Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information for

Nanodiamonds from coal at ambient conditions

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Figure S1. (a-c) SEM image, XRD pattern and EDS of bitumite coal. (d-f) SEM image, XRD pattern and EDS of coke.

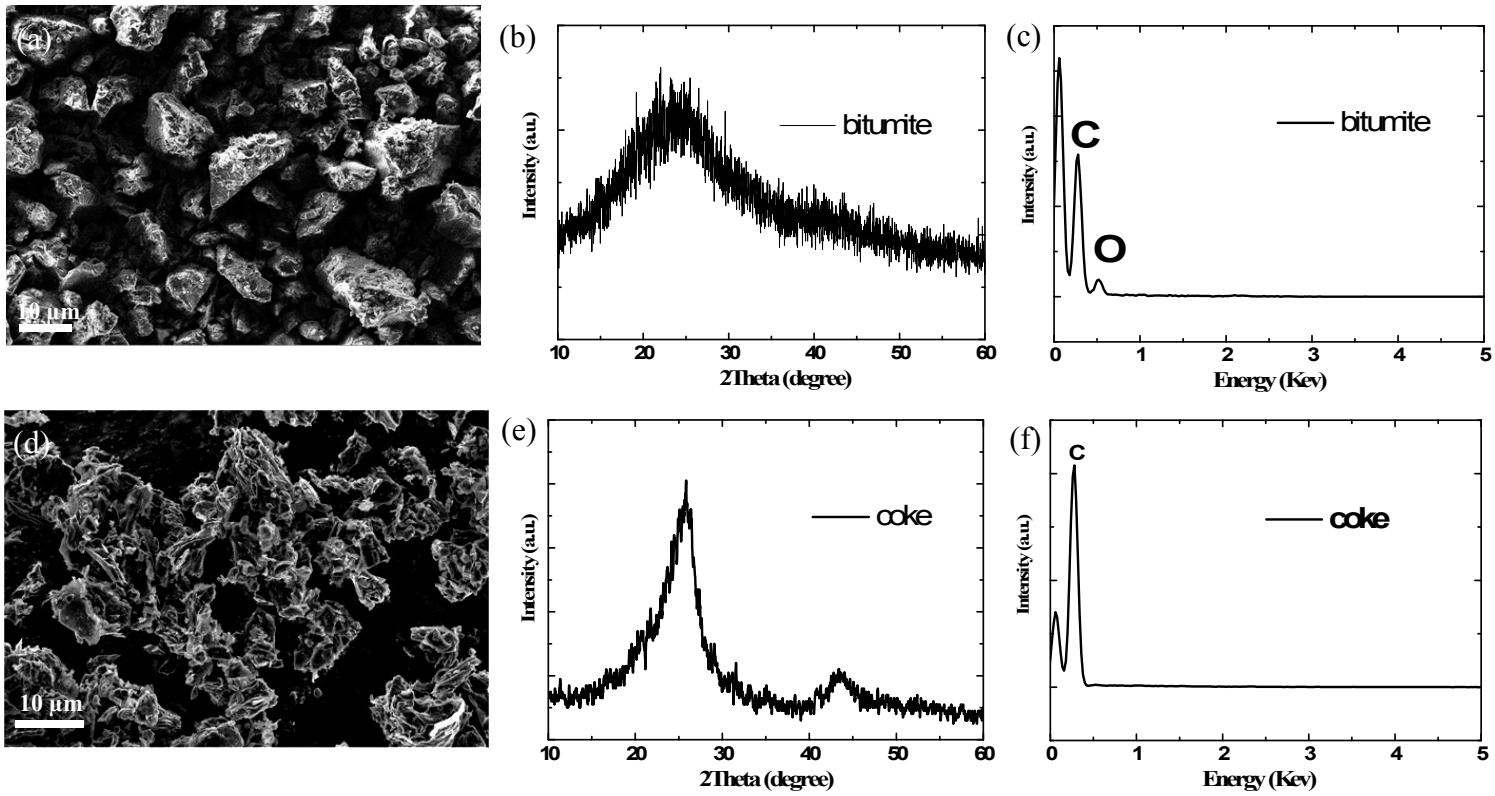


Figure S2. (a-b) Low magnification and size distribution of nanodiamonds synthesized from bitumite coal and (c-d) the corresponding SAED pattern and HRTEM image.

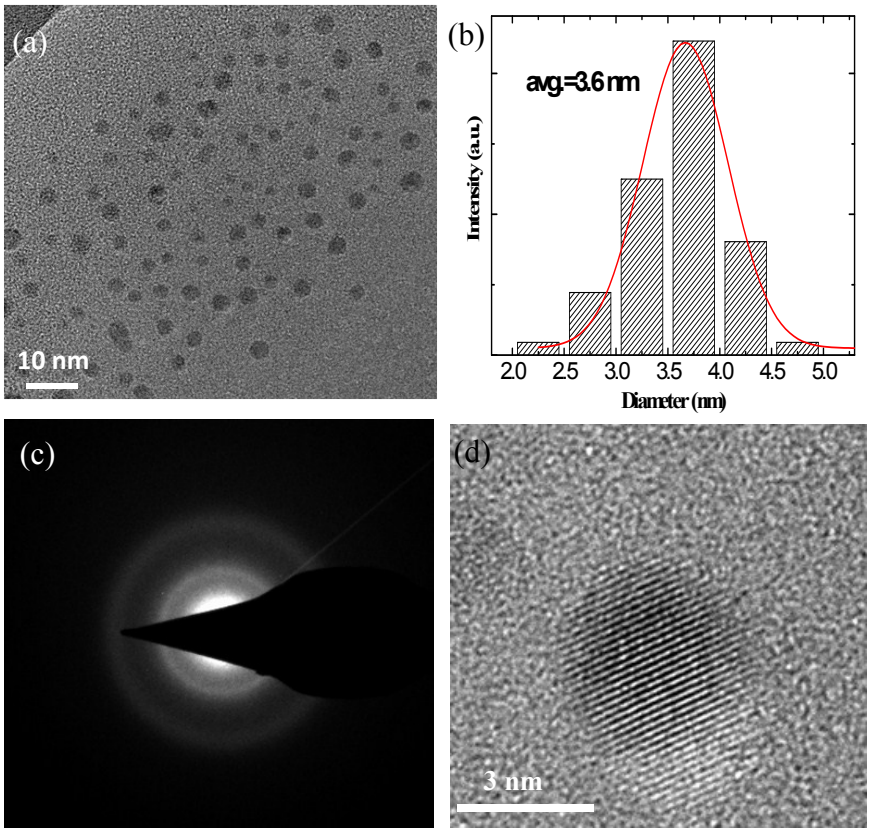


Figure S3. (a-b) Low magnification and size distribution of nanodiamonds synthesized from coke coal and (c-d) the corresponding SAED pattern and HRTEM image.

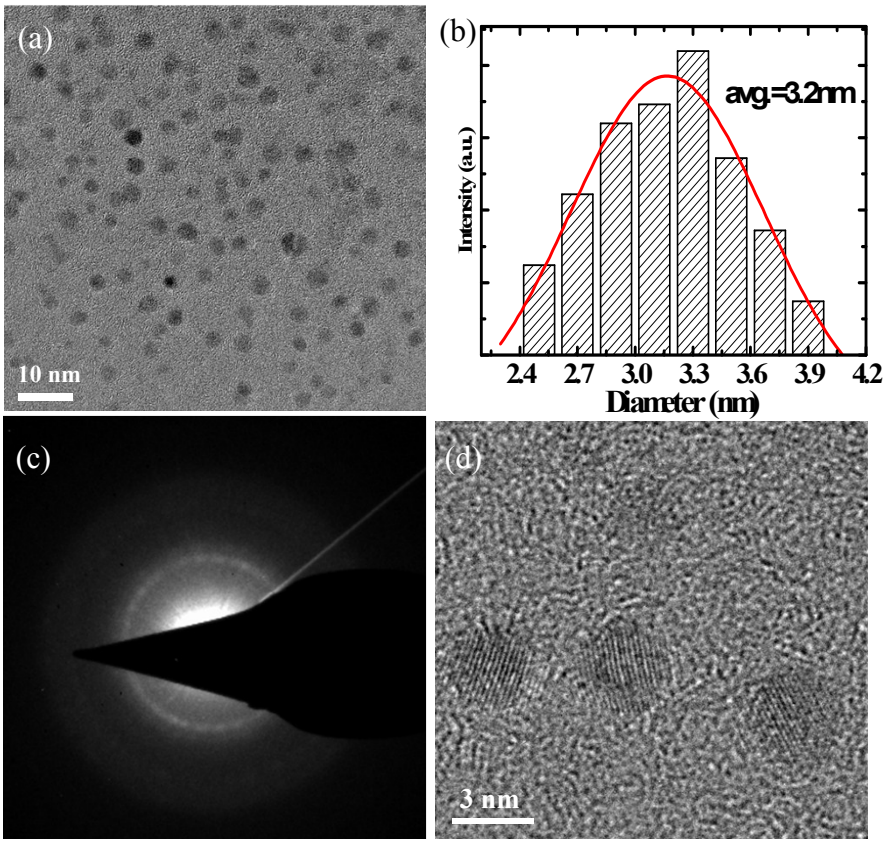
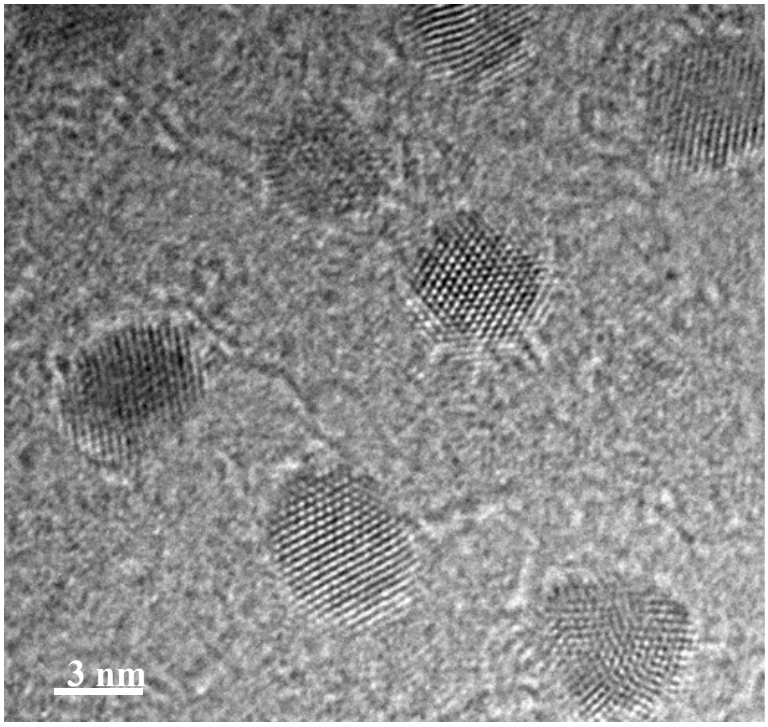


Figure S4. (a) HRTEM image of abundant nanodiamonds. (b) STEM image of some nanodiamonds embedded within amorphous carbon matrix.

(a)



(b)

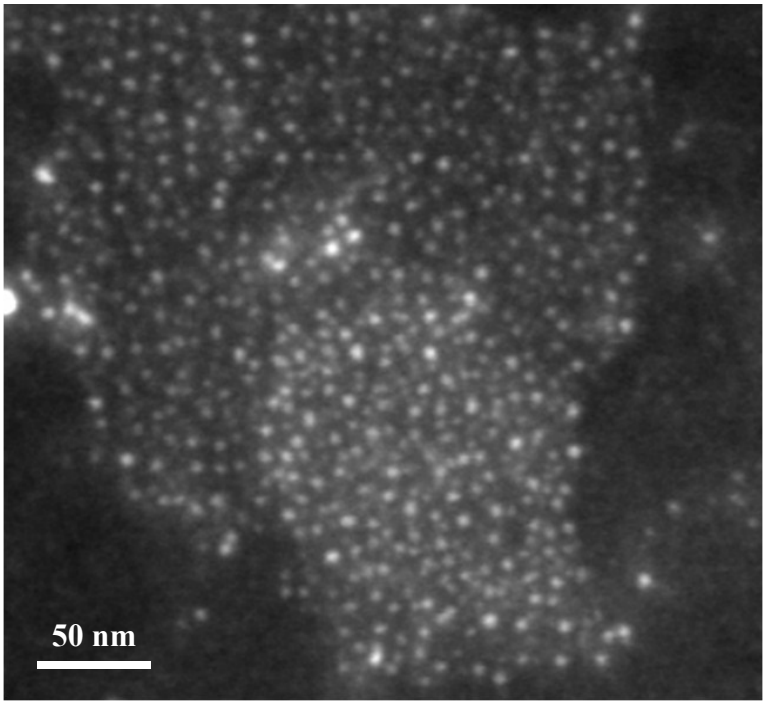


Figure S5. The XRD pattern of samples after purification in a mixture of sulfuric acid (98%) and nitric acid (70%; 3:1 v/v, 60mL).

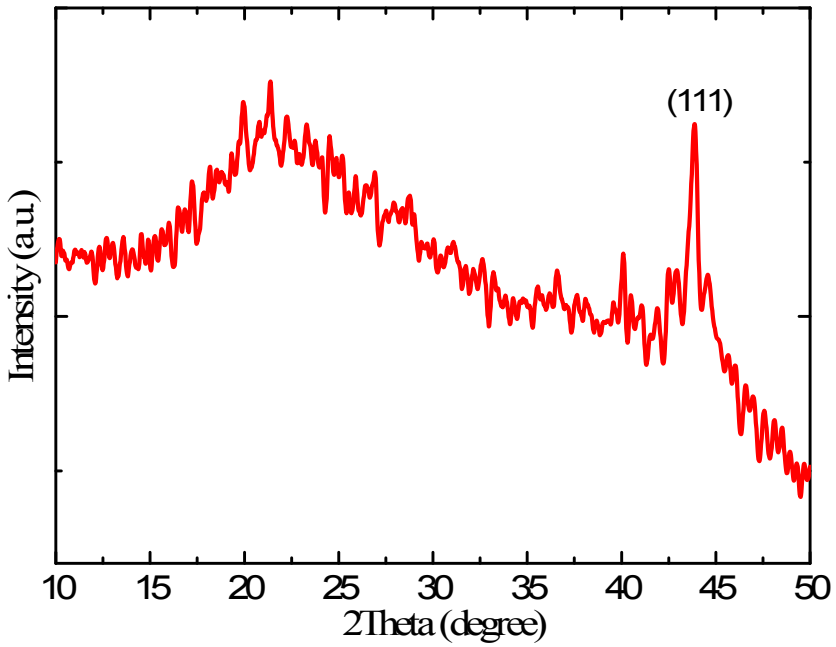


Figure S6. Color change with the increase of the laser irradiation time. Clearly, the color of the solution changes from opaque greyish to dark reddish brown and finally to transparent yellow.

1 2 3 4 5 6 7 8 9

Figure S7. FTIR spectrum of raw anthracite, bitumite, coke coal.

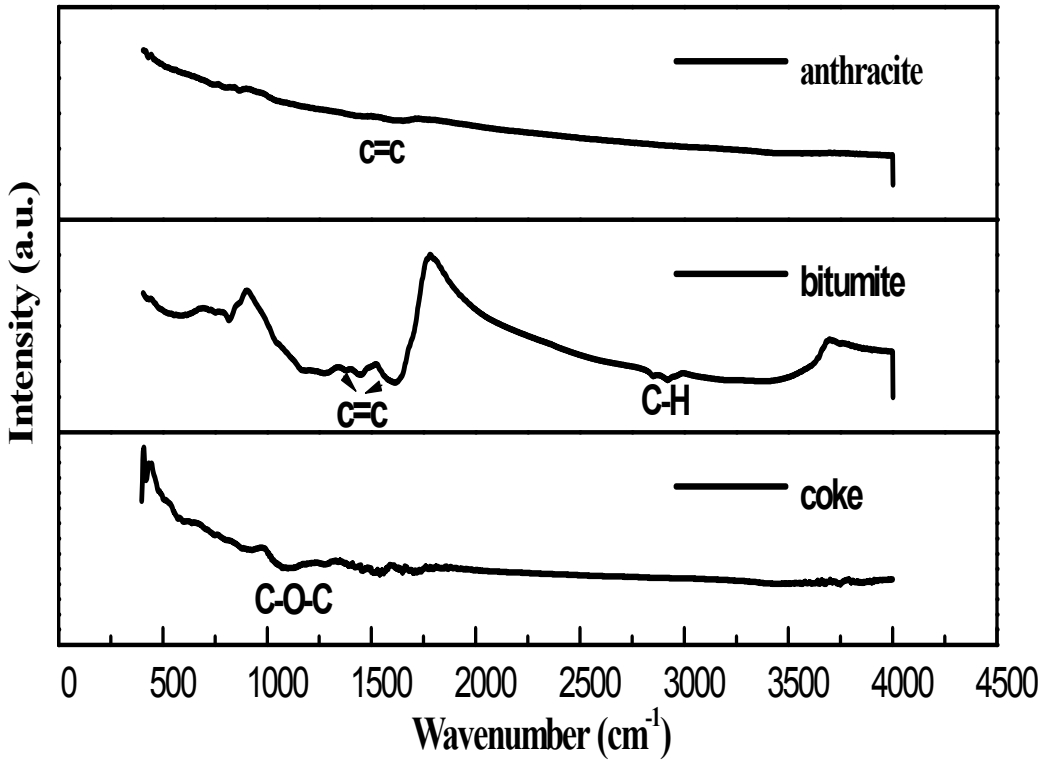
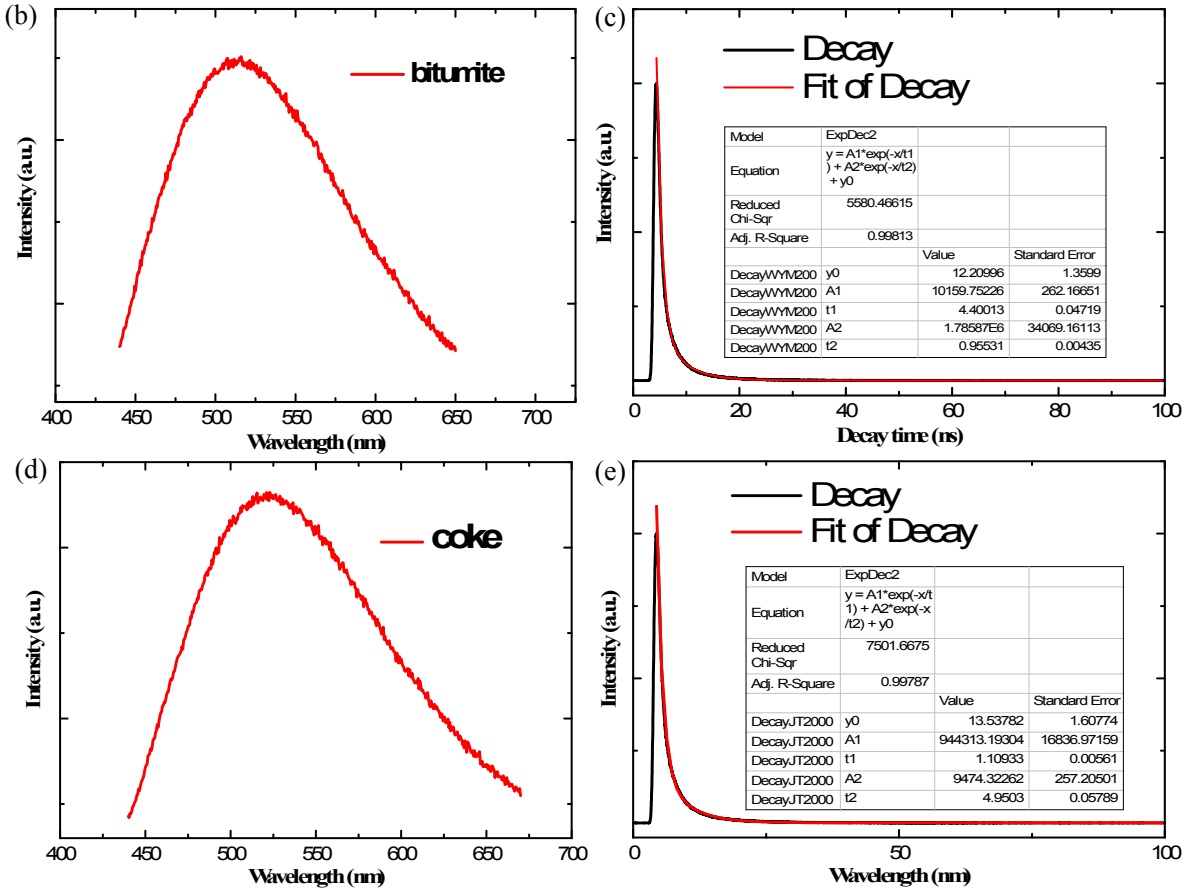


Figure S8. (a) Decay time of 1.84 ns for the nanodiamonds from anthracite coal. (b-c) PL emission and decay time of 0.96 ns for the nanodiamonds from bitumite. (d-e) PL emission and decay time of 1.11 ns for the nanodiamonds from coke.

(a)

Model	ExpDec2		
Equation	y = A1*exp(-x/t1) + A2*exp(-x/t2) + y0	anthracite	
Reduced Chi-Sqr	1936.57235		
Adj. R-Squar	0.99966		
		Value	Standard Err
Decay6	y0	18.78471	0.88559
Decay6	A1	27887.7990	503.12933
Decay6	t1	5.53149	0.02954
Decay6	A2	999205.981	13991.4565
Decay6	t2	1.84008	0.00783



Model	ExpDec2		
Equation	y = A1*exp(-x/t1) + A2*exp(-x/t2) + y0		
Reduced Chi-Sqr	5580.46615		
Adj. R-Square	0.99813		
		Value	Standard Error
DecayWYM200	y0	12.20996	1.3599
DecayWYM200	A1	10159.75226	262.16651
DecayWYM200	t1	4.40013	0.04719
DecayWYM200	A2	1.78587E6	34069.16113
DecayWYM200	t2	0.95531	0.00435

Model	ExpDec2		
Equation	y = A1*exp(-x/t1) + A2*exp(-x/t2) + y0		
Reduced Chi-Sqr	7501.6675		
Adj. R-Square	0.99787		
		Value	Standard Error
DecayJT2000	y0	13.53782	1.60774
DecayJT2000	A1	944313.19304	16836.97159
DecayJT2000	t1	1.10933	0.00561
DecayJT2000	A2	9474.32262	257.20501
DecayJT2000	t2	4.9503	0.05789

Figure S9. (a-b) Low magnification and size distribution of nanodiamonds synthesized from coal in water, inset showing corresponding optical graph and (c-d) the corresponding HRTEM image and SAED pattern.

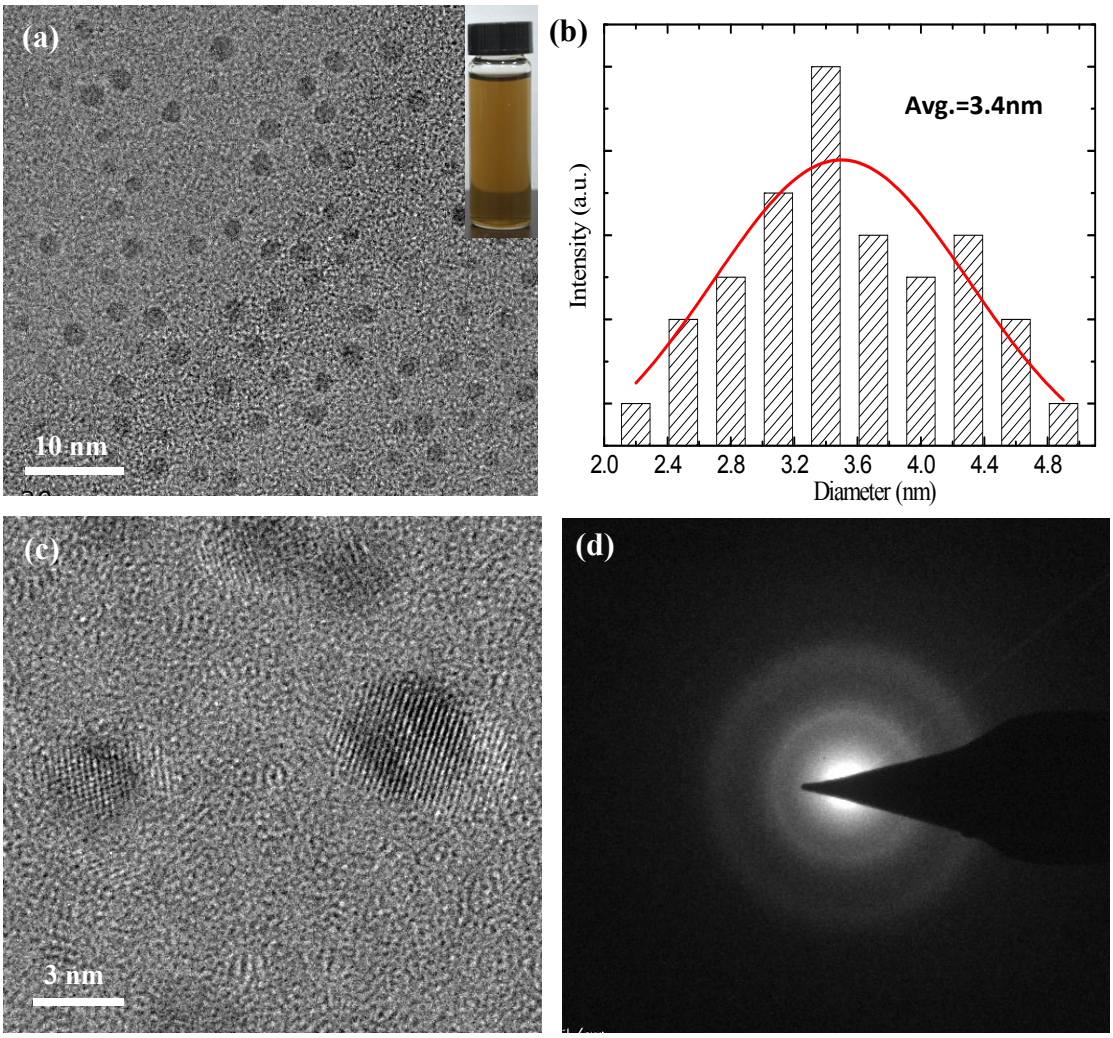


Figure S10. Luminescence emission spectra recorded at progressively longer excitation wavelength in different liquid. (a) Alcohol. (b) Water.

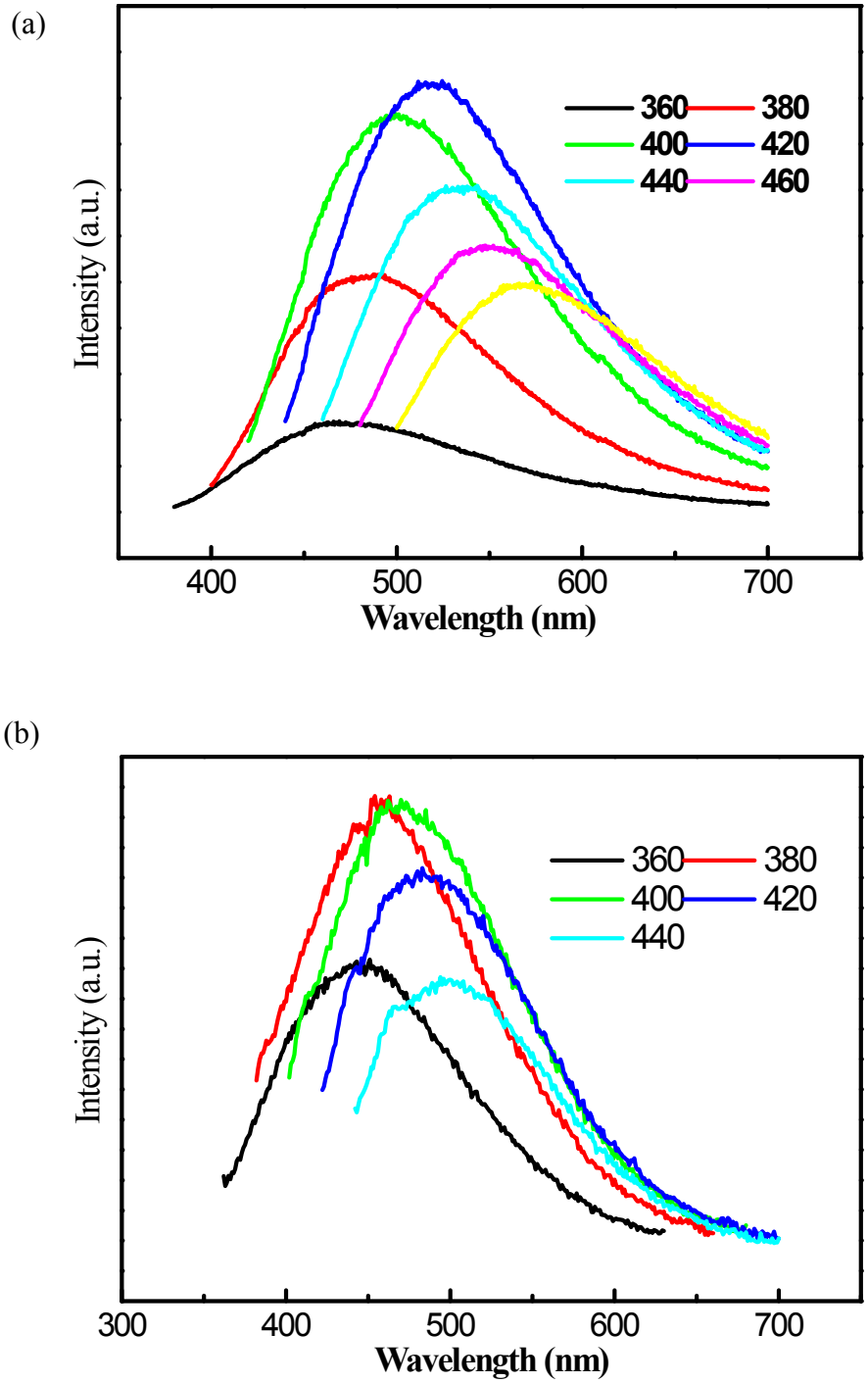
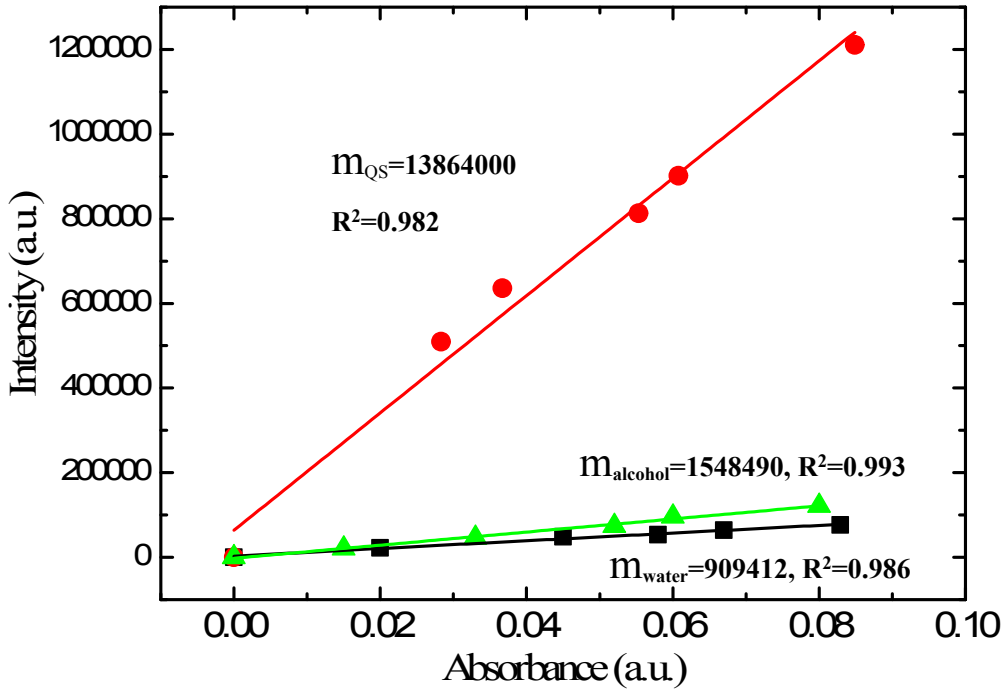


Figure S11. Quantum yield calculations. The quantum yield (Φ) of nanodiamonds is calculated by comparing the integrated photoluminescence intensities (excited at 400 nm) and the absorbance values at 400 nm of the nanodiamonds with the reference quinine sulfate. The quinine sulfate (QS) (literature Φ = 0.54) was dissolved in 0.1 M H_2SO_4 (refractive index (η) of 1.33) and the nanodiamonds was dissolved in ultra pure water (η = 1.33) and in ethanol (η = 1.36).



The quantum yield was calculated using the below equation:

$\Phi x = \Phi_{QS} (m_x / m_{QS}) (\eta^2_x / \eta^2_{QS})$

Where Φ is the quantum yield, m the slope, η the refractive index of the solvent, QS for the quinine sulfate and X for the sample. The quantum yield of the nanodiamonds synthesized in alcohol and water are calculated to be 0.06 and 0.035.