Electronic Supplementary information

Spectral and luminescent properties of ZnO/SiO_2 nanoparticles with size-selected ZnO cores

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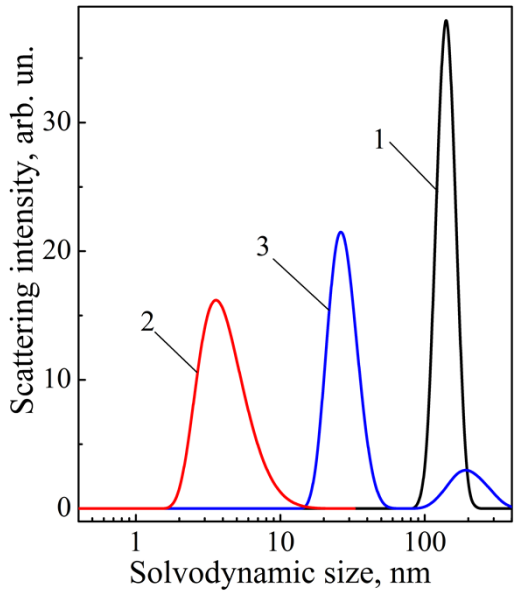


Figure S1. Hydrodynamic size distribution of colloidal SiO_2 particles produced by TEOS hydrolysis in the absence of ZnO NPs (curve 1), freshly prepared ZnO/SiO_2 (curve 2) and ZnO/SiO_2 NPs heated at 90 °C for 180 min (curve 3). [ZnO] = 0.02 M, [TEOS] = [NEt_4OH] = 0.04 M.

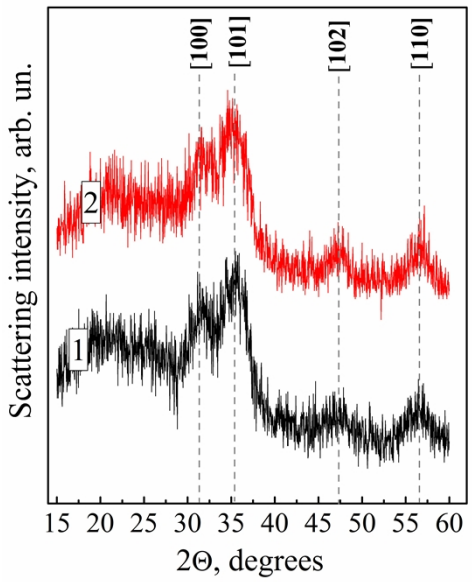


Figure S2. X-ray diffraction patterns of core-shell ZnO/SiO_2 NPs (curve 1) and ZnO-SiO_2 composite synthesized by co-hydrolysis of $ZnAc_2$ and TEOS (curve 2). The NPs were synthesized at [ZnO] = 0.02 M, [TEOS] = [NEt_4OH] = 0.05 M. Dashed lines represent characteristic maxima of hexagonal zincite (JCPDS card # 36–1451).

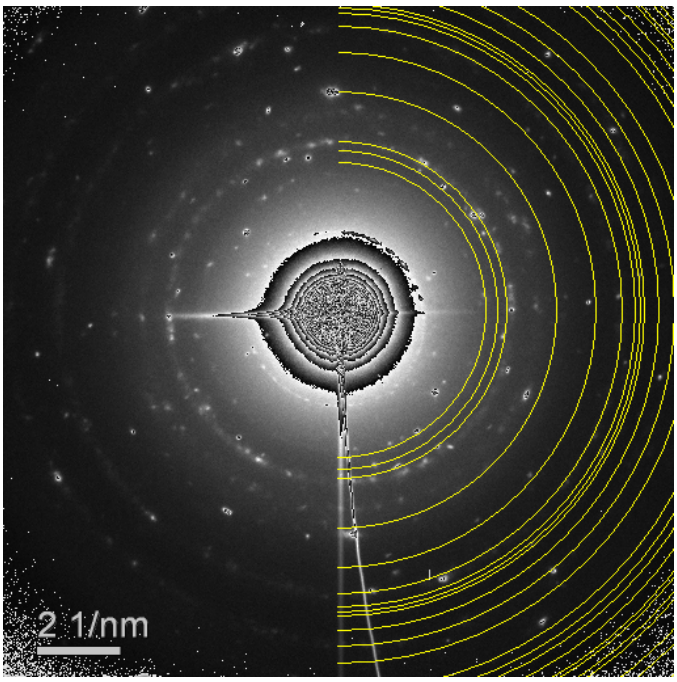


Figure S3. Selected area electron diffraction patterm of ZnO/SiO_2 NPs produced at 1 min ageing of ZnO core before deposition of a silica shell.

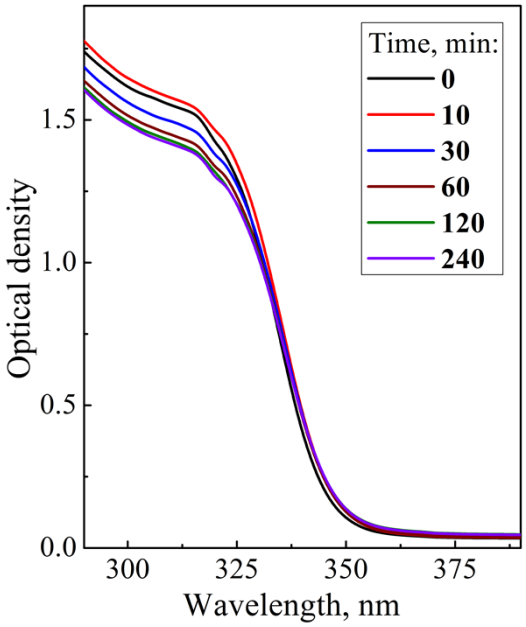
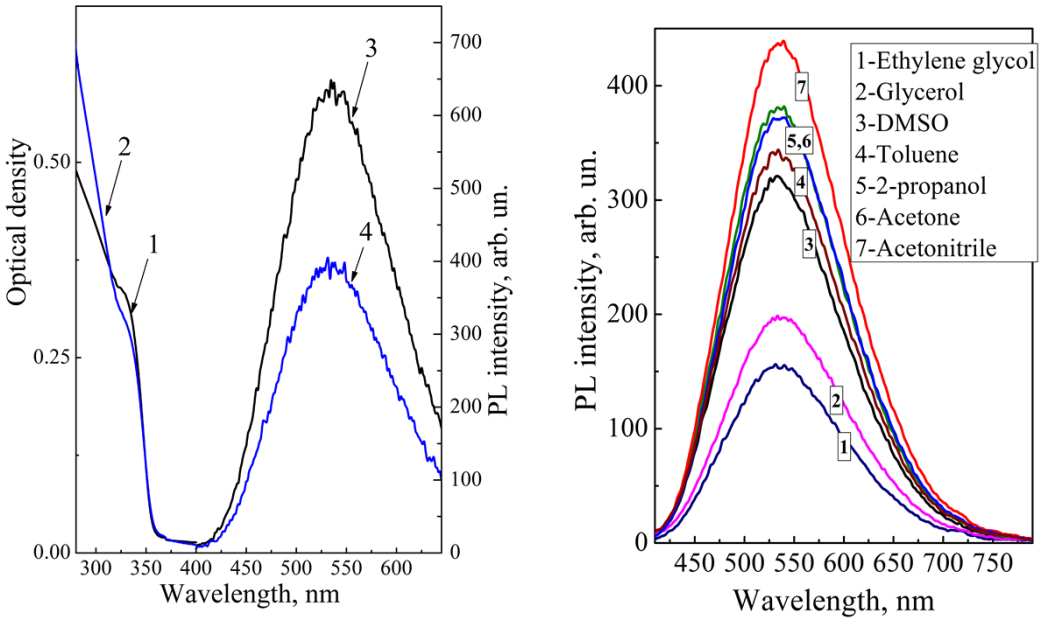


Figure S4. Absorption spectra of core/shell ZnO/SiO_2 NPs heated at 90 °C for 0–240 min. Cuvette – 1.0 mm. [ZnO] = 0.02 M, [TEOS] = $[NEt_4OH]$ = 0.04 M.



a b

Figure S5. Absorption (curves 1, 2) and PL (curves 3, 4) spectra of ZnO/SiO_2 colloidal NPs diluted in 20 times by DMSO (curves 1, 3) and water (curves 2, 4) and aged for 14 days. Original zinc oxide concentration is 0.02 M, cuvette – 10.0 mm. (b) PL spectra of ZnO/SiO_2 colloid in DMSO and 1:1 (v/v) mixtures of such colloids with acetone, acetonitrile, ethylene glycol, glycerol, 2-propanol, and toluene. Cuvette – 10.0 mm. *Note*: ZnO/SiO_2 colloids in DMSO should be subjected to the thermal treatment at 60–80 °C for 30 min prior to dilution with water to increase stability of the ZnO/SiO_2 NPs toward aggregation in aqueous environment.

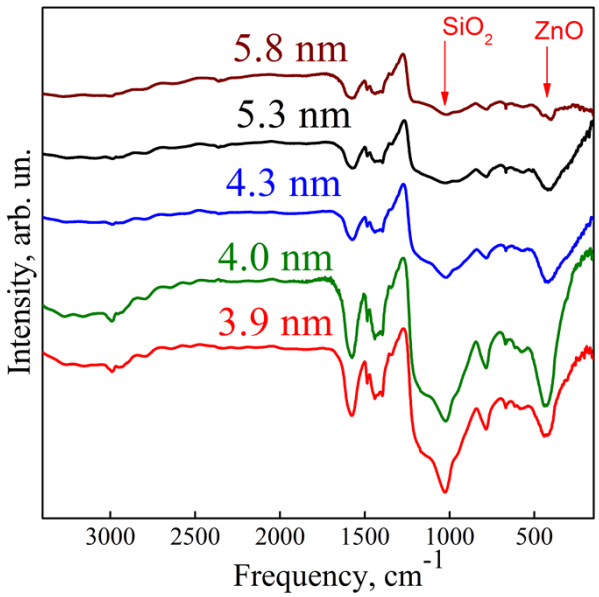


Figure S6. FTIR reflection/absorption spectra of ZnO/SiO_2 NPs produced from ZnO NPs with different size.

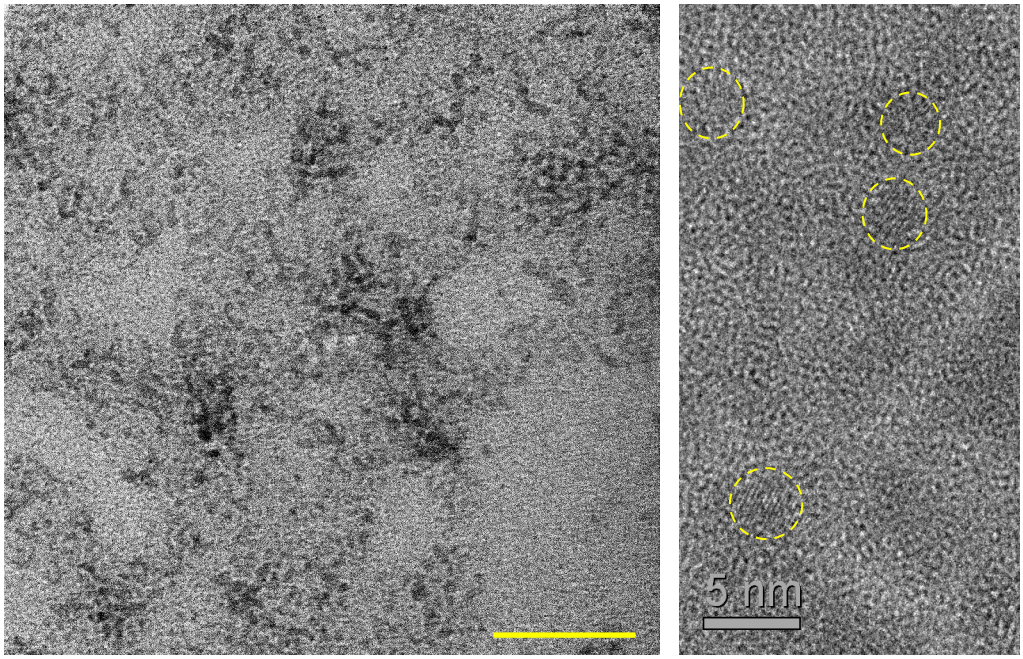


Figure S7. TEM (a) and HRTEM (b) images of ZnO-SiO_2 NPs produced by co-hydrolysis of TEOS and $ZnAc_2$ (0.02 M) at [TEOS] = 0.05 M.

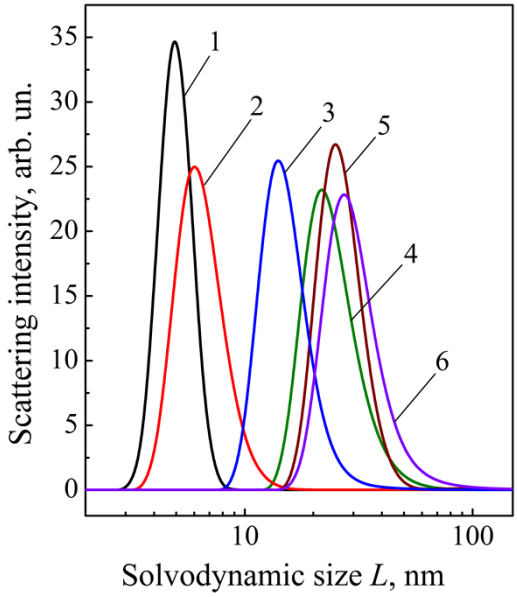


Figure S8. Hydrodynamic size distrubution of ZnO-SiO_2 NPs produced by co-hydrolysis of TEOS and $ZnAc_2$ (0.02 M) at [TEOS] = 0.01 M (curve 1), 0.02 M (2), 0.05 M (3), 0.08 M (4), 0.12 M (5), and 0.20 M (6). [NEt_4OH] = 0.02 M + 0.5×[TEOS].