Electronic Supplementary Material (ESI) for Journal of Materials Chemistry B

Core-shell designs of photoluminescent nanodiamonds with porous silica coatings for bioimaging and drug delivery I: Fabrication

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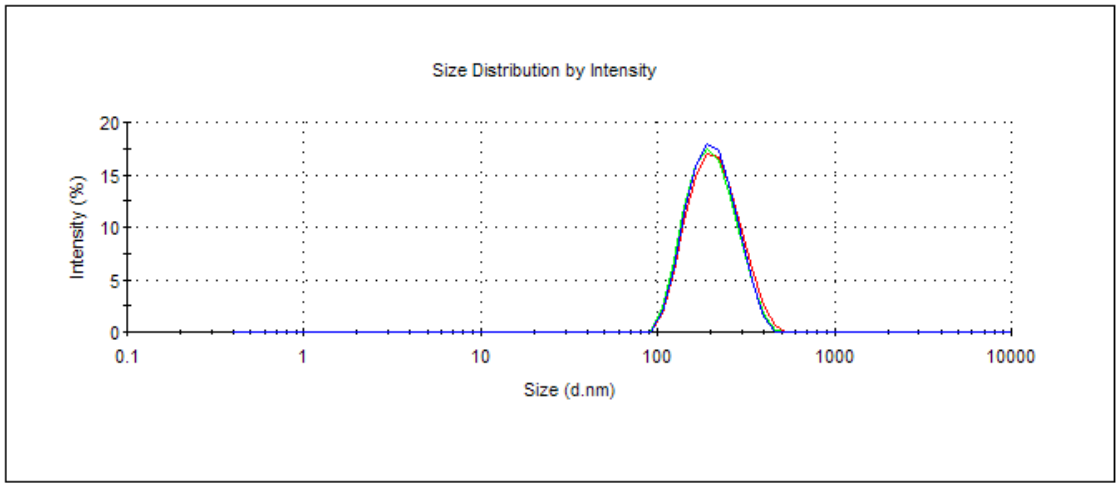
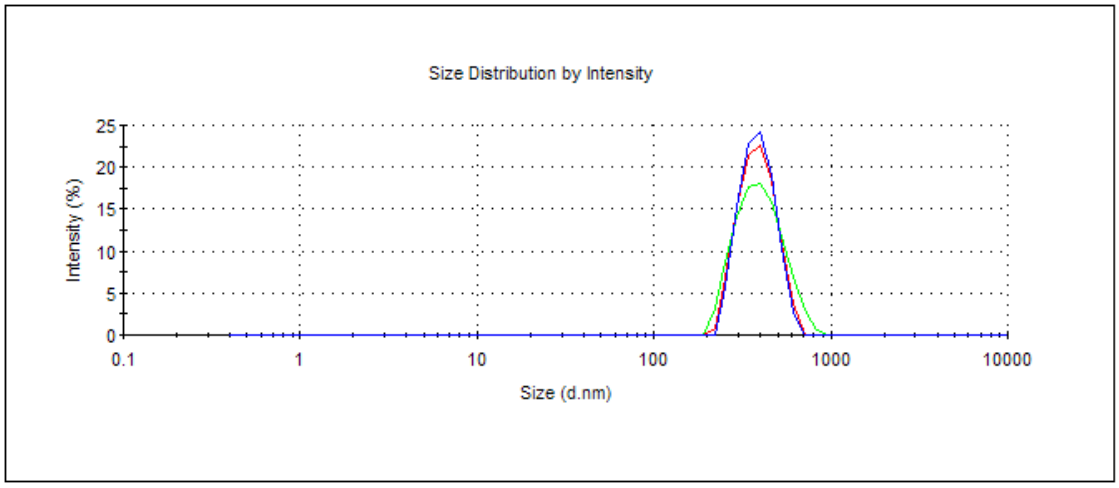
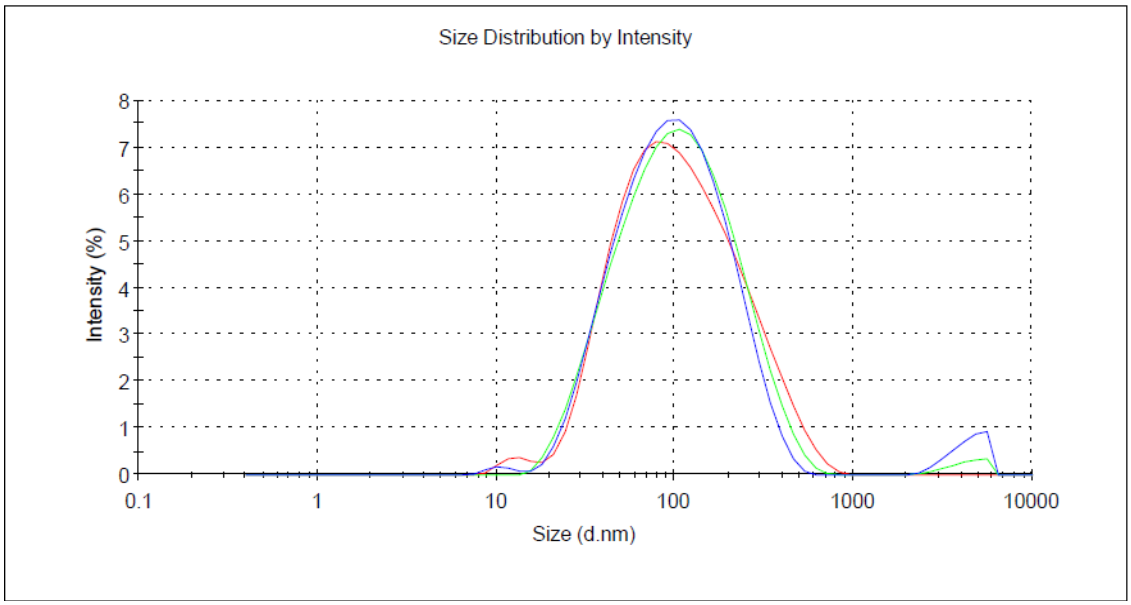
Supplementary Information



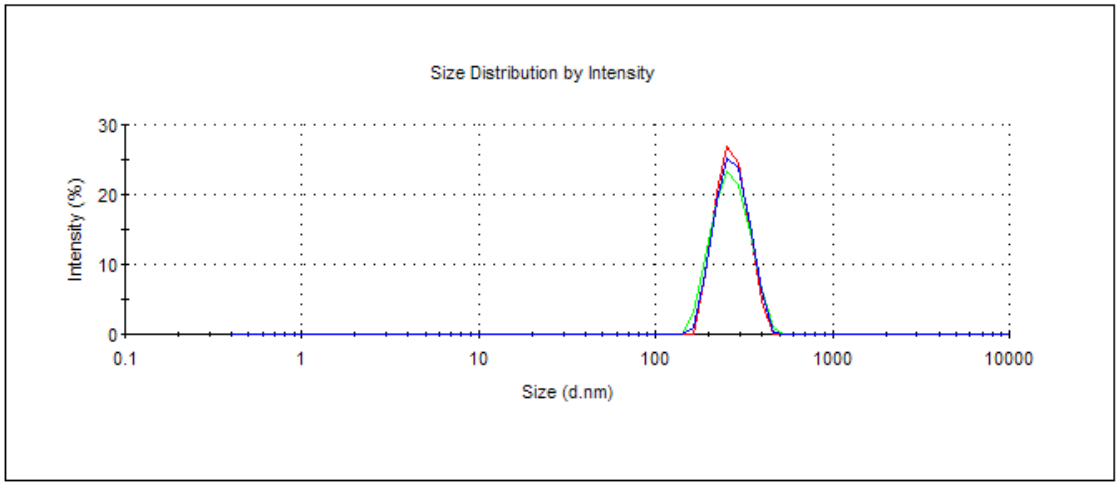
Supplementary Figure 1. DLS of sample ND-1. z-average=193 nm, PDI=0.096, (Intensity mean=212 nm; volume mean =216 nm ; number mean =168 nm)



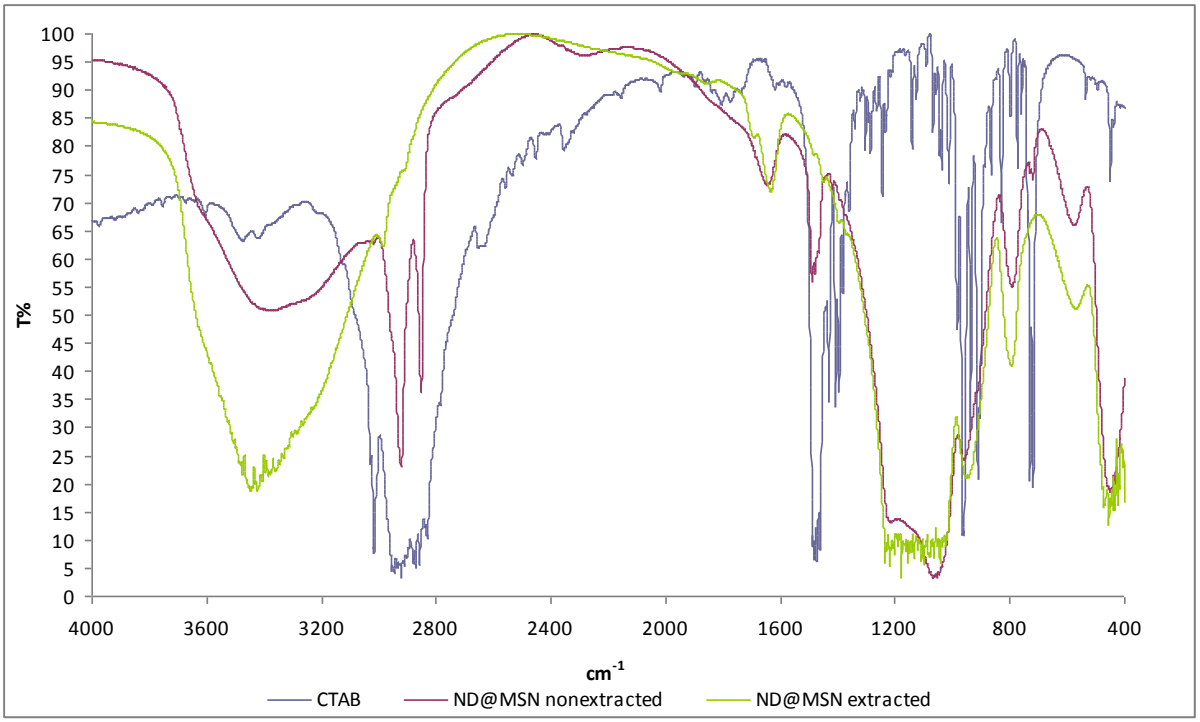
Supplementary Figure 2. DLS of SiO_2-coated ND-1 (CTAB/TEOS 40/100). z-average=373 nm, PDI=0.067, (Intensity mean=398 nm, volume mean = 428 nm, number mean= 356 nm).



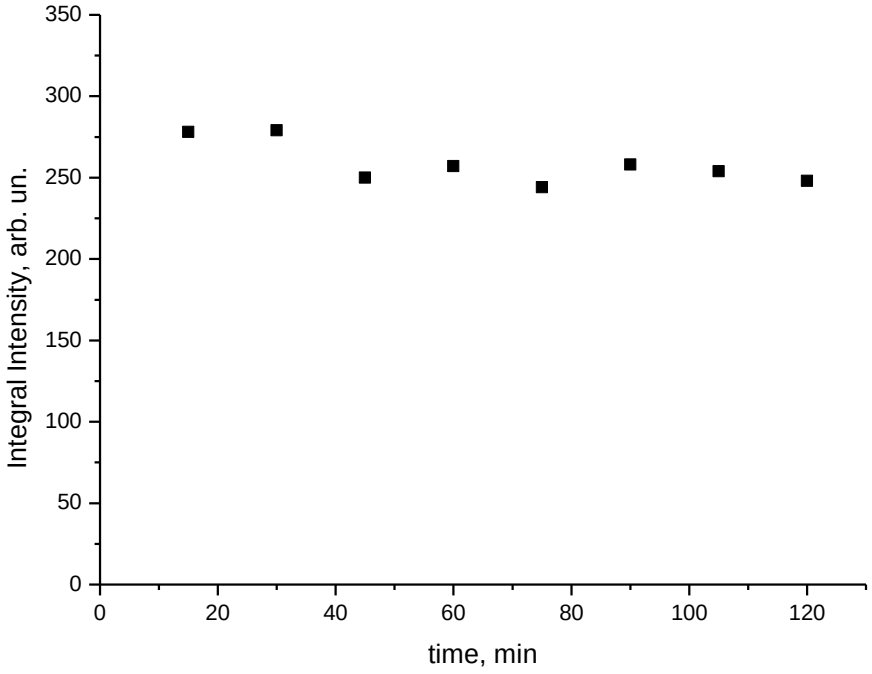
Supplementary Figure 3. DLS of sample ND-2. z-average =84 nm, PDI=0.325, (DLS average size by intensity of main peak=129 nm; intensity mean=198 nm; number mean= 15 nm; volume mean=82 nm)



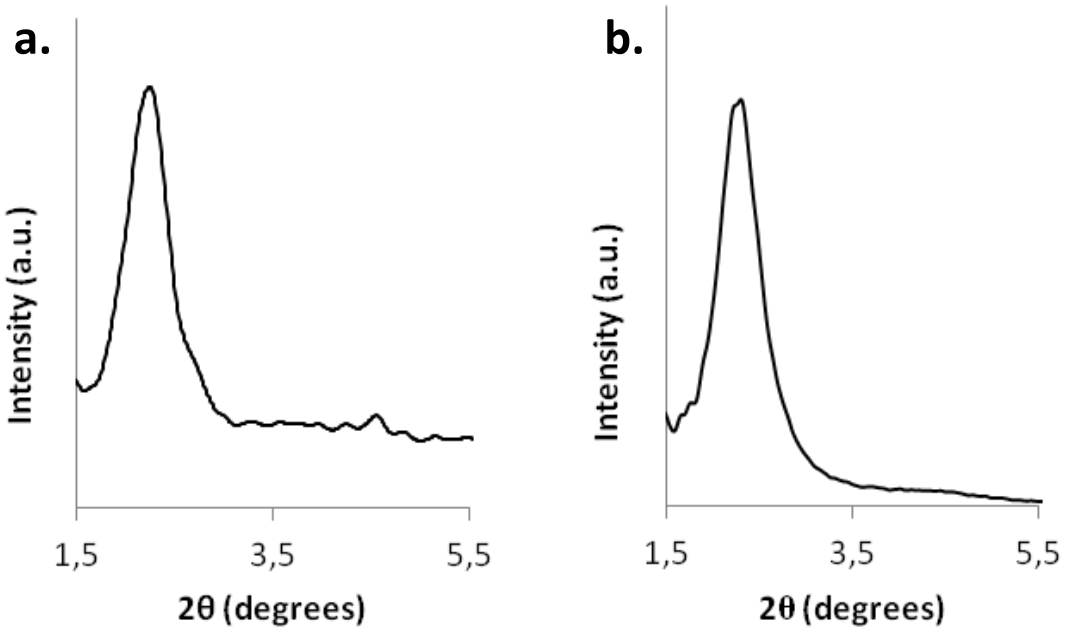
Supplementary Figure 4. DLS of SiO_2-coated ND-2. z-average =262 nm, PDI=0.024, (DLS average size by intensity=272 nm, volume mean = 284 nm, number mean= 248 nm).



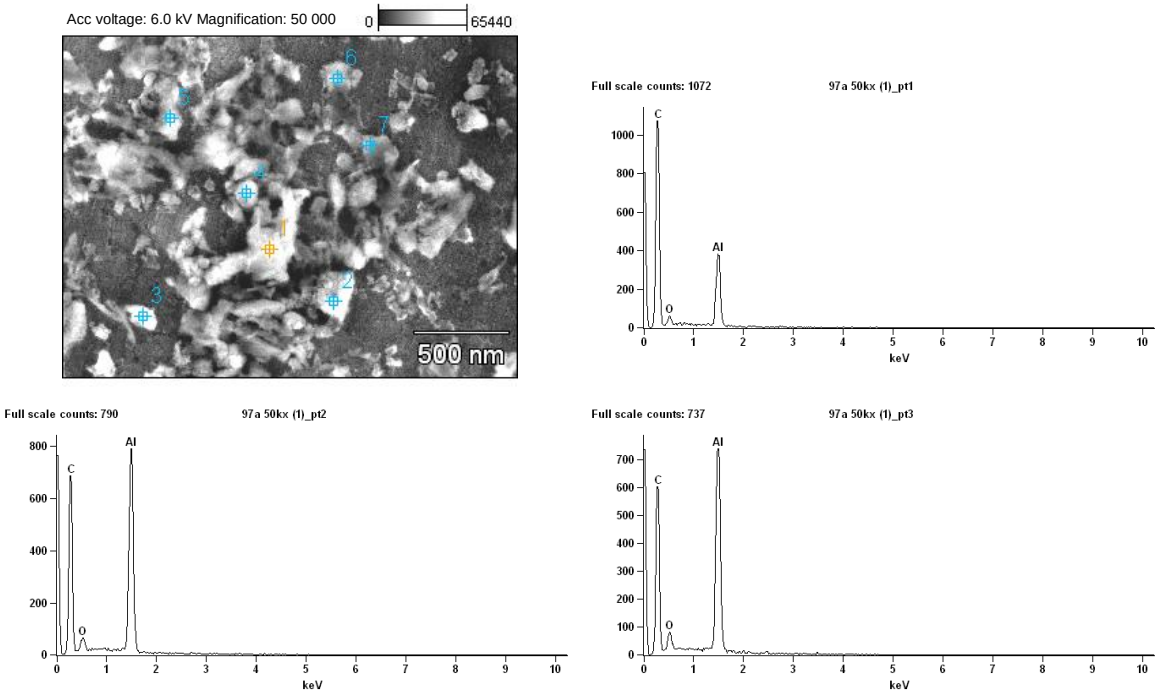
Supplementary Figure 5. Fourier transform infrared transmission spectra for pure CTAB, ND@MSN before and after extraction of the CTAB template. The green spectrum corresponds to that of pristine SiO_2.

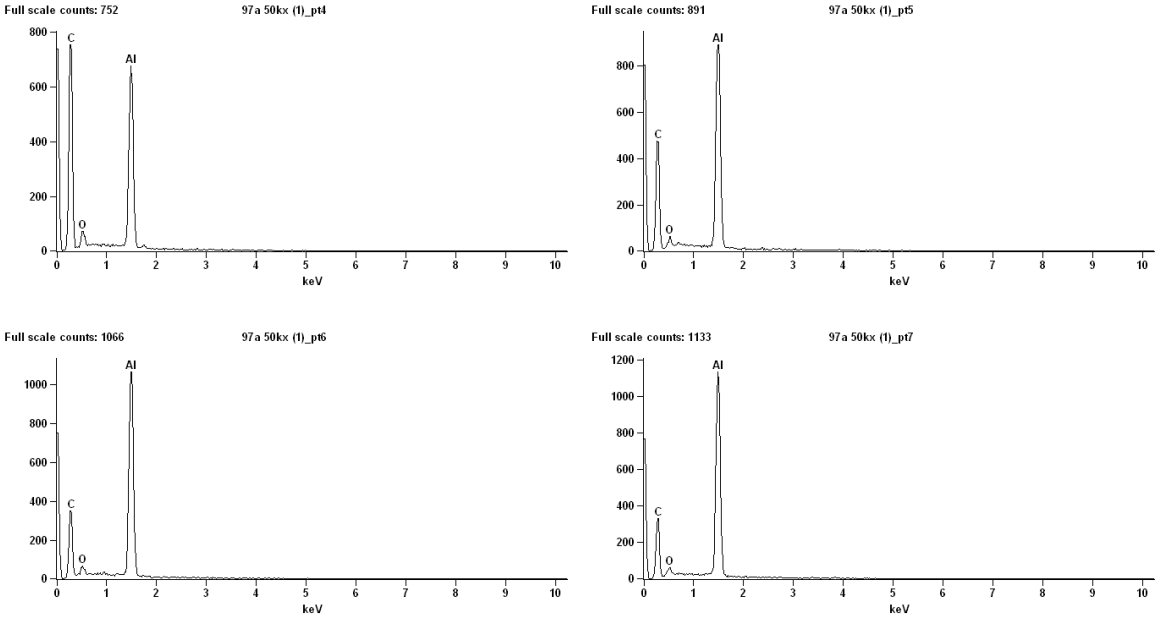


Supplementary Figure 6. The dependency of integral PL intensity over time for 0.3 mg/ml water suspension of ND-2. The PL intensity was measured every 15 min for 2-hours of irradiation of the suspensions with 488 nm Ar laser light of 10 W/cm^2 power density.



Supplementary Figure 7. Powder XRD patterns of silica-coated samples a) ND-1@MSN and b) ND-2@MSN. The *d*-values for both peaks are 38.5 Å, characteristic of ordered mesopores in the size range 3-4 nm.





Supplementary Figure 8. Elemental analysis on sample CTAB/TEOS 10/20 confirming the presence of carbon (ND) only.

Nanodiamond/silica ratio in silica-coated ND-1, 230 nm (average from TEM)

$d(ND_{core})$ = 80 nm → r = 40 nm
$d(ND\text{-}SiO_2)$ = 230 nm → r = 115 nm

ρ_{ND} = 3.5 g/cm^3
$\rho_{np\ SiO2}$ = 2.2 g/cm^3
$\rho_{mp\ SiO2}$= 0.73 g/cm^3 (~66% porosity)
[pore volume = 0.795 cm^3/g]

$$V = \frac{4}{3}\pi r^3$$

$$V_{ND} = \frac{4}{3}\pi * (40nm)^3 = 2.716 * 10^4 nm^3$$

$$V_{ND-SiO2} = \frac{4}{3}\pi(115nm)^3 = 6.455 * 10^5 nm^3$$

$$V_{SiO2} = V_{ND\text{-}SiO2} - V_{ND} = \frac{4}{3}\pi 115^2 - \frac{4}{3}\pi 40^2 = 6.1834 * 10^5 \ nm^3$$

$$\rho = \frac{m}{V} \qquad n = \frac{N}{N_A} \qquad n = \frac{m}{M}$$

$$m_{ND} = \rho V = 3.5\frac{g}{cm^3} * 2.716 * 10^4 * 10^{-18} cm^3 = 9.506 * 10^{-14} g$$

$$m_{SiO2} = \rho V = 0.73\frac{g}{cm^3} * 6.1834 * 10^5 * 10^{-18} cm^3 = 4.514 * 10^{-13} g$$

$$\frac{m_{ND}}{m_{SiO2}} = 9.506 * \frac{10^{-14} g}{4.514 * 10^{-13} g} = \frac{1}{4.75}$$

Ratio ND/SiO_2 ~1/4.75