Supporting Information

Confined Nucleation and Growth of PdO Nanocrystals in a Seed-Free Solution inside Hollow Nanoreactor

Daun Kim,[†,‡] Jung Kyu Choi,[†,‡] Soo Min Kim,[‡] Ilha Hwang,[§] Jaehyoung Koo,[‡,§] Seoyoung Choi,[‡] Seung Hwan Cho,[‡] Kimoon Kim,[*,‡,§] and In Su Lee[*,†,‡]

[†]National Creative Research Initiative Center for Nanospace-confined Chemical Reactions (NCCRs) and [‡]Department of Chemistry, Pohang University of Science and Technology (POSTECH), Pohang 37673, Korea

[§]Center for Self-assembly and Complexity, Institute for Basic Science, Pohang 37673, Korea

[*]To whom correspondence should be addressed

e-mail: insulee97@postech.ac.kr (I. S. L.); kkim@postech.ac.kr (K. K.)

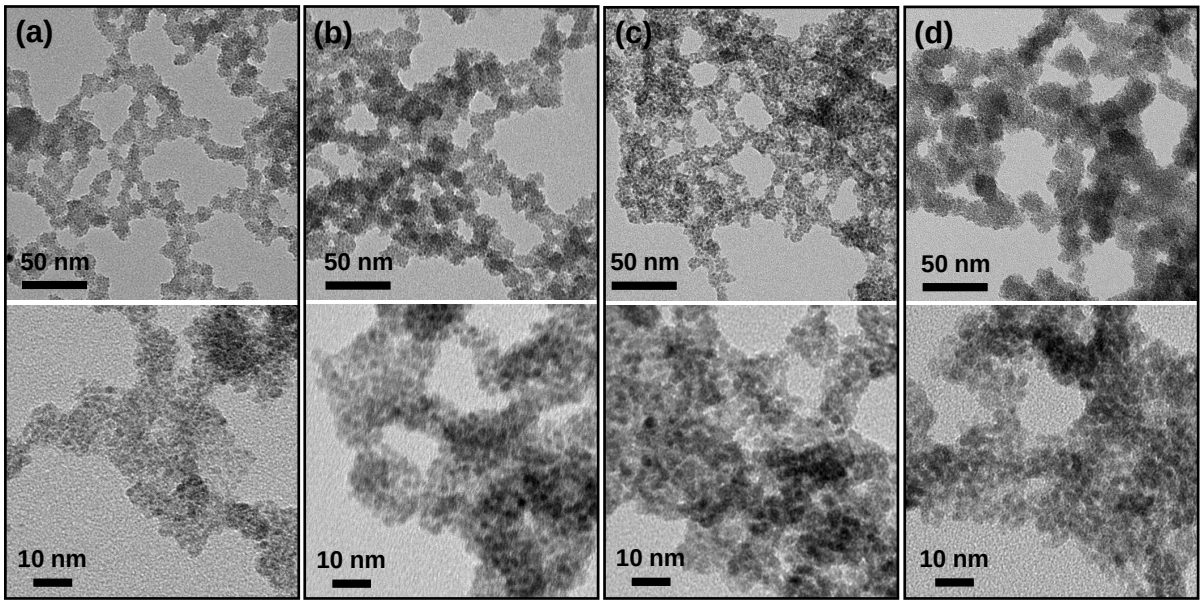

Figure S1. Time course TEM images of the cluster of PdO NCs which were isolated from a an aqueous solution of Na_2PdCl_4 at different reaction time-periods at (a) 10 min, (b) 2 h, (c) 6 h, and (d) 12 h.

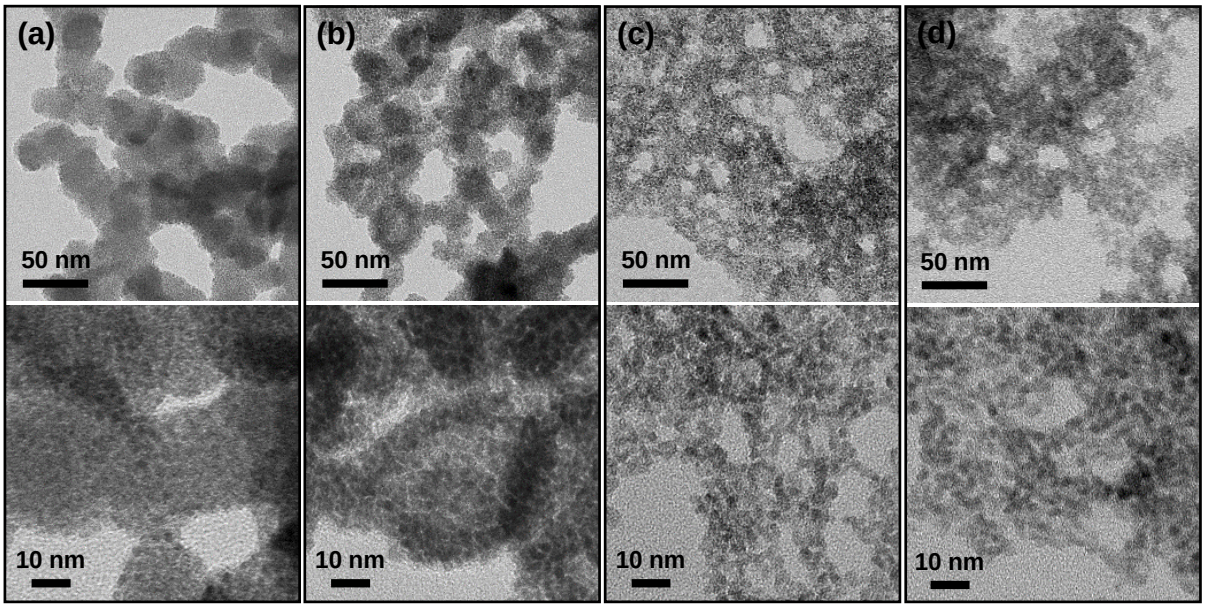

Figure S2. TEM images of the cluster of PdO NCs synthesized from the bulk aqueous solution of Na_2PdCl_4 at varying reaction temperature such as (a) 5 ℃, (b) 25 ℃, (c) 70 ℃, and (d) 100 ℃.

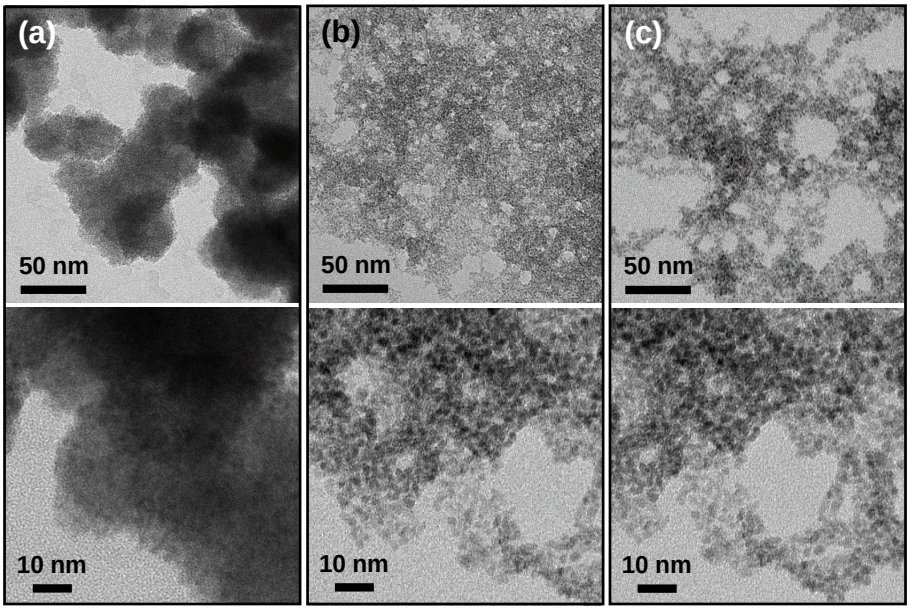

Figure S3. TEM images of the cluster of PdO NCs synthesized from the bulk aqueous solution of Na_2PdCl_4 at different pH condition such as (a) pH 2.8, (b) pH 3.4, and (c) pH 5.0.

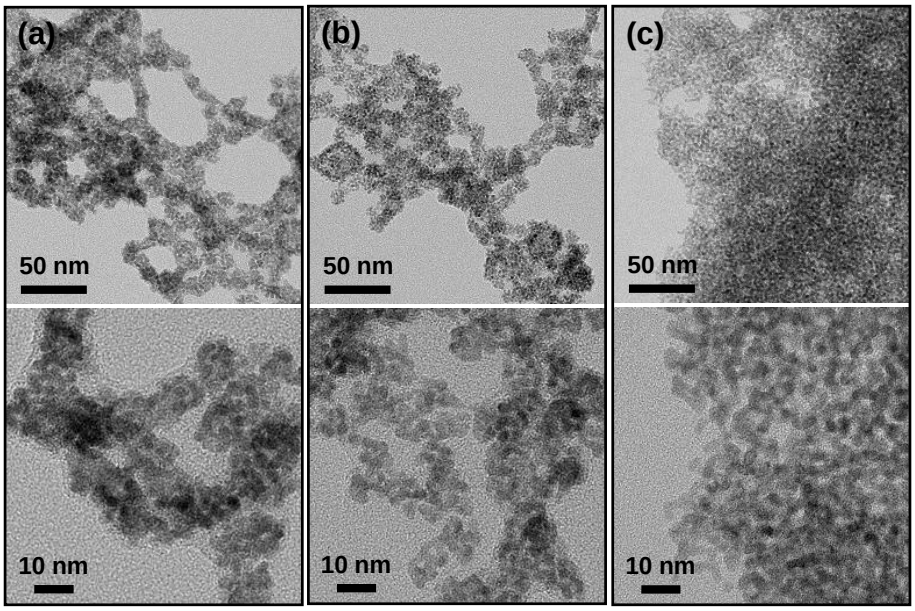

Figure S4. TEM images of the cluster of PdO NCs synthesized from the bulk aqueous solution-phase medium with using the different Pd ion precursors. (a) Na_2PdCl_4, (b) K_2PdCl_4, and (c) $Pd(NO_3)_2$.

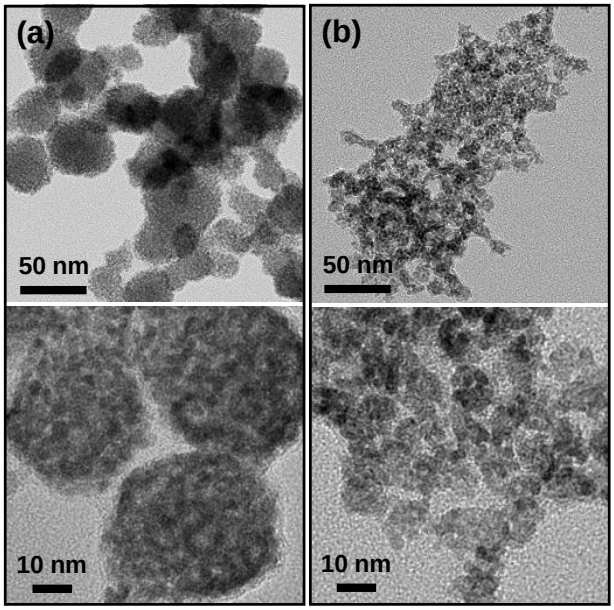

Figure S5. TEM images of the cluster of PdO NCs synthesized from the bulk aqueous solution containing Na_2PdCl_4 under (a) N_2 and (b) O_2 flow environments.

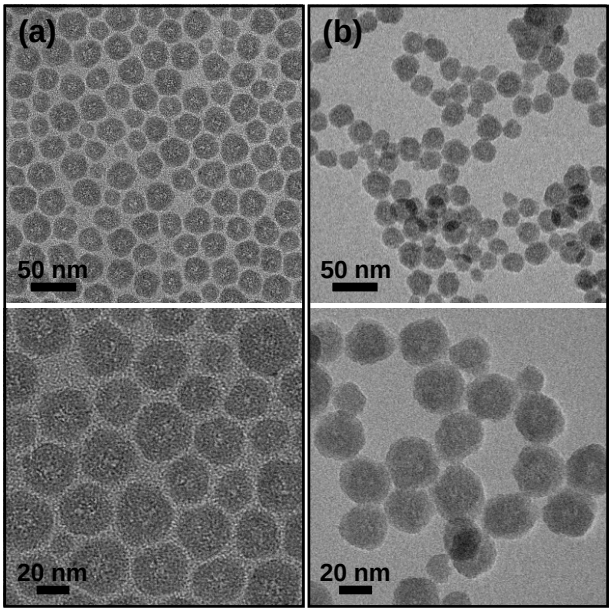

Figure S6. TEM images of **CB-SiO_2** before (a) and after (b) the washing process.

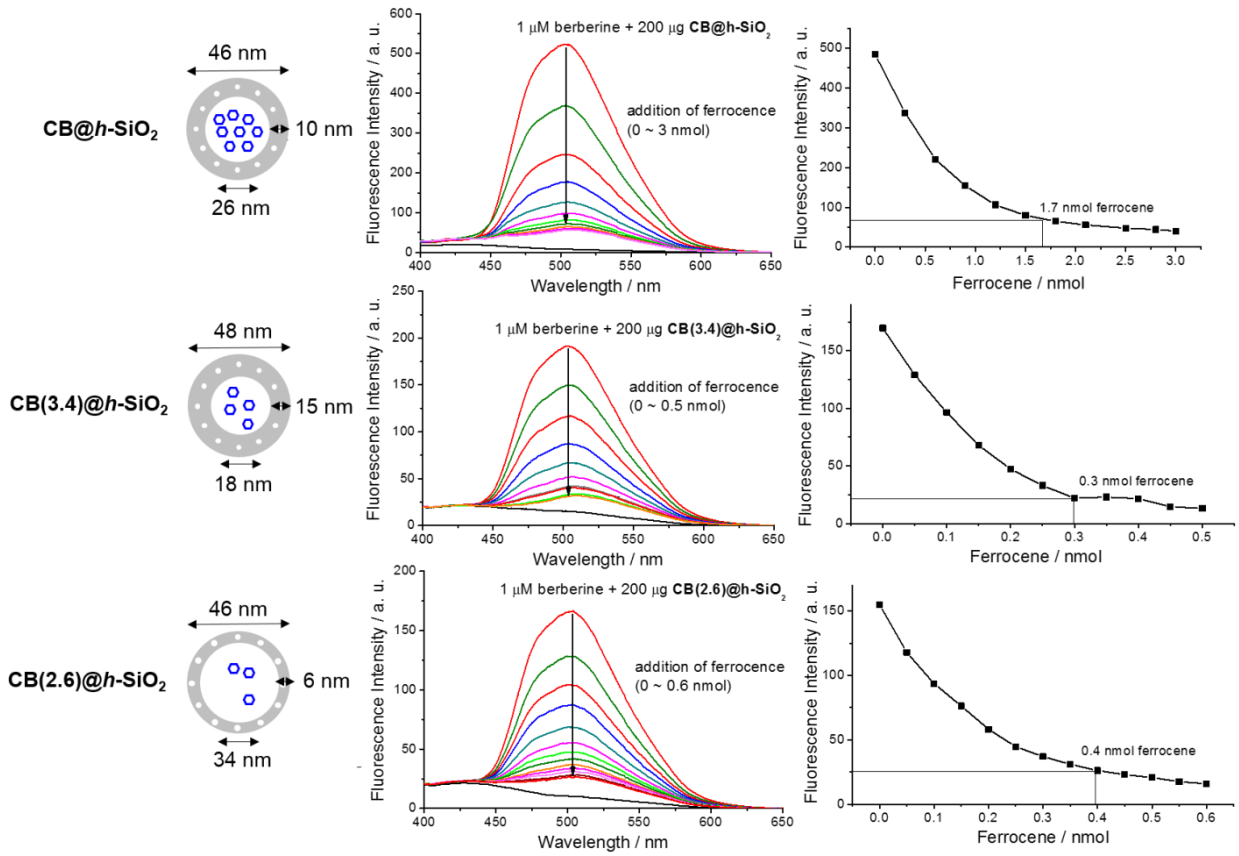

Figure S7. Emission (λ_{ex} = 345 nm) spectra of the mixture solution of mixture solution (3 mL) of 1 μM berberine and 200 μg **CB@*h*-SiO$_2$** (40 μL, stock solution = 5 mg/mL) titrated with 1-hydroxylmethylferrocene (stock solution = 1 μM) in de-ionized water and calibration curves for the changes of emission as a function of amount of 1-hydroxylmethylferrocene was monitored at 500 nm.

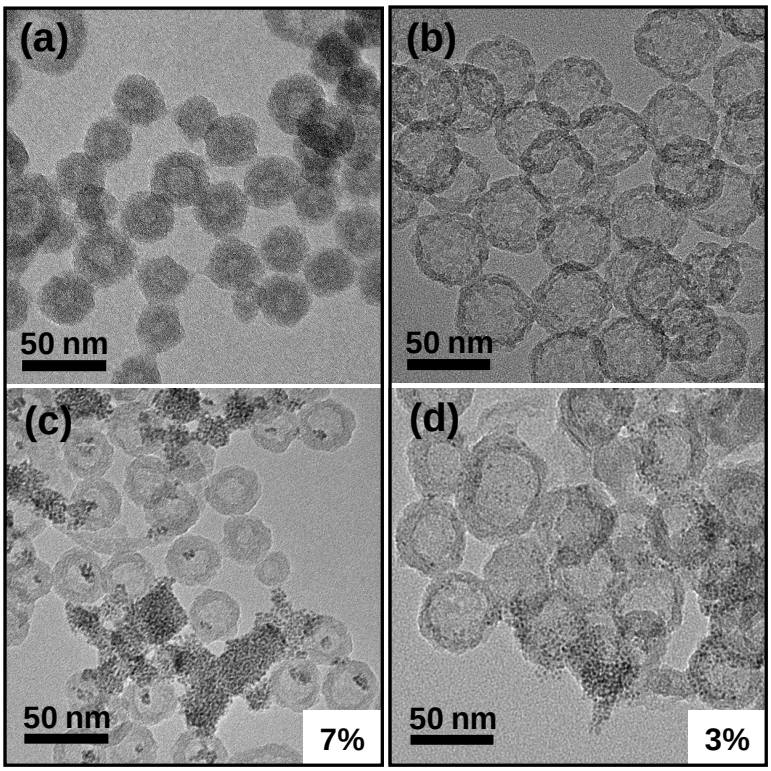

Figure S8. TEM images of (a) **CB(3.4)@*h*-SiO$_2$**, (b) **CB(2.6)@*h*-SiO$_2$**, and the products of PdO formation reaction in suspension of (c) **CB(3.4)@*h*-SiO$_2$** and (d) **CB(2.6)@*h*-SiO$_2$**, which shows only 7% and 3% of PdO growth inside the cavity, respectively.

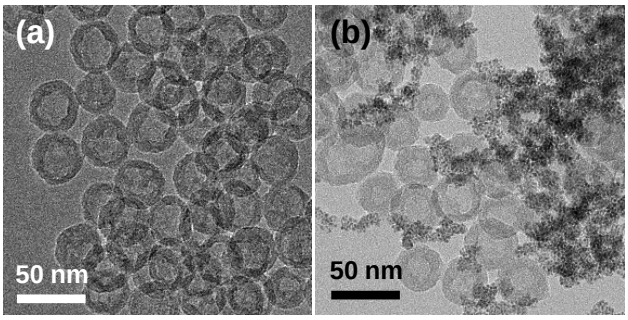

Figure S9. TEM images of (a) the hollow silica nanospheres and (b) the products of PdO formation reaction in its suspension, which shows the generation of most of PdO NCs in the outer solution.

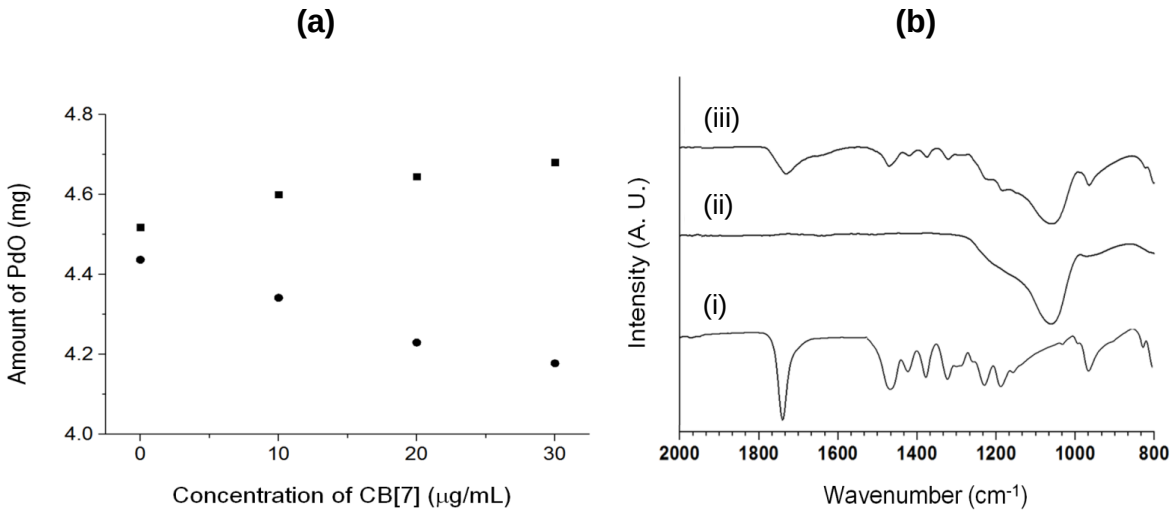

Figure S10. (a) Amounts of PdO precipitates formed with various concentrations of CB[7] in the presence (■) and absence (●) of SiO_2 nanoparticles, analyzed by ICP. (b) FT-IR spectra of (i) CB[7], (ii) SiO_2, and (iii) CB[7]/SiO_2 mixture. The perturbation of the carbonyl group of CB[7] by surface silanol groups led to spectroscopic shift of -8 cm^{-1} (1738 cm^{-1} for CB[7] and 1730 cm^{-1} for CB[7]/silica, respectively) in the position of the C=O stretching vibrations.

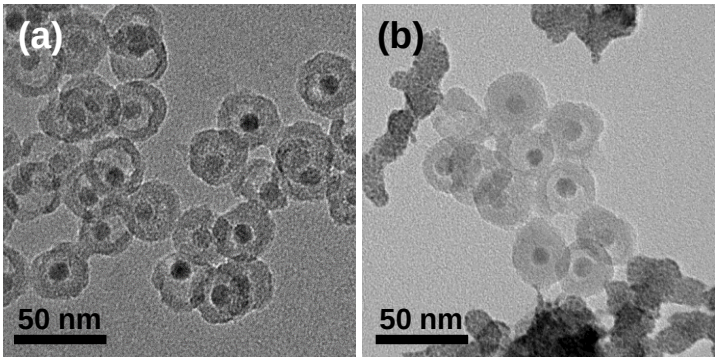

Figure S11. TEM images of (a) **Fe_3O_4@*h*-SiO_2** and (b) the product of the control reaction for the PdO formation reaction in the suspension of **Fe_3O_4@*h*-SiO_2** and Na_2PdCl_4.