Solubility of Nanocrystalline Cerium Dioxide: Experimental Data and Thermodynamic Modeling

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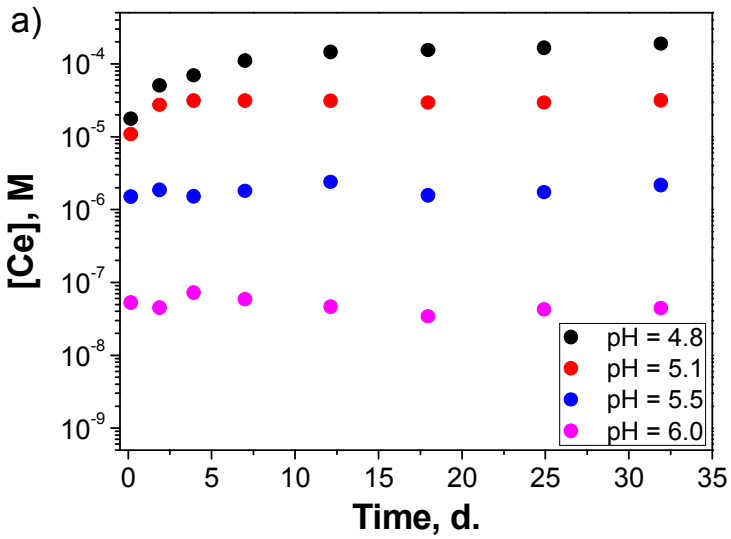
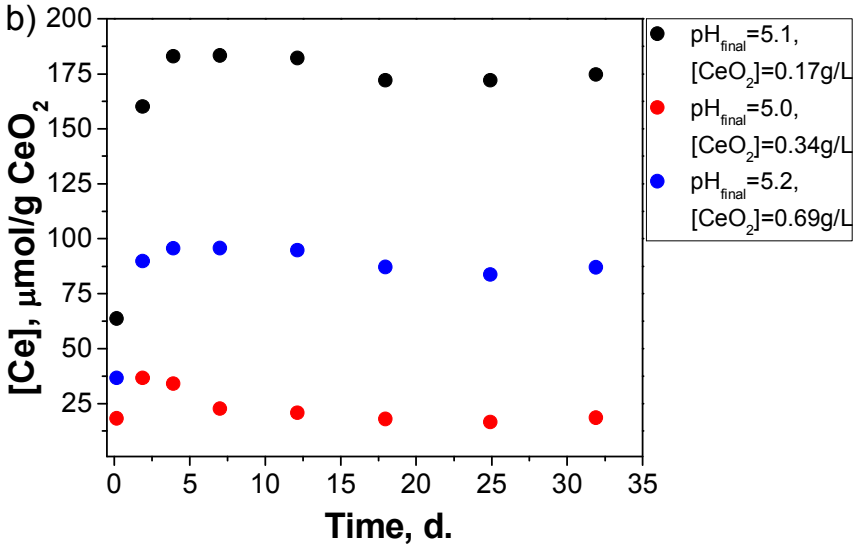
Figure 1_S illustrates the kinetics of CeO_2 nanoparticles dissolution at different pH values. It is clearly seen that the steady-state conditions are reached in the first 15 days. Figure S_1b illustrates the kinetics of CeO_2 dissolution at different solid phase concentrations (0.1-0.7 g/L). It is clearly seen that cerium concentrations expressed in μmol/g(CeO_2) units are different. Nevertheless the concentrations of Ce expressed in mol/L units are exactly the same for all of these experiments.





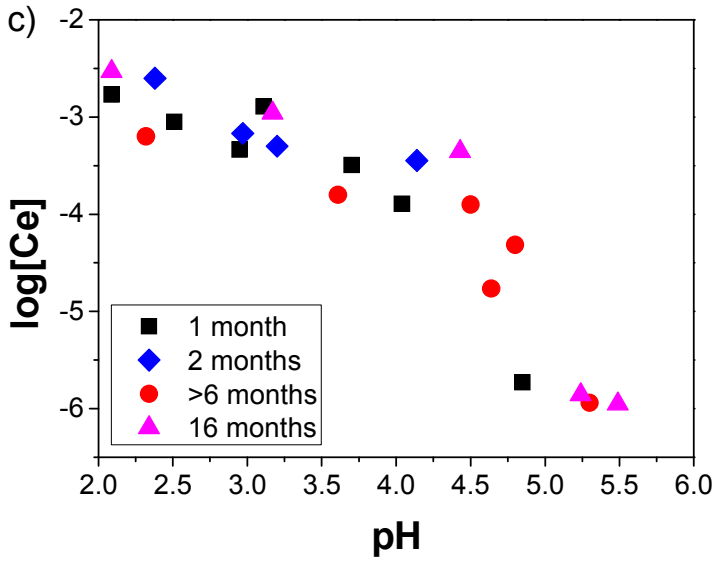


Figure 1_S. Kinetics of CeO_2 dissolution a) at different pHs (pH values after 30 days of equilibration are presented) and b) at different ceria concentrations. c) Comparison of ceria solubility data at different times of equilibration.

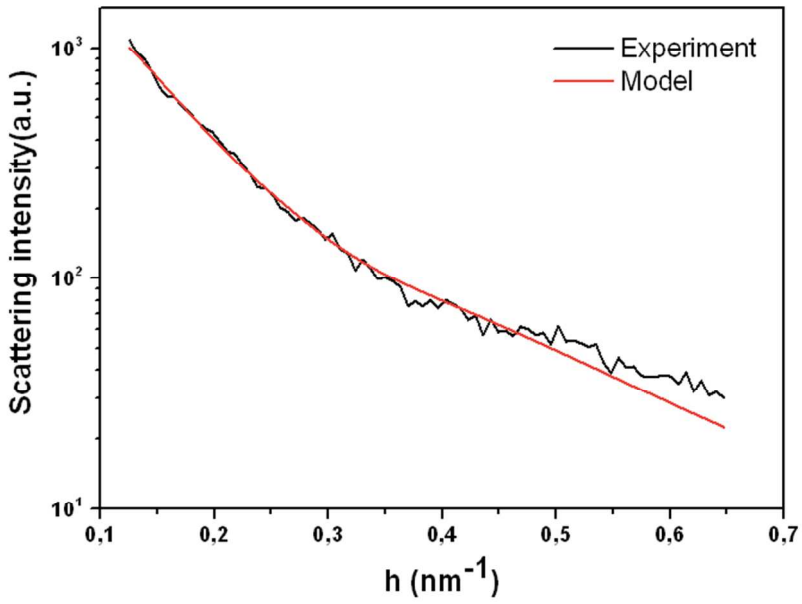


Figure 2_S. Experimental SAXS data for ceria suspension, and fitting curve obtained using GNOM program.

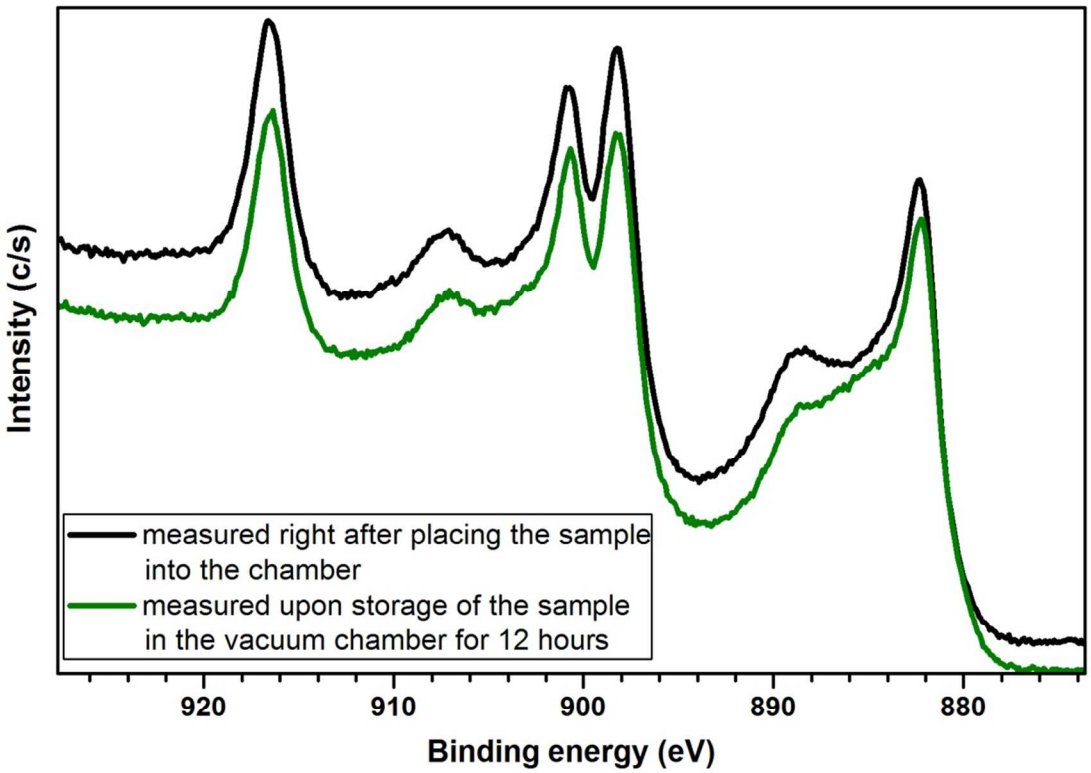
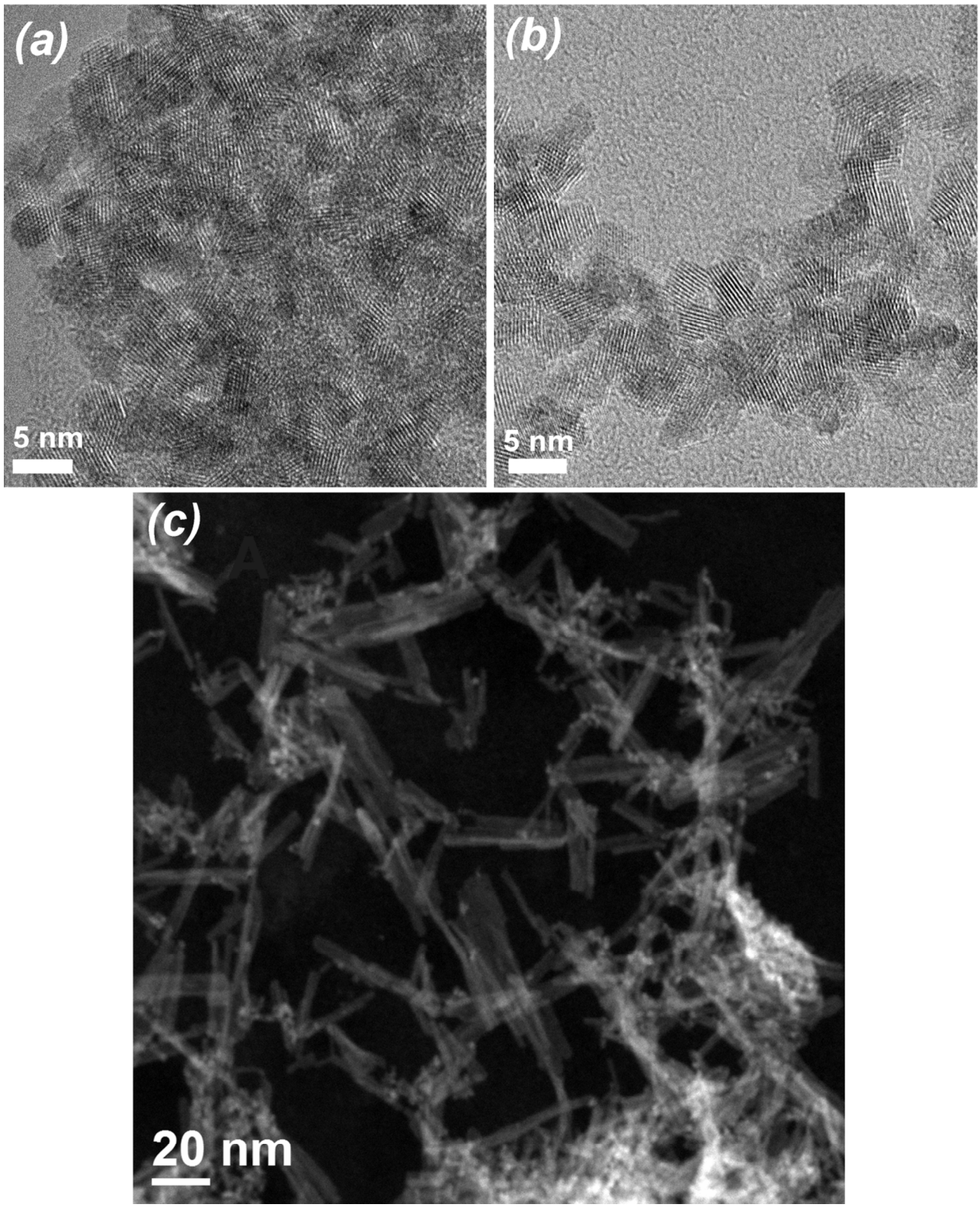


Figure 3_S. XPS spectra of nanosized CeO_2. The black line corresponds to the spectrum measured immediately after loading of the sample into the chamber. Green-colour spectrum was recorded for the sample that was stored in the chamber under vacuum conditions for 12 hours.

Determination of the Ce^{3+}/Ce^{4+} ratio was performed taking into account the intensity of the 916 eV line. According to XPS data, Ce^{3+} concentration in ceria nanoparticles was determined to be 17% in initial measurements, and 27% after storage of the sample in the vacuum chamber (without X-ray exposure).


(a)
5 nm
(b)
5 nm
(c)
20 nm

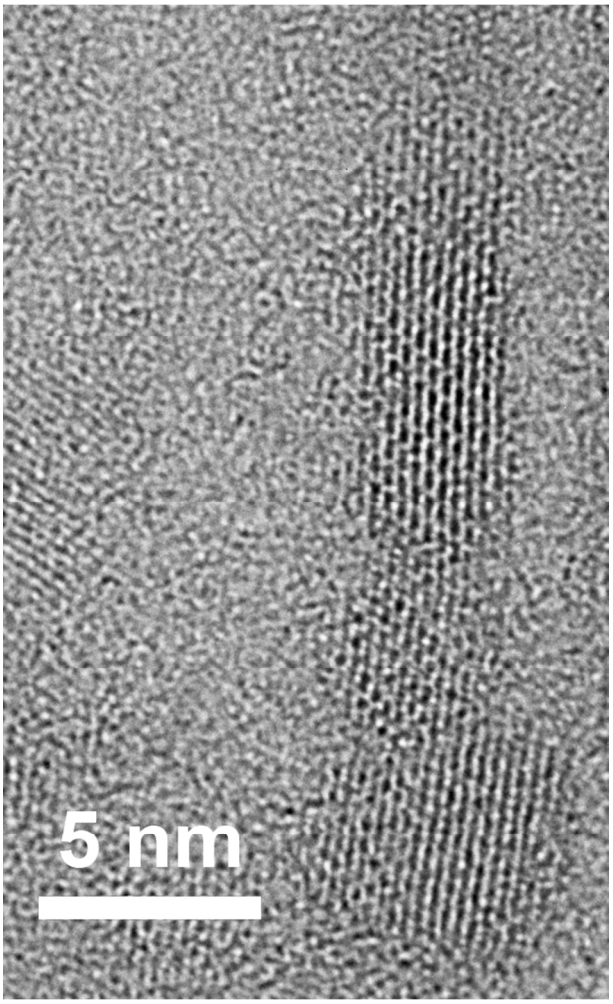


Figure 4_S. TEM images of ceria nanoparticles after equilibration for 1 month at (a) pH 3.1, (b) pH 4.9, and c,d) pH 7.6.

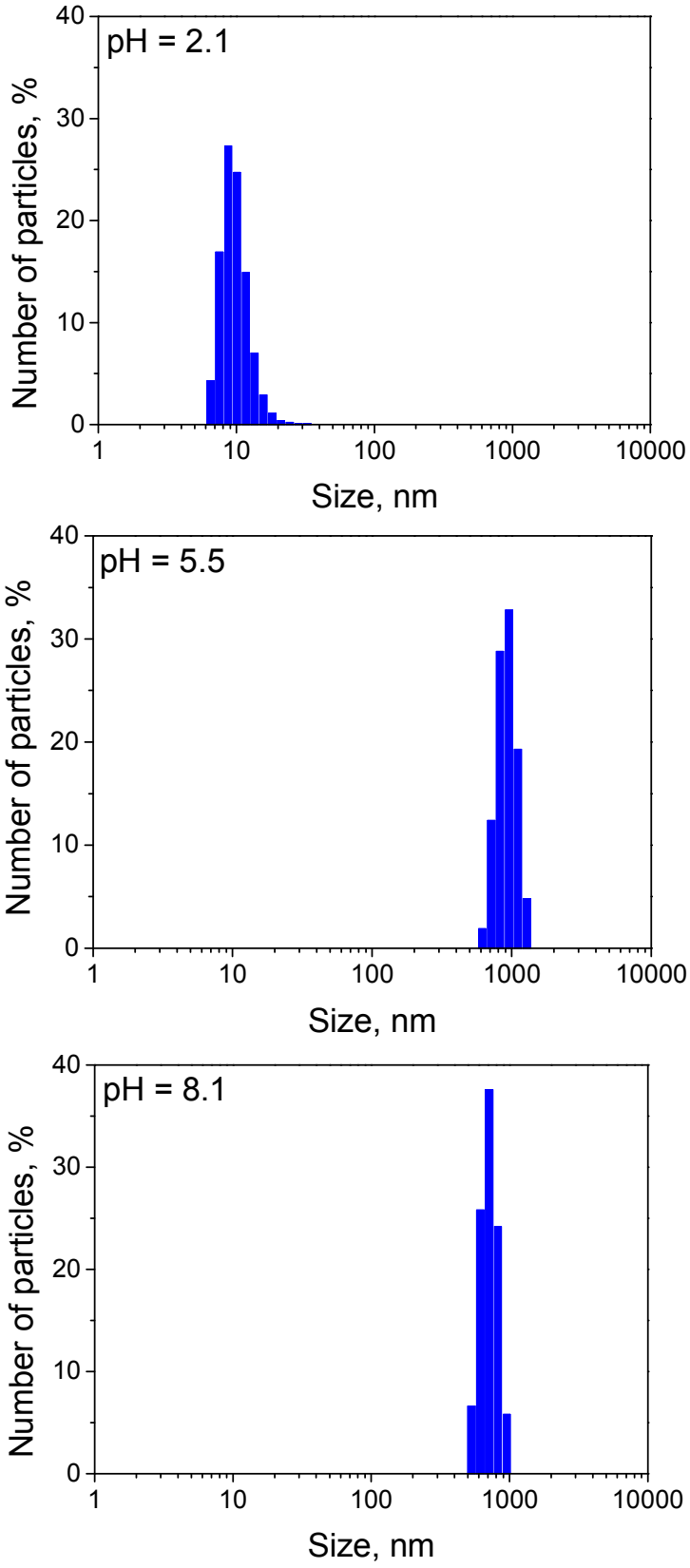


Figure 5_S. CeO_2 particles size distributions in 0.01M $NaClO_4$ at different pH values (as measured by DLS technique).

Table S_1 The interplanar distances calculated from ED patterns and corresponding PC-PDF database values

Sample	ED pattern	PC–PDF [81-792]	Miller indices for crystal planes (hkl)
pH 3.1	3.15	3.12	111
	2.71	2.71	200
	1.91	1.91	220
	1.63	1.63	311
pH 4.9	3.11	3.12	111
	2.67	2.71	200
	1.89	1.91	220
	1.61	1.63	311
pH 7.6	3.09	3.12	111
	2.69	2.71	200
	2.12	1.91	220
	1.68	1.63	311