

**A Universal Strategy for Preparing Carbon Quantum Dots Based Composites
with Blue and Green Afterglow Luminescence**

*Yaqing Zhu¹, Jianliang Bai¹, Zhujun Huang, Guojun Yuan, Lu Zhang, Xinyu Wang, Lili Ren**

School of Chemistry and Chemical Engineering, Southeast University, Nanjing, 211189, China

[*] Corresponding author. E-mail address: liliren@seu.edu.cn (L. Ren).

[¹] These authors contributed equally to this work.

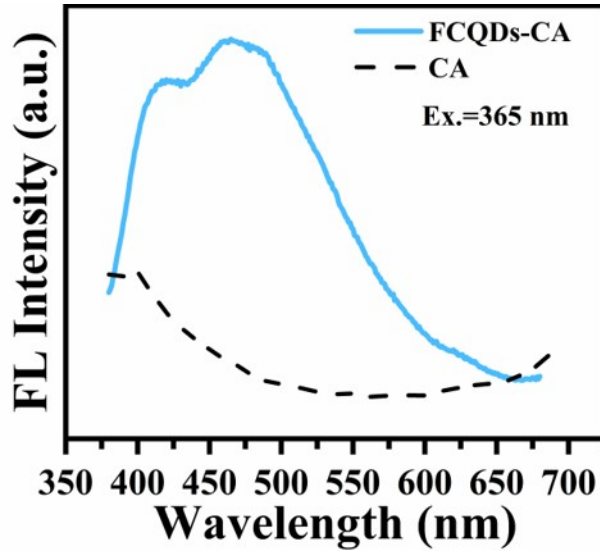


Fig. S1. FL emission spectra of FCQDs and CA at 365 nm excitation under ambient conditions.

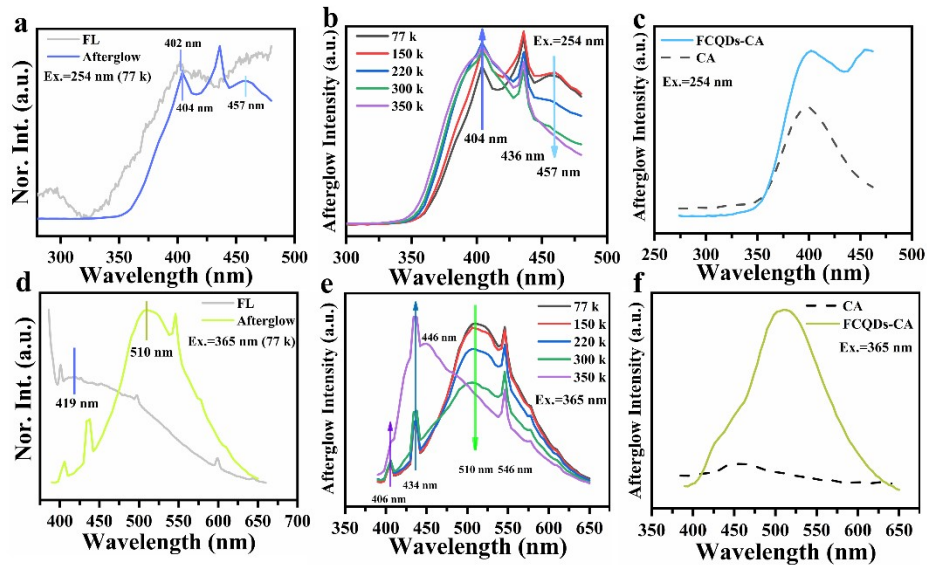


Fig. S2. (a) and (d) The normalized FL and afterglow emission spectra of FCQDs-CA powder at 254 nm and 365 nm excitation under 77 k, respectively. (b) and (e) Afterglow emission spectra of FCQDs-CA powder at different temperatures under 254 nm and 365 nm excitation, respectively. (c) and (f) Afterglow emission spectra of FCQDs-CA powder and CA under 254 nm and 365 nm excitation under ambient conditions, respectively.

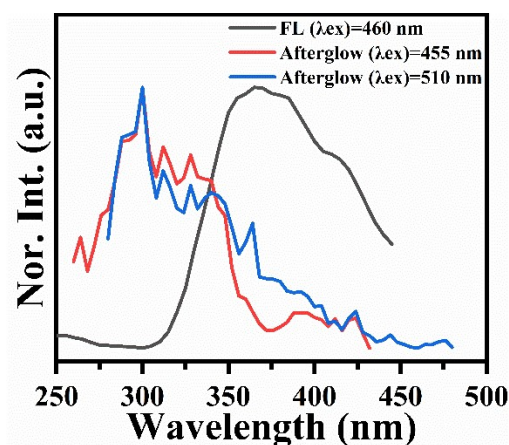


Fig. S3. FL (black line) and afterglow (red and blue line) excitation spectra of FCQDs-CA.

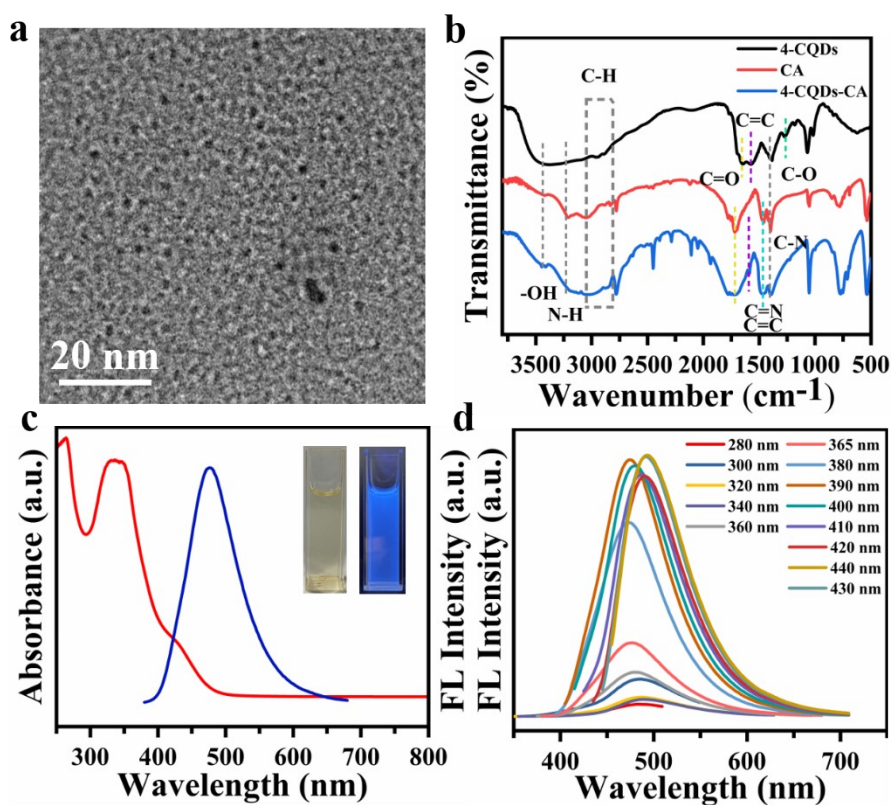


Fig. S4. (a) TEM image of 4-CQDs. (b) FT-IR spectra of 4-CQDs (black line), CA (red line) and 4-CQDs-CA (blue line). (c) UV/vis absorption (red line), FL emission (blue line) spectra of 4-CQDs in aqueous solution, and inset (a) photographs of this aqueous solution under day light (left) and UV light (365 nm) (right). (d) FL spectra of 4-CQDs dispersed in H₂O under different excitation wavelengths.

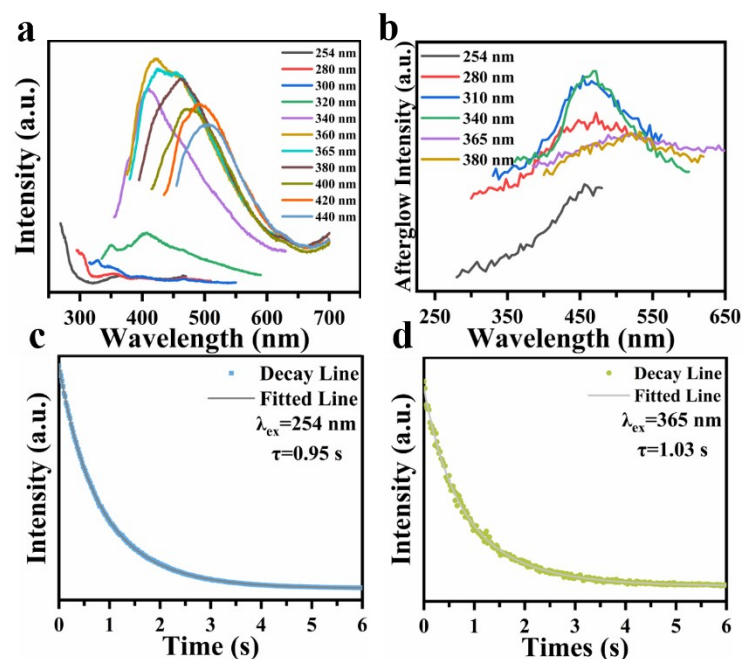


Fig. S5. (a) FL spectra of 4-FCQDs-CA under different excitation wavelengths. (b) Afterglow emission spectra of 4-FCQDs-CA powder under different excitation wavelengths. RTP decay spectra and fitted curve (blue line) and (green line) of 4-FCQDs-CA powder at 254 nm (c) and 365 nm (d) excitation under ambient conditions, respectively.

Table S1. The contents of C, N and O in FCQDs determined by XPS.

Name	C Content (%)	N Content (%)	O Content (%)
FCQDs	66.49	15.58	17.93

Table S2. The contents of each type of group in C 1s of FCQDs determined by the integration of deconvoluted XPS.

Peak (eV)	284.80	285.54	288.40
Name	C-C	C-N	C=N/C=O
Content (%)	12.94	72.67	14.39

Table S3. The contents of each type of group in N 1s of FCQDs determined by the integration of deconvoluted XPS.

Peak (eV)	398.93	399.61	400.10
Name	C-N=C	C-N	N-H
Content (%)	12.31	24.67	63.02

Table S4. The contents of each type of group in O 1s of FCQDs determined by the integration of deconvoluted XPS.

Peak (eV)	531.68	532.98
Name	C=O	C-O
Content (%)	64.67	35.33

Table S5. Fitting parameters of the afterglow decay curves of FCQDs-CA under excitation at 254 nm and 365 nm.

Wavelength h	τ_1 (s)	A1 (%)	τ_2 (s)	A2 (%)	τ_{avg} (s)	χ^2
254 nm	0.475	31.1	1.21	68.9	1.10	0.982
365 nm	0.643	37.3	1.40	62.7	1.24	0.999

Table S6. The lifetime and afterglow of different matrices

Matrix	Lifetime	Afterglow
Biuret [1]	1.06 s	green
Polyurethane [2]	8.7 ms	green
Silica gel [3]	1.8 s	green
NaCl [4]	314 ms	green
Boric acid [5]	0.2 s - 2.3 s	blue, green, green-yellow and orange
CA [this work]	1.24 s	blue/green

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