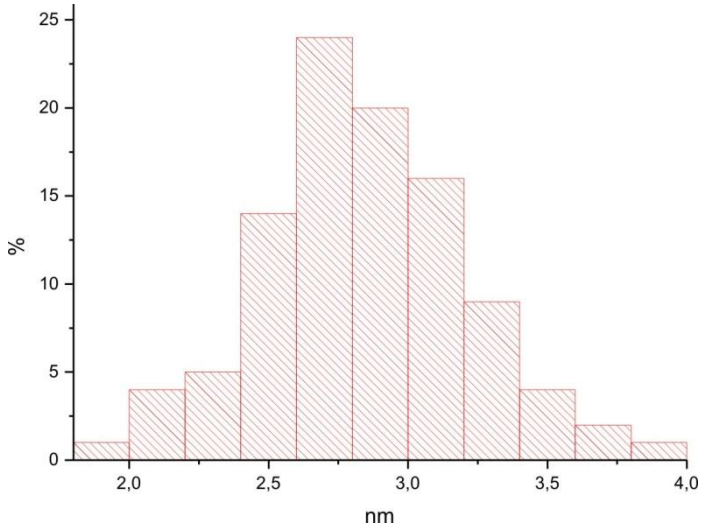

Figure S17. Size distribution of **ZnO-2b** calculated from TEM images.

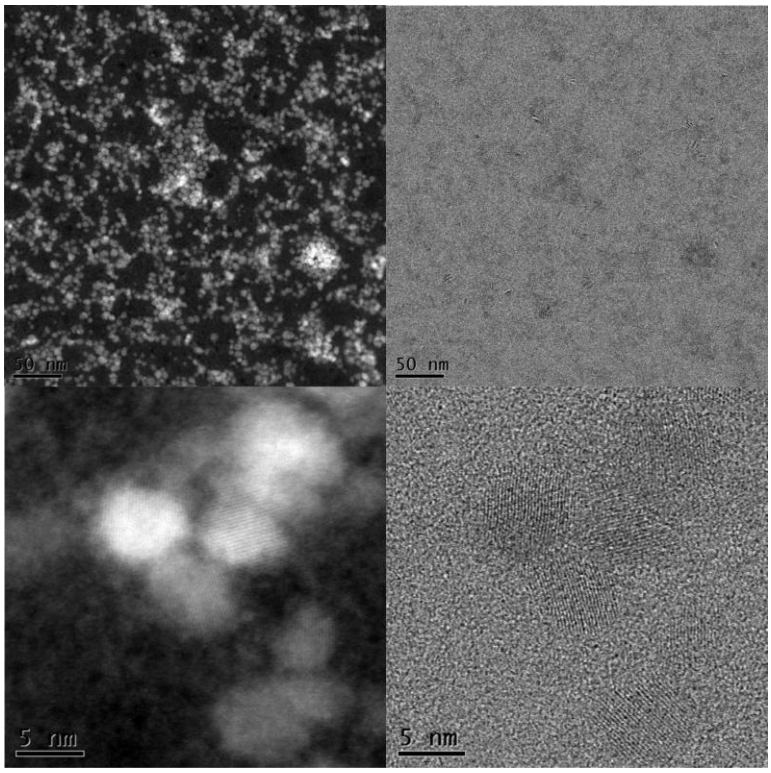

Figure S18. TEM images (modes: HAADF STEM left, HR TEM right) of **ZnO-3a** in DMSO.

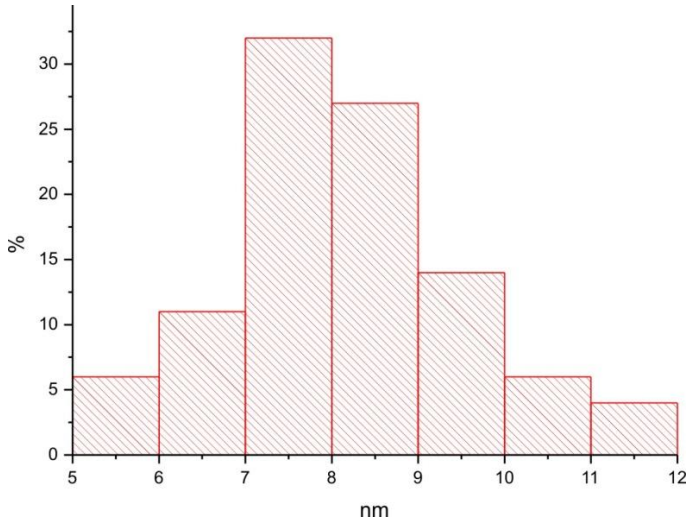

Figure S19. Size distribution of **ZnO-3a** calculated from TEM images.

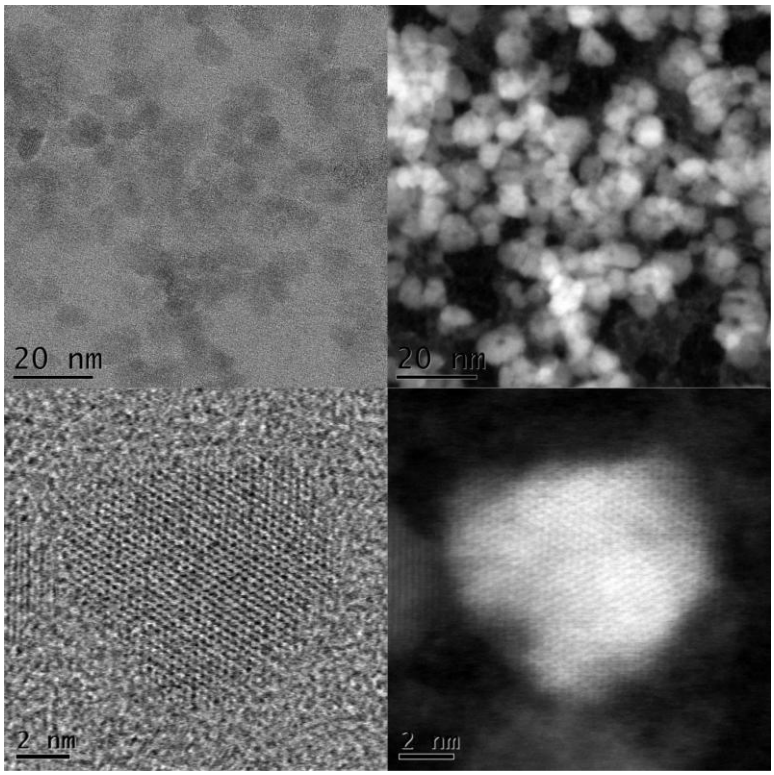

Figure S20. TEM images (modes: HR TEM left, HAADF STEM right) of **ZnO-3b** in DMSO.

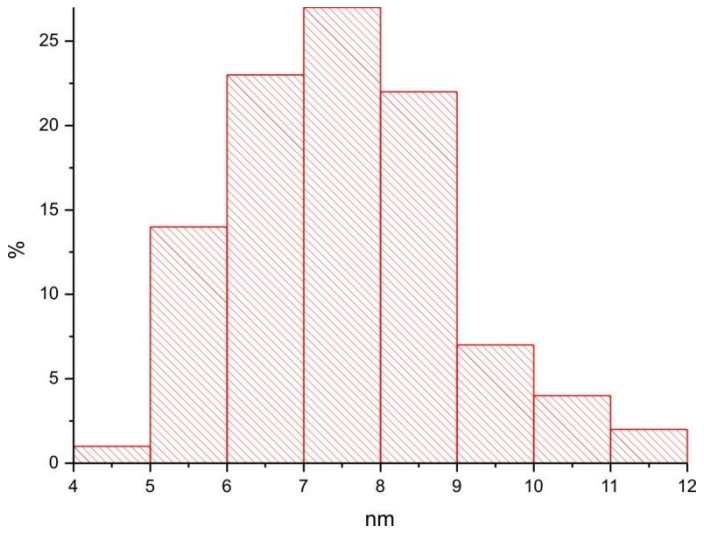

Figure S21. Size distribution of **ZnO-3b** calculated from TEM images.

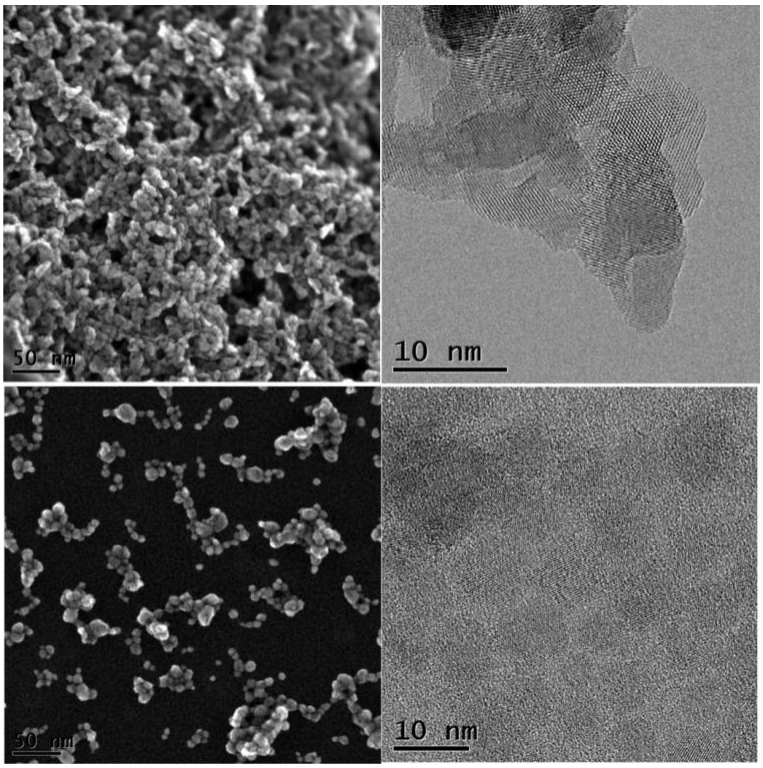

Figure S22. TEM images(modes: SE left, HR TEM right) of **ZnO-4** in THF (top) and DMSO (bottom).

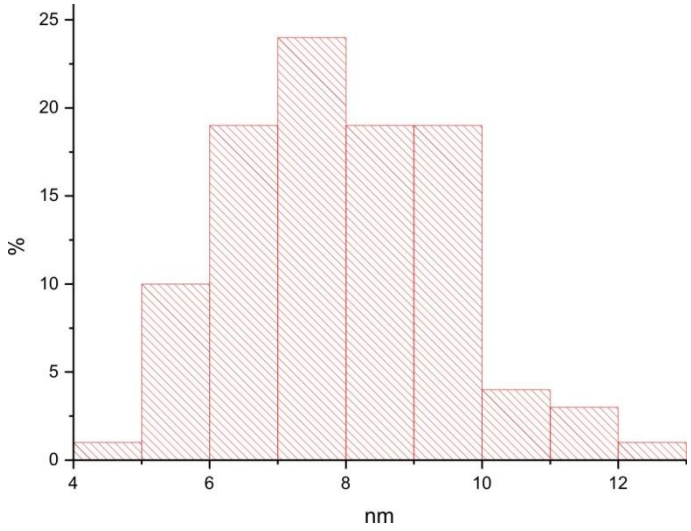

Figure S23. Size distribution of **ZnO-4** calculated from TEM images.

Powder X-ray diffraction

Powder XRD data were collected on a Empyrean diffractometer (PANalytical). Measurements employed Ni-filtered Cu Kα radiation of a copper sealed tube charged with 40 kV voltage and 40 mA current and Bragg-Brentano geometry with beam divergence of 1 deg. in the scattering plane. Diffraction patterns were measured in the range of 20-80 degrees of scattering angle by step scanning with step of 0.017 degree.

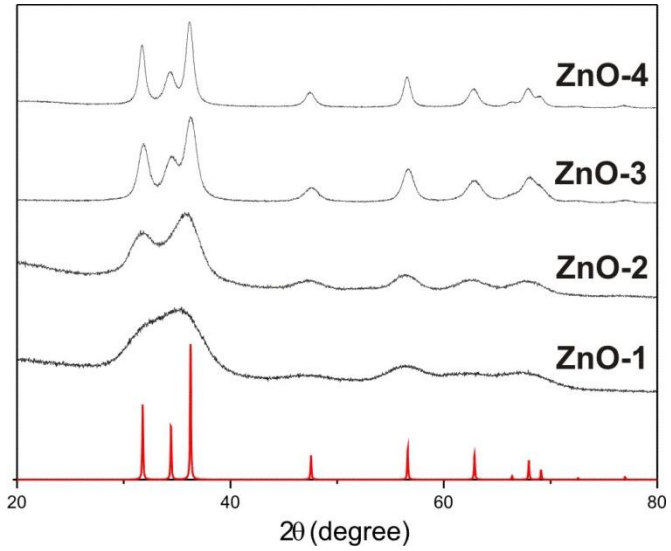

Figure S24. PXRD pattern of **ZnO-1 - ZnO-4**.

PXRD patterns are identical for **ZnO-1a** and **ZnO-1b**, **ZnO-2a** and **ZnO-2b**, **ZnO-3a** and **ZnO-3b**, respectively, and on Fig. S24 only one representative pattern is shown. Size of ZnO NCs calculated form PXRD: **ZnO-1**: 2.3±0.3 nm; **ZnO-2**: 3±0.1; **ZnO-3**: 5.2±0.7; **ZnO-4**: 8.1±1.9 nm.

Circular dichroism

Circular dichroism (CD) spectra were recorded with a Jasco J-815 spectropolarimeter in THF or DMSO solution.

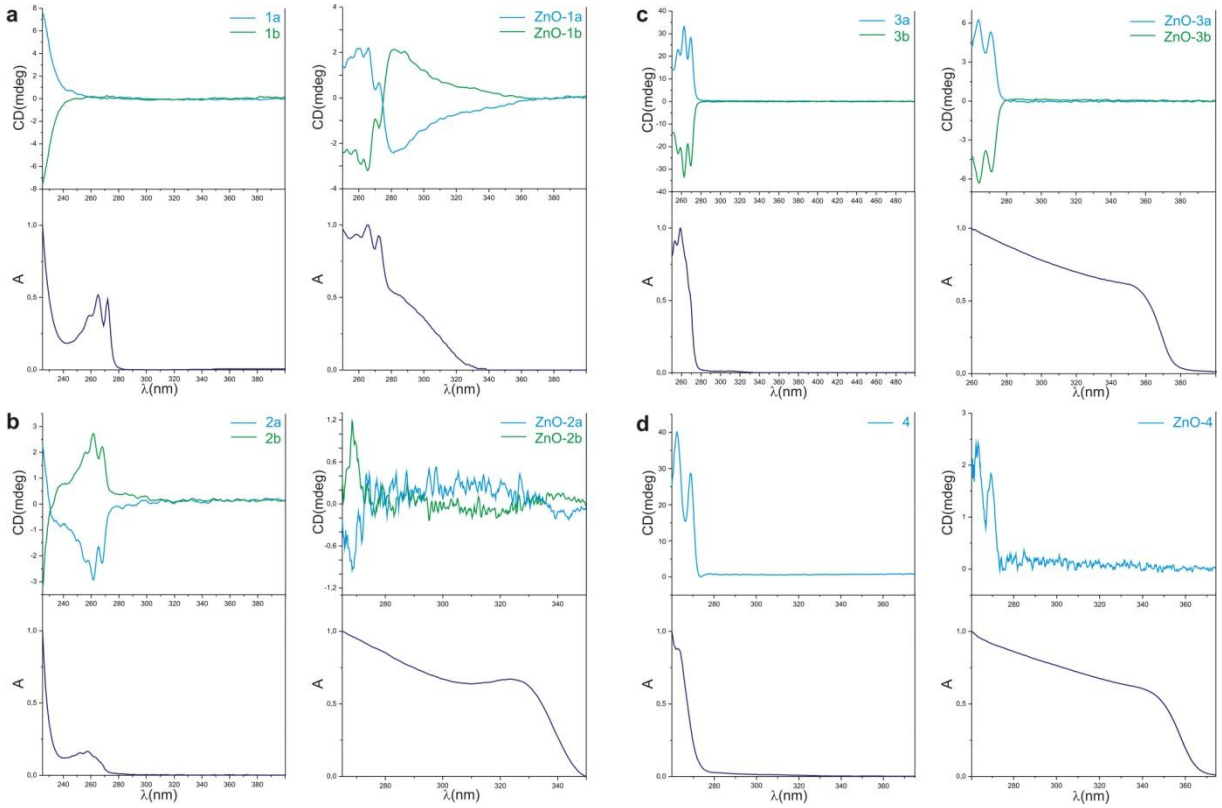

Figure S25. CD and normalized absorption spectra of proligands and ZnO NCs: (a) **1a**, **1b**, **ZnO-1a, ZnO-1b** (b) **2a**, **2b**, **ZnO-2a, ZnO-2b** (c) **3a**,**3b**, **ZnO-3a, ZnO-3b** (d) **4**, **ZnO-4**.

Absorption spectra of respectively **ZnO-1a** and **ZnO-1b**, **ZnO-2a** and **ZnO-2b**, **ZnO-3a** and **ZnO-3b** are essentially identical and on Fig. S25 only one representative spectrum is shown.