Supporting Information

Glass-confined Carbon Dots: Transparent Afterglow Material with Switchable TADF and RTP

Pengwei Wang,‡[a] Peixi Cong,‡[b] Jiachen Chen,[a] Huaiyuan Cao,[a] Qi Yue,[a] Zixiao Xue,[a] Junji Zhang,[c] Long Zhang,[a] Robert S. Weatherup,*[b] Jiabin Cui*[d] and Jin He*[a]

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Results and Discussion

Optical characterization of the 500-CDs-NG

The CDs-NG-500 was prepared by sol-gel method. These prepared monolithic CDs-NG-500 are inherently suitable for optical device applications owing to their high transparency at the visible range, as revealed by UV–vis transmittance spectra.

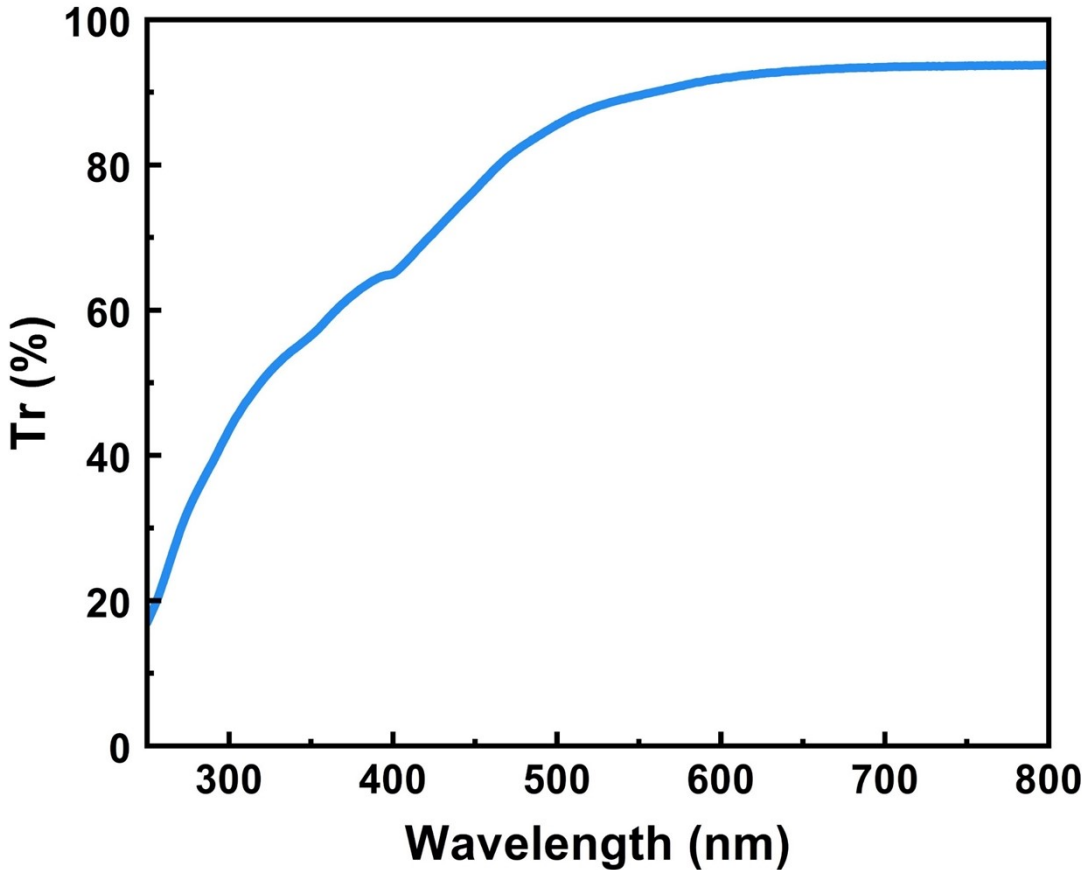

Figure S1. UV-Vis transmittance spectra of CDs-NG-500.

Structural characterization of the CDs-NG-500

The prepared CDs-NG-500 is the nanoporous glass.

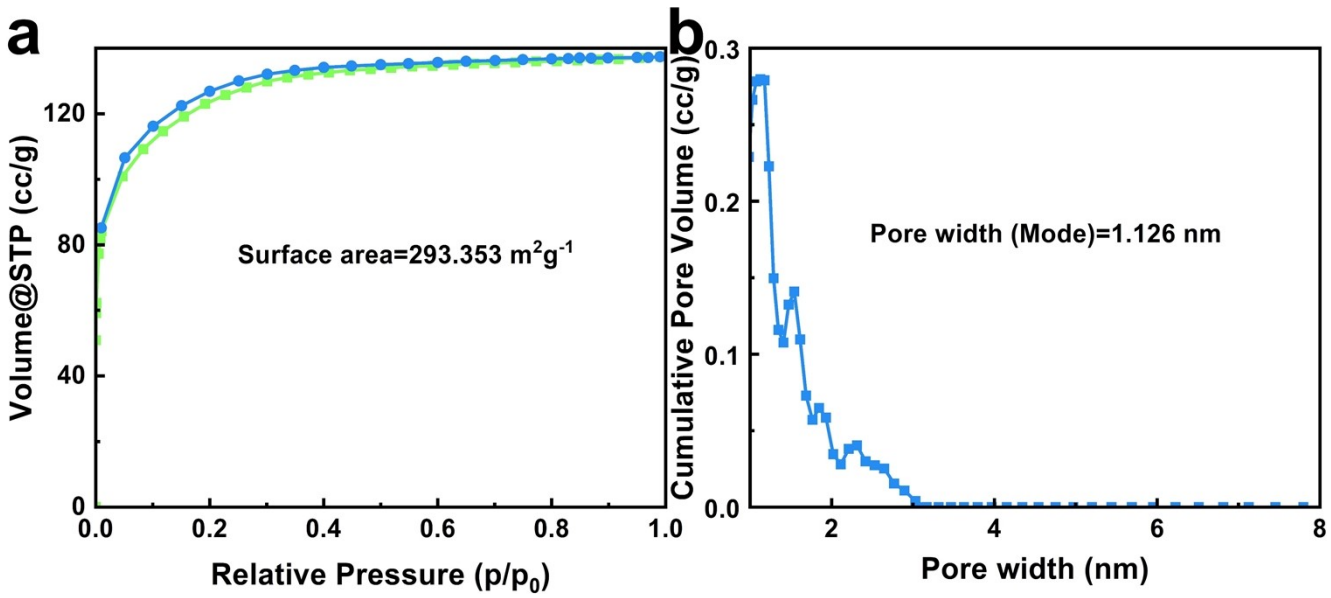

Figure S2. (a) Adsorption-desorption isotherm of N_2. (b) Pore size distribution.

Structural characterization of the CDs stripped from CDs-NG-500

The average size of CDs stripped from CDs-NG-500 is around 4.4 nm.

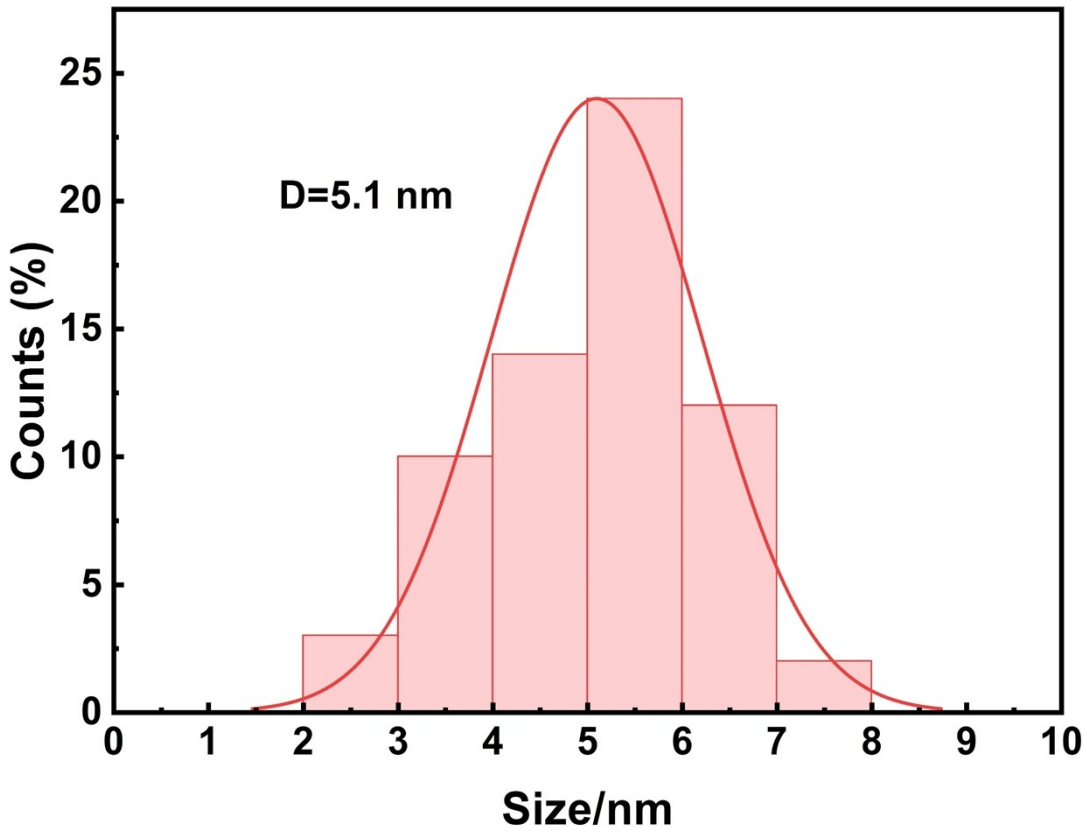

Figure S3. The size distribution histograms of the CDs stripped from CDs-NG-500.

Structural characterization of the xerogel

The xerogel was prepared by sol-gel method. The desired amount of aluminum lactate is dissolved in a moderate amount of deionized water by stirring, and the corresponding amount of TEOS is dispersed in a moderate amount of isopropyl alcohol by the same method. The two clarified solutions being mixed continue to be stirred on the stirring table. After being stirred for 8-10 h, the mixture was transferred to a circular mould, then left at ambient temperature for 12 hours. The circular moulds were transferred to an oven at 50 °C, and the oven was slowly heated to 100 °C over three days. Then the xerogel was obtained.

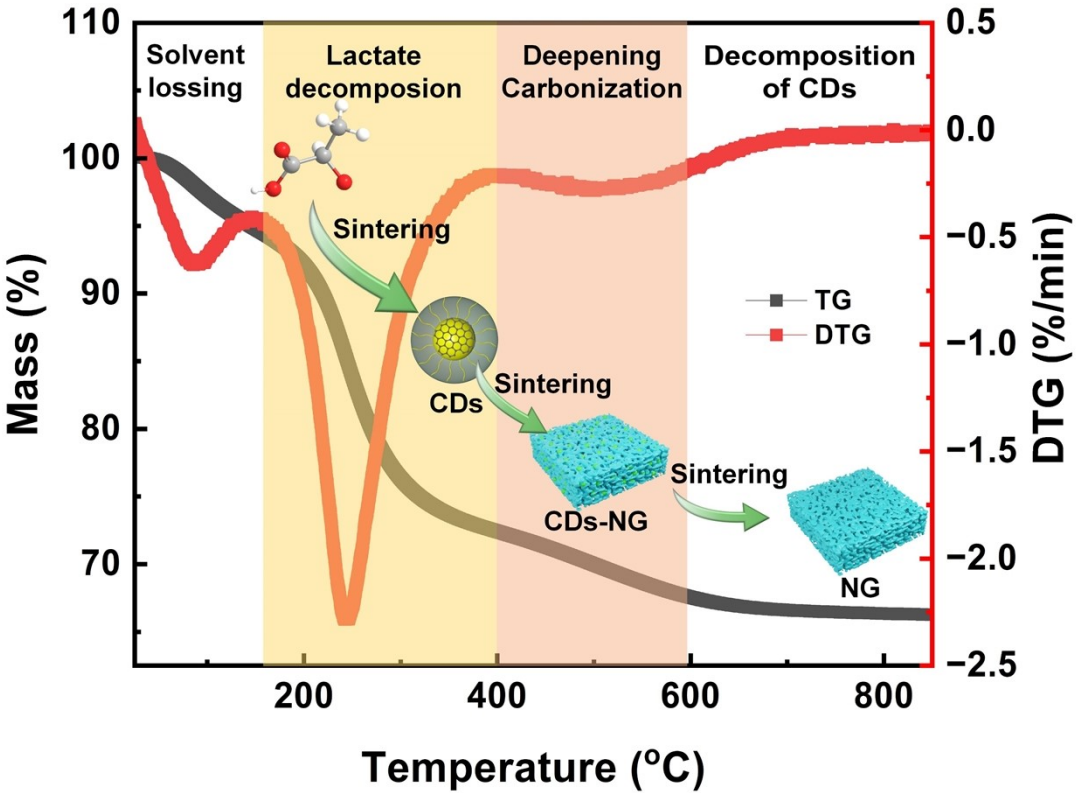

Figure S4. TG and DTG spectra of the xerogel.

Morphological characterization of the CDs-NG-500

Square glass can also be fabricated by sol-gel.

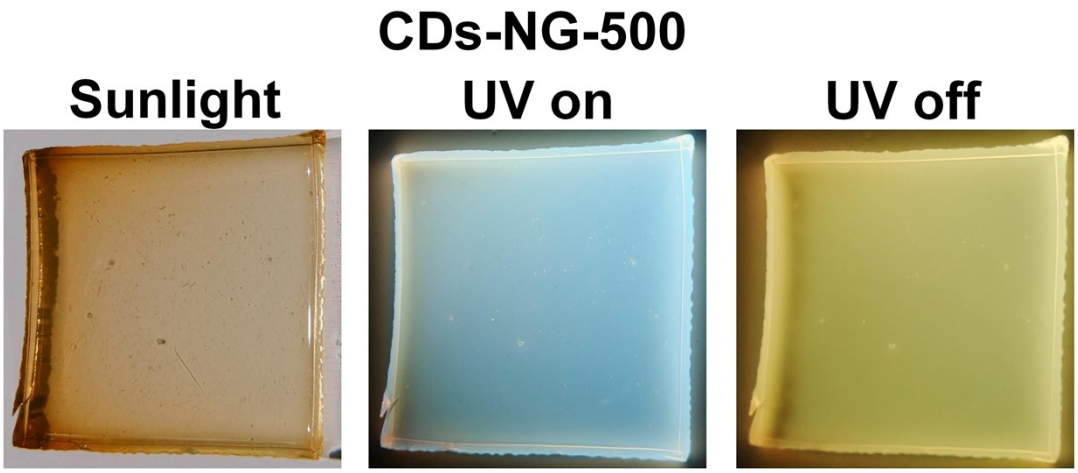

Figure S5. Images captured in Sunlight, under illumination with a 365 nm UV lamp, and in the dark after UV illumination ceases.

Optical characterization of the CDs-NG-550 and CDs-NG-600

The CDs-NG-550 and CDs-NG-600 were prepared by sol-gel method. These prepared monolithic are inherently suitable for optical device applications owing to their high transparency at the visible range, as revealed by UV–vis transmittance spectra.

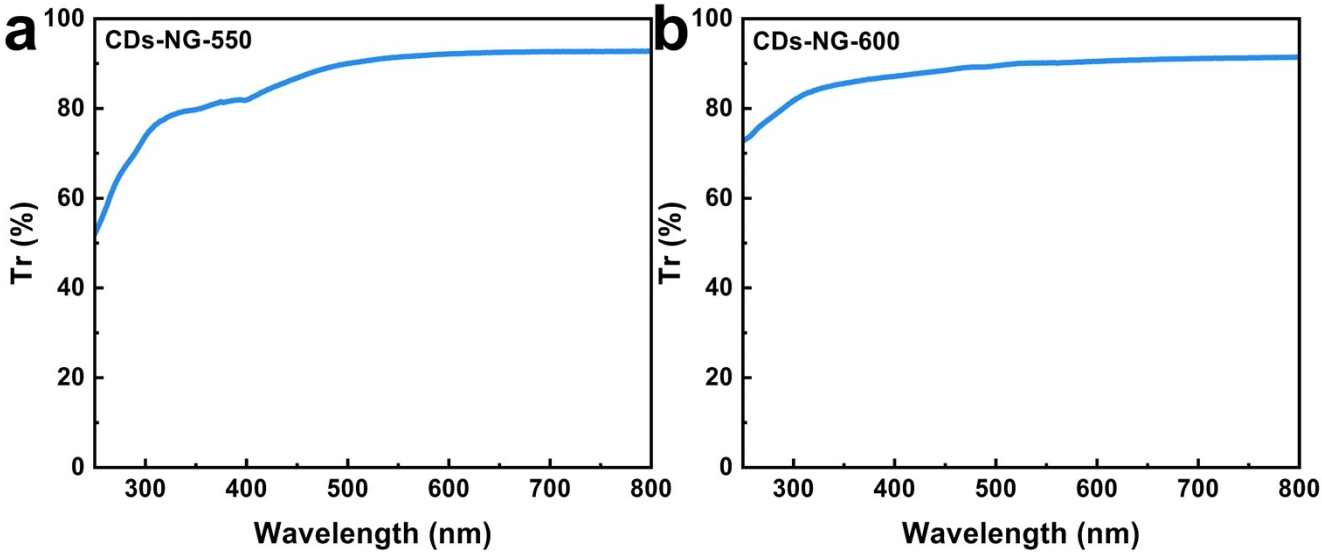

Figure S6. UV-Vis transmittance spectra of CDs-NG-550 and CDs-NG-600.

Structural characterization of the CDs-NG-550 and CDs-NG-600

The prepared CDs-NG-550 and CDs-NG-600 are the nanoporous glass.

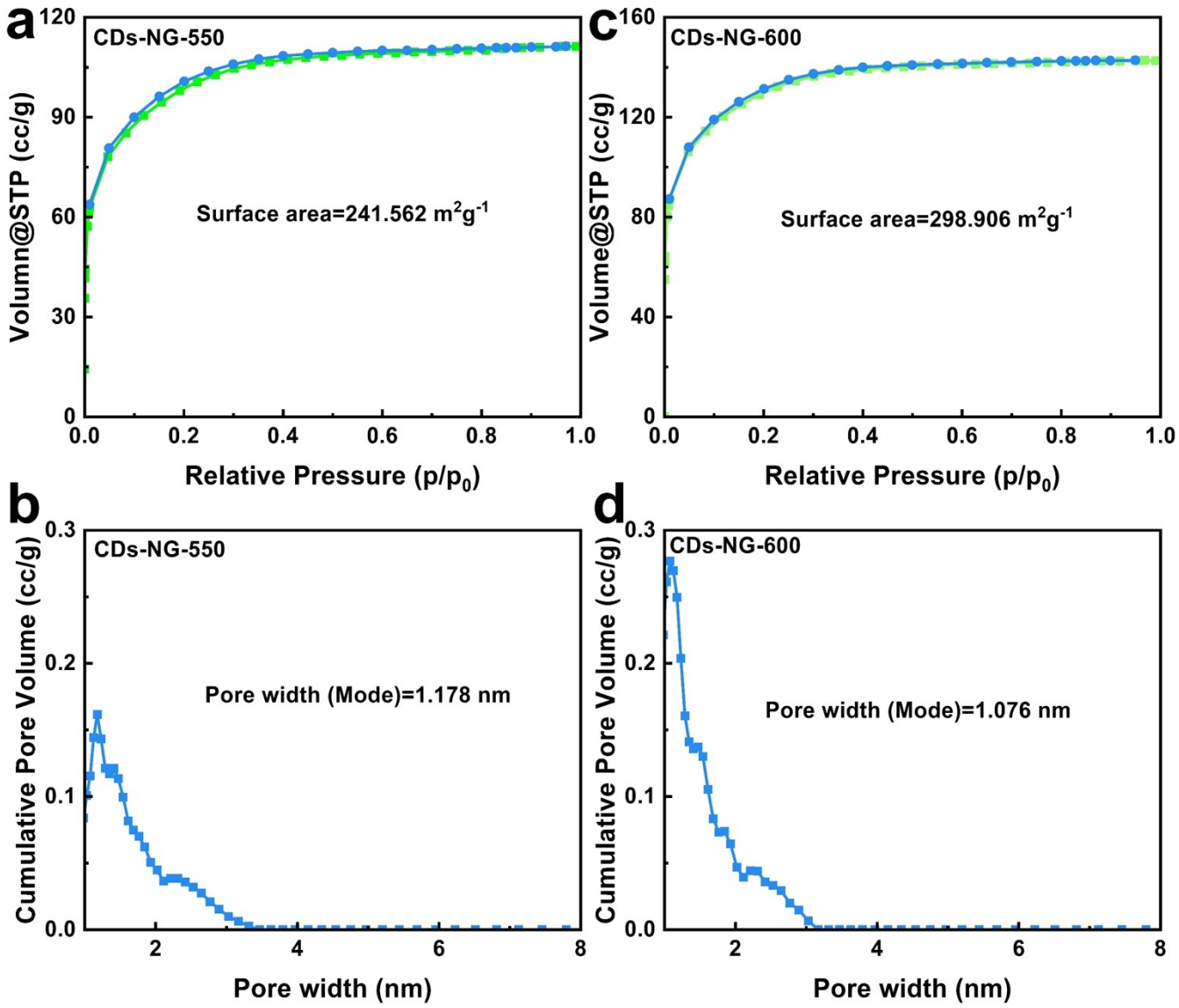

Figure S7. (a) Adsorption-desorption isotherm of N_2 of the CDs-NG-550. (b) Pore size distribution of the CDs-NG-550. (c) Adsorption-desorption isotherm of N_2 of the CDs-NG-600. (d) Pore size distribution of the CDs-NG-600.

Structural characterization of the CDs exfoliated from CDs-NG-550 and CDs-NG-600

TEM revealed well-dispersed CDs with average particle sizes of 4.2 nm and 3.4 nm, respectively.

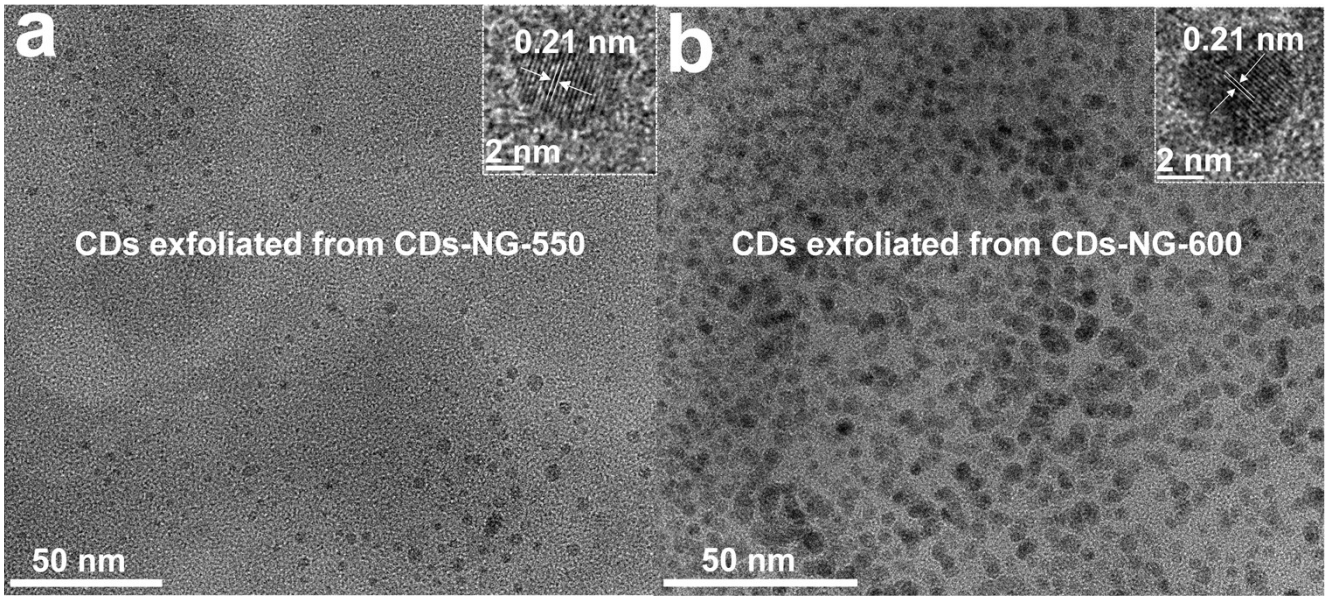

Figure S8. (a) TEM, HR-TEM images of the CDs exfoliated from CDs-NG-550. (b) TEM, HR-TEM images of the CDs exfoliated from CDs-NG-600.

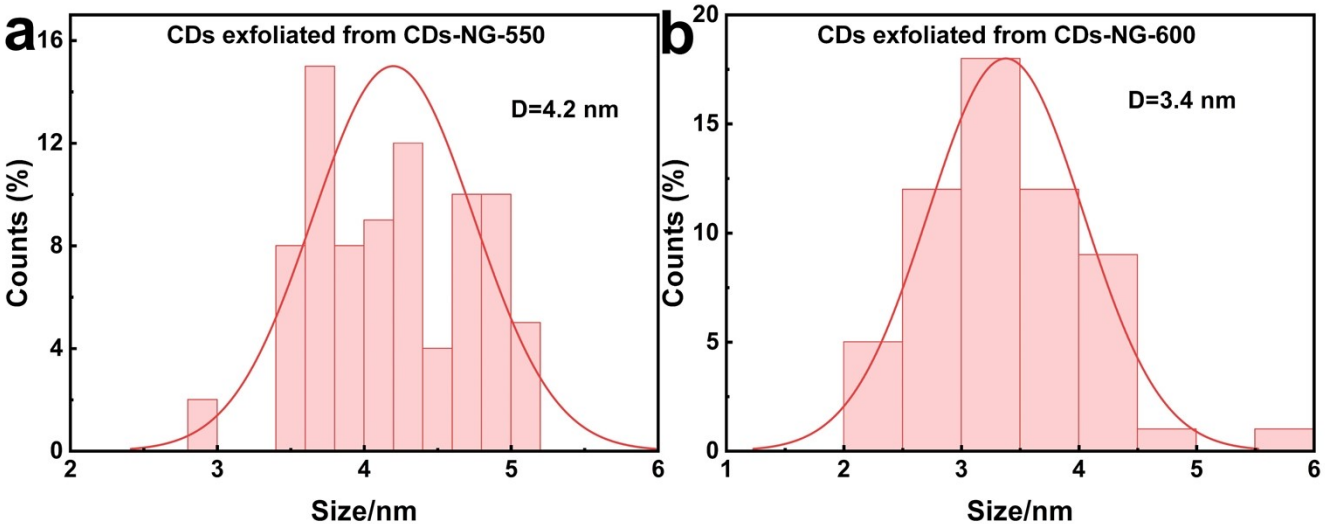

Figure S9. (a) The size distribution histograms of the CDs exfoliated from CDs-NG-550. (b) The size distribution histograms of the CDs exfoliated from CDs-NG-600.

Optical characterization of the CDs exfoliated from CDs-NG-550 and CDs-NG-600

As the sintering temperature increases, the emission center of the CDs blue-shifts from 450nm to 390nm.

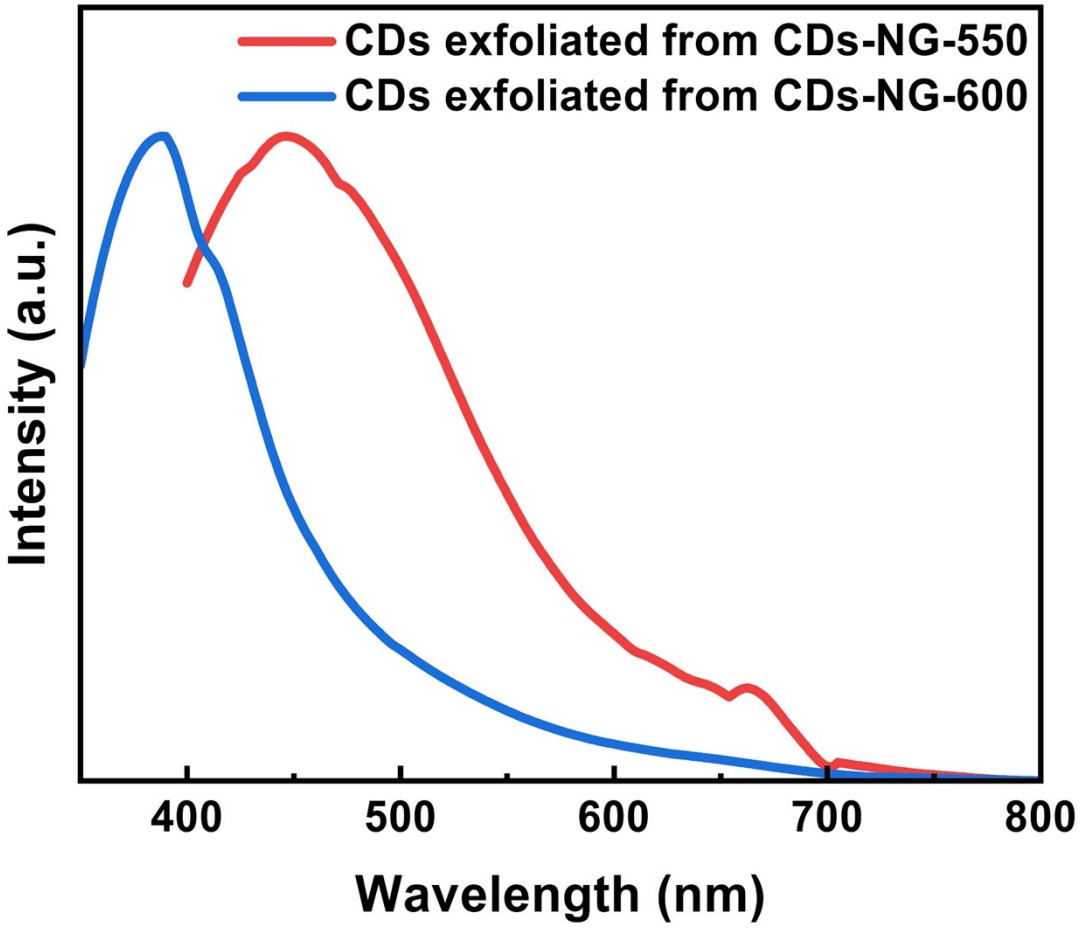

Figure S10. The PL spectra of the CDs exfoliated from CDs-NG-550 and CDs-NG-600.

Optical characterization of the CDs-NG

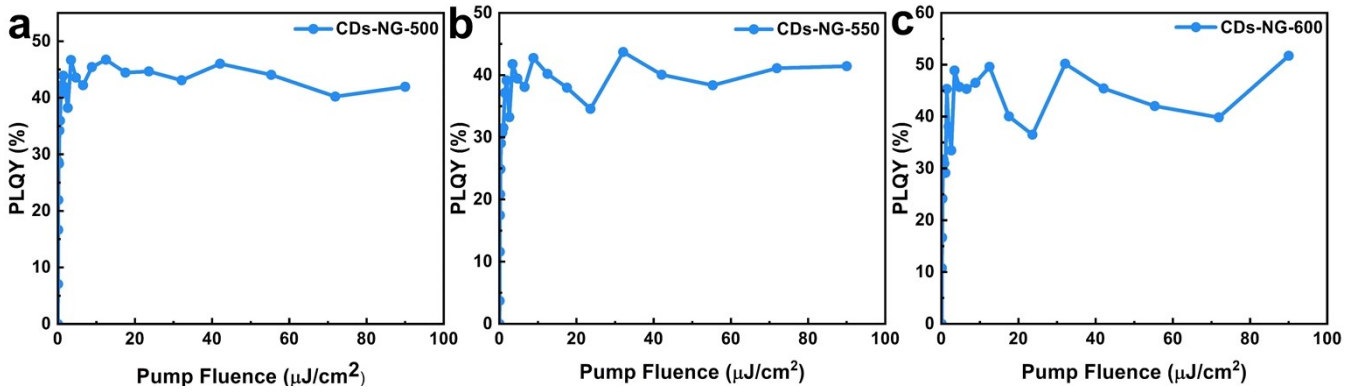

Figure S11. The PLQY of the CDs-NG-500, CDs-NG-550, and CDs-NG-600.

Structural characterization of the 0.01% Pb-CDs-NG and 1.0% Pb-CDs-NG

The prepared 0.01% Pb-CDs-NG and 1.0% Pb-CDs-NG are the nanoporous glass.

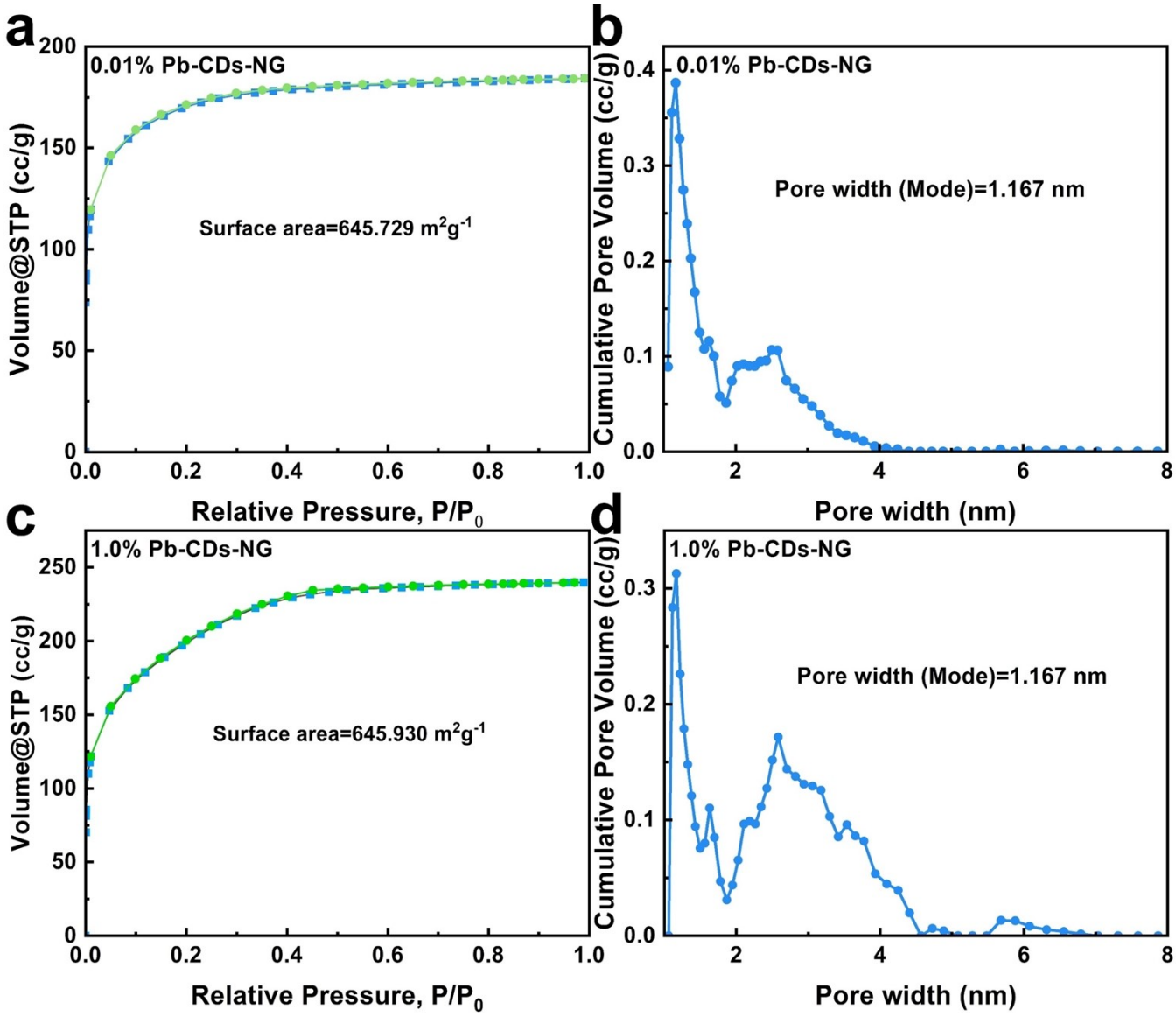

Figure S12. (a) Adsorption-desorption isotherm of N_2 of the 0.01% Pb-CDs-NG. (b) Pore size distribution of the 0.01% Pb-CDs-NG. (c) Adsorption-desorption isotherm of N_2 of the 1.0% Pb-CDs-NG. (d) Pore size distribution of the 1.0% Pb-CDs-NG.

Optical characterization of the 0.01% Pb-CDs-NG

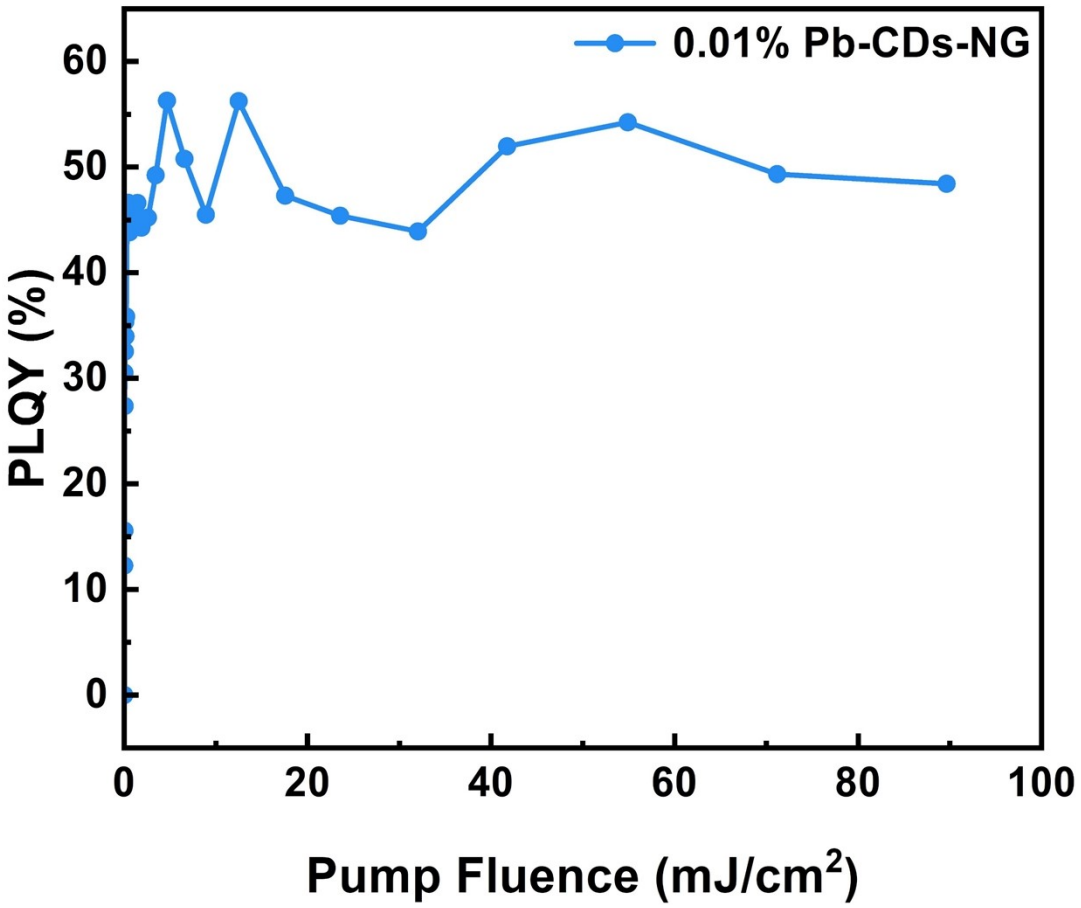

Figure S13. The PLQY of the 0.01% Pb-CDs-NG.

Optical characterization of the 0.01% Pb-CDs-NG-550

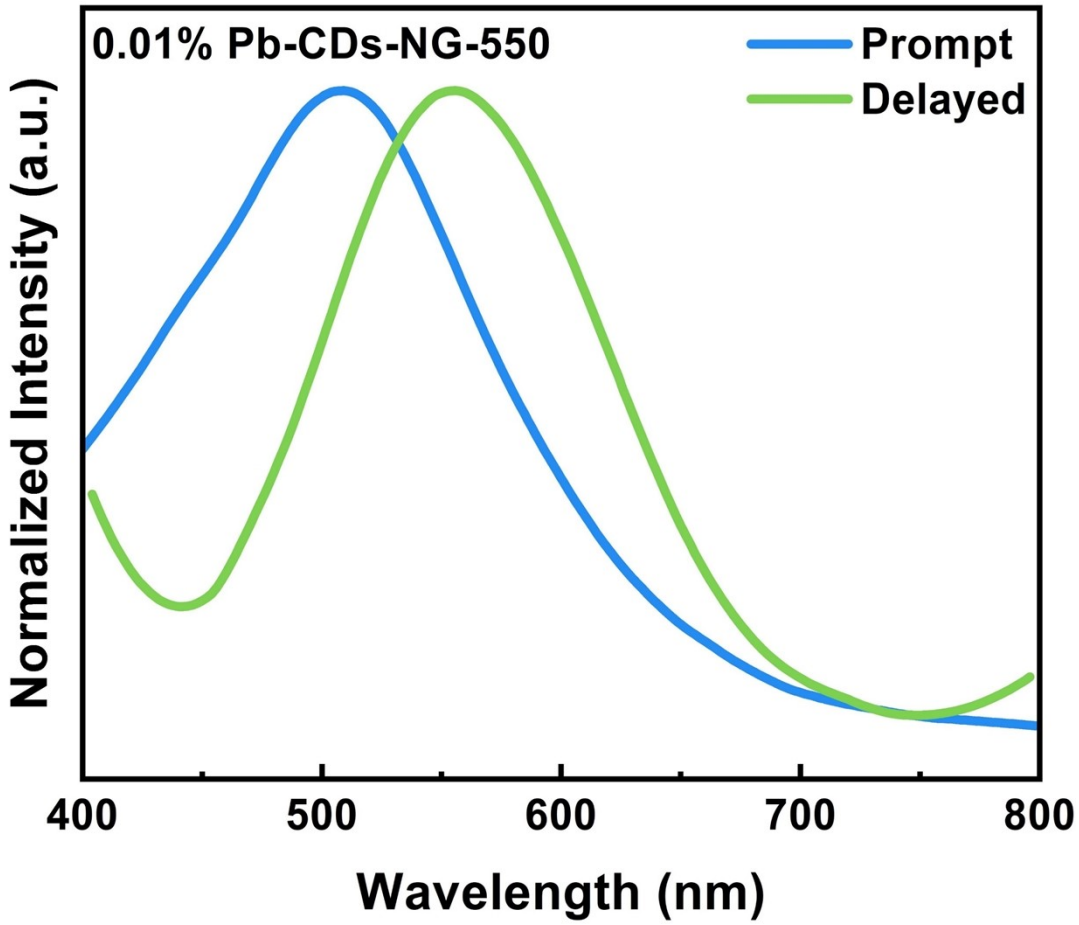

Figure S14. Prompt (blue line) and delayed (green line) spectra of 0.01% Pb-CDs-NG-550, excited under 360 nm.

Structural characterization of the Pb-NG

A distinct XPS spectrum of Pb 4f is observable.

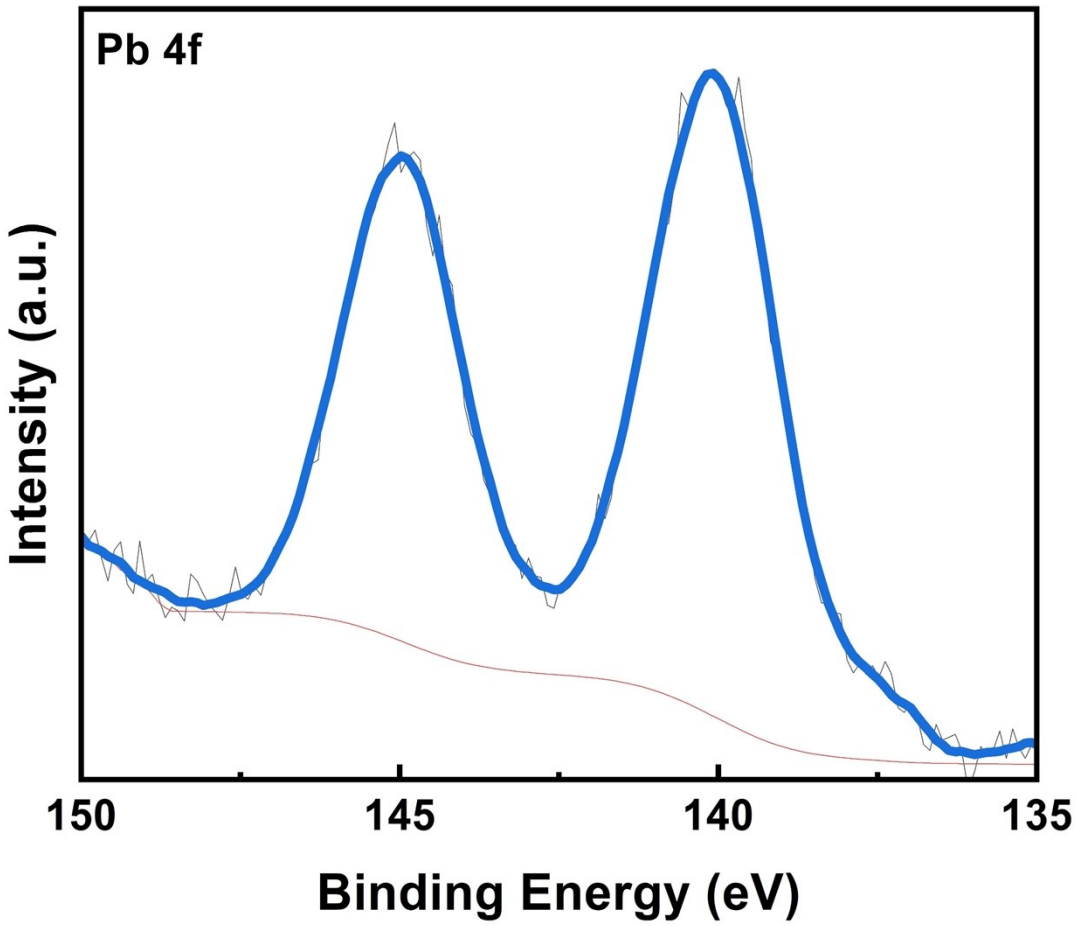

Figure S15. XPS spectra of Pb 4f of 1.0% Pb-NG.

Structural characterization of the Pb-CDs-NG

Table S1. ICP of the supernatant and the precipitate.

Sample	Element	Element Content (μg/L)
supernatant	Pb	55767.38
precipitate	Pb	254.97

Table S2. EXAFS of the 1.0% Pb-NG and 1.0% Pb-CDs-NG.

Sample	Scattering Path	R (Å)	σ^2(Å^2)	ΔE_0 (eV)	R-factor
1.0% Pb-NG	Pb-O	2.44 (2)	0.034 (4)	-5 (2)	0.0171
1.0% Pb-CDs-NG	Pb-O	2.40 (2)	0.030 (4)	-5 (2)	0.0167

Extended X-ray absorption fine structure (EXAFS) measurements were performed at the Beamline B18, Diamond Light Source (DLS), UK. The storage beam energy was 3 GeV and the ring current was 250 mA. Data were collected at the Pb LIII-edge (13035 eV) in transmission mode using ion chambers with a fast scanning (QEXAFS) Si (111) double-crystal monochromator. All samples were pressed into pellets, with the amount of sample optimised for a suitable edge step. Pb foil references were measured simultaneously for each scan for the energy reference. Three scans were taken for each sample and the spectra were averaged for better signal-to-noise ratio. EXAFS data reduction and analysis were performed using the Demeter package (Athena and Artemis).