Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Activating Room Temperature Phosphorescence from Organic Materials by Synergistic Effects

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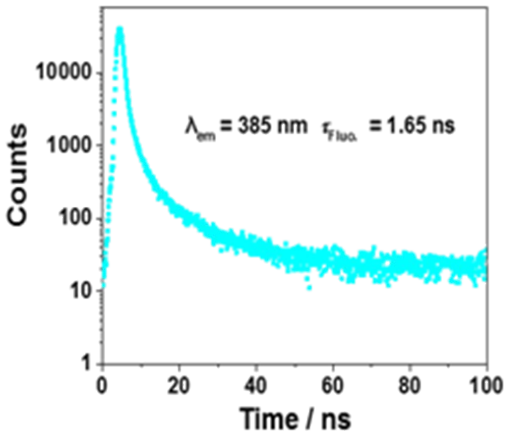

Figure S1. Fluorescence decay profile of Zn-CDs-LDHs.

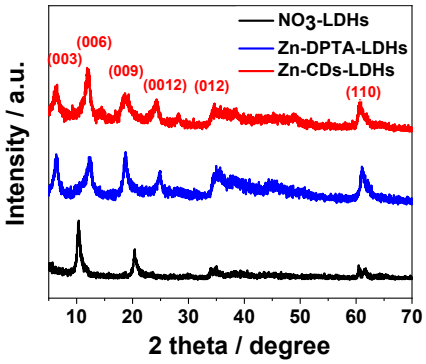

Figure S2. XRD patterns of NO_3-LDHs, Zn-DTPA-LDHs and Zn-CDs-LDHs.

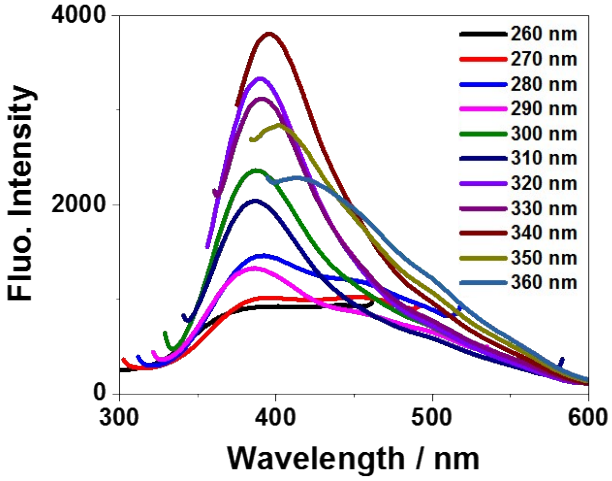

Figure S3. Fluorescence spectra of Zn-CDs-LDHs with different excitation wavelengths.

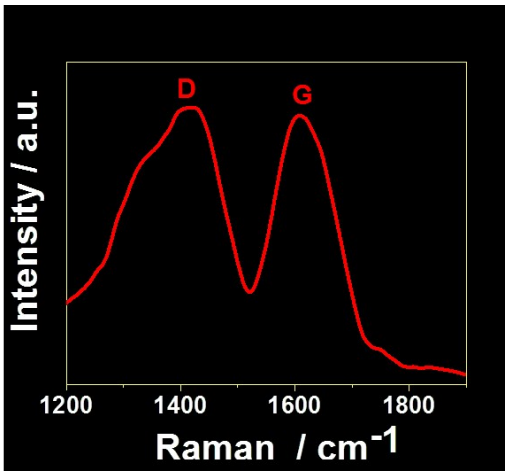

Figure S4. Raman spectrum of Zn-CDs@ha.

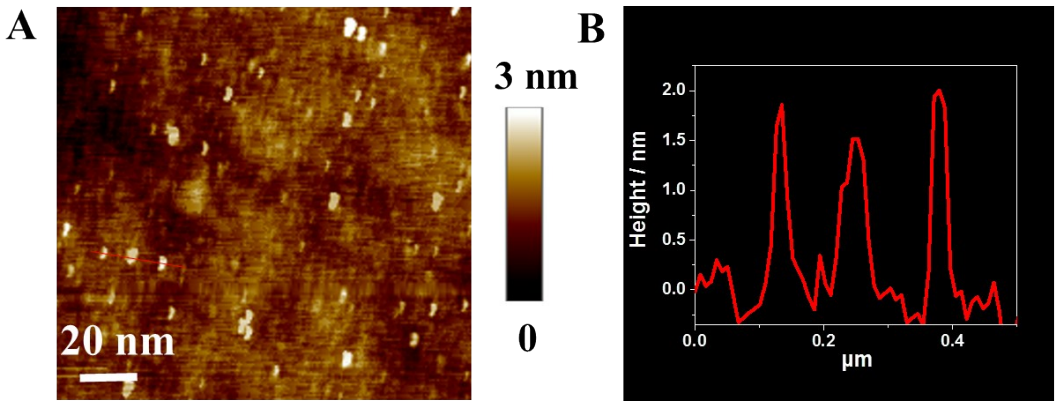

Figure S5. AFM image of Zn-CDs@dc on a Si substrate. (A) Height profile along the red line in (B).

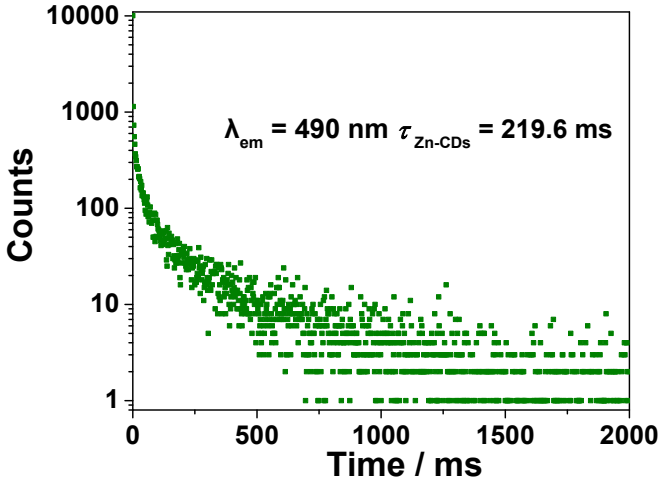

Figure S6. Phosphorescence decay profile of Zn-CDs.

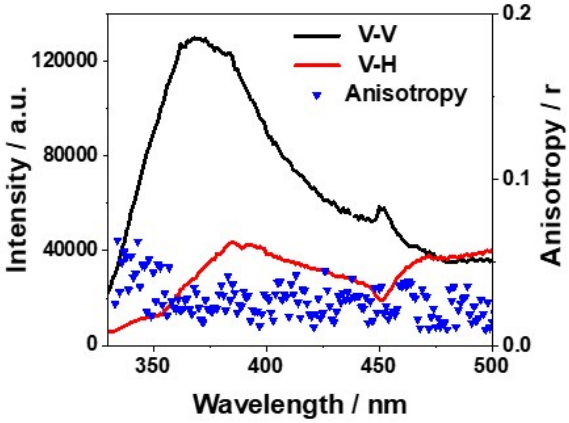

Figure S7. Polarized fluorescence profiles in the VV, VH modes and anisotropic value (*r*) for Zn-CDs deposited on quartz substrate.

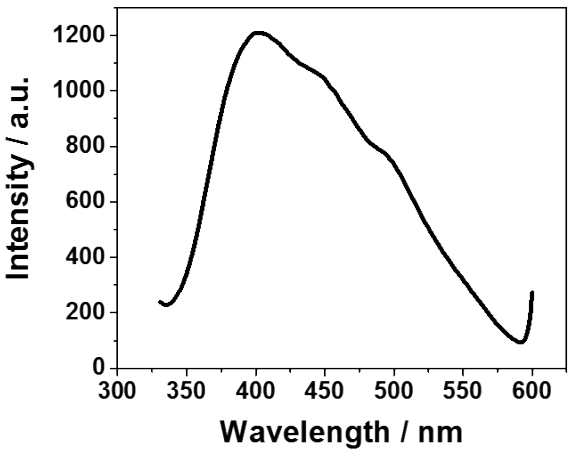

Figure S8. Fluorescence spectrum of Zn-CDs.

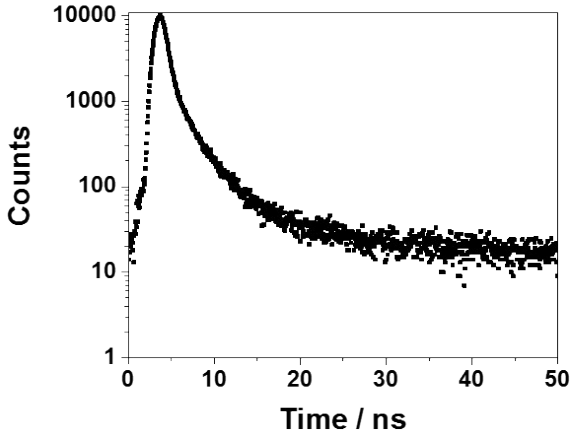

Figure S9. Fluorescence decay profile of Zn-CDs.

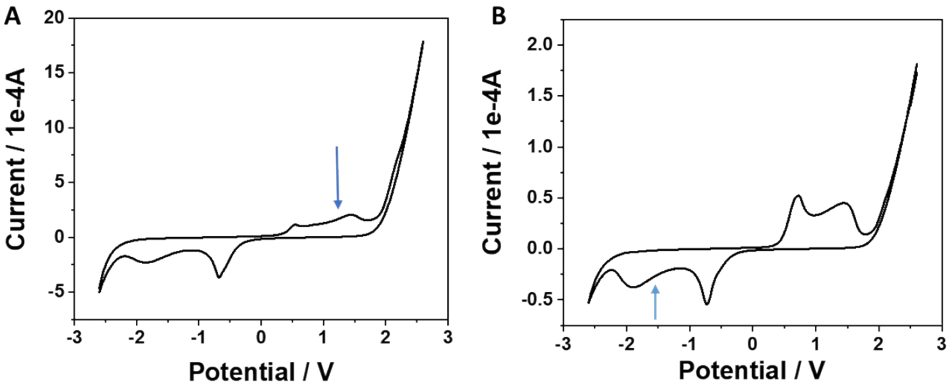

Figure S10. The cyclic voltammogram curves of Zn-CDs-LDHs (A) the positive scanning and (B) the negative scanning.

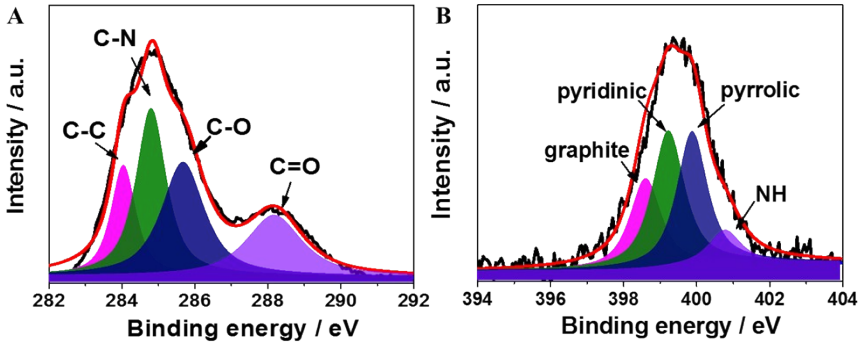

Figure S11. XPS spectra of Zn-CDs-LDHs: (A) C 1s and (B) N 1s.

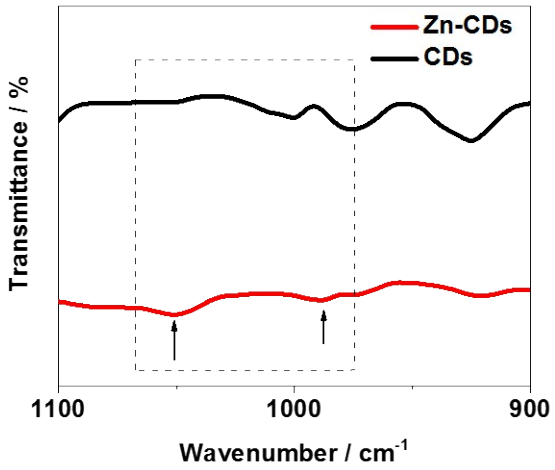

Figure S12. Amplified FTIR spectra of Zn-CDs and CDs.

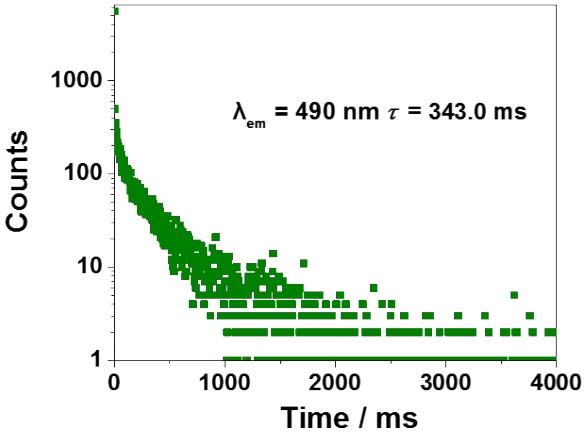

Figure S13. Phosphorescence decay profile of CDs-LDHs.

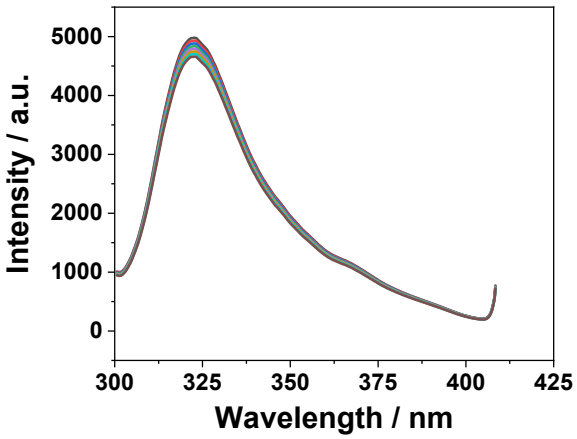

Figure S14. The fluorescence emission spectra of the Zn-CDs-LDHs recorded in 90 min.

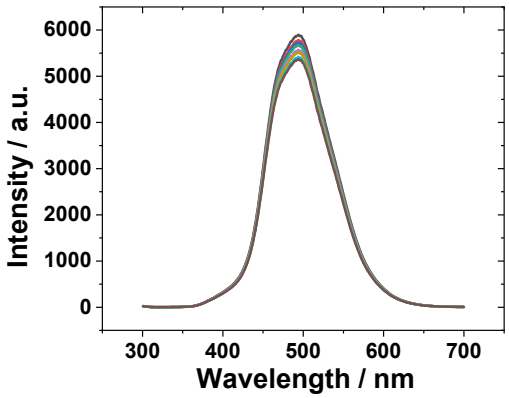

Figure S15. The phosphorescence emission spectra of the Zn-CDs-LDHs recorded in 90 min.

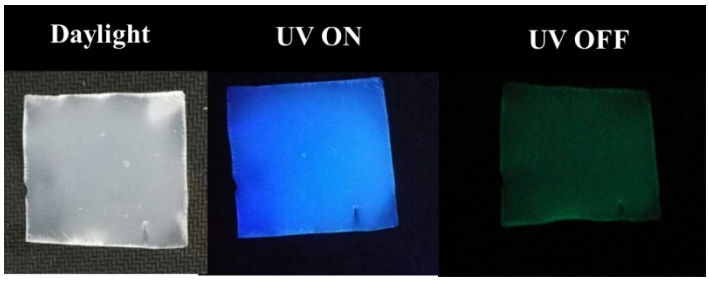

Figure S16. Photographs of Zn-CDs-LDHs/PVA film under daylight, and irradiation with 365 nm UV lamp on and off.

Figure S17. Security protection applications.

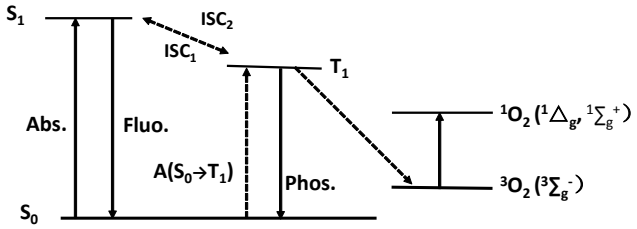

Figure S18. Mechanism diagram for optical oxygen quenching.

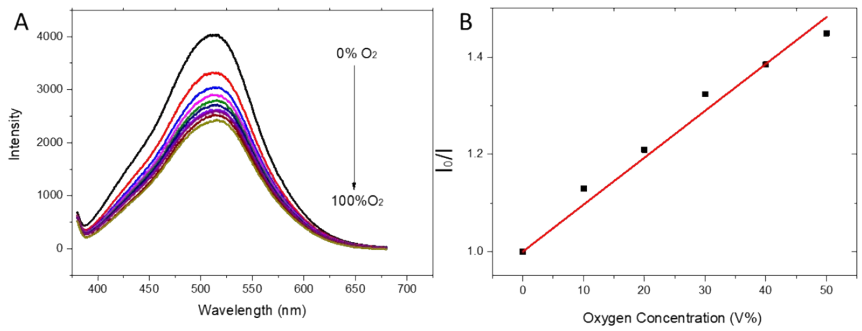

Figure 19. (A) Phosphorescence emission spectra of CDs-MgAl-LDHs under different oxygen concentration. (B) Plots of I_0/ I_1 as a function of oxygen concentration.

Table S1. Multi-exponential fitting for time-resolved phosphorescence dynamics.

Sample	Emission[nm]	τ1 [ms]/[%]	τ2 [ms]/[%]	τ3[ms]/[%]	τAvg [ms]
Zn-CDs-LDHs	490	46.50/6.69	497.30/21.56	849.7/71.75	719.9
CDs-LDHs	490	8.31/7.06	150.45/14.25	408.02/78.69	343.0
Zn-CDs	490	6.77/7.22	48.27/6.78	250.4/86.00	219.6

Table S2. The phosphorescence quantum yield and RTP lifetime of reported CD-based materials.

samples	lifetime / s	quantum yield	reference
m-CDs-PVA	0.46	–	29 a)
CDs-cyanuric acid	0.687	–	29 b)
CDs-PVA	0.38	–	29 c)
NCDs- urea- biuret	1.06	7%	29 d)
Zn-CDs-LDHs	0.719	9.58	our work

Table S3. Multi-exponential fitting for time-resolved fluorescence dynamics of Zn-CDs-LDH sample at different illumination times.

illumination	Emission [nm]	τ_1 [ns]/[%]	τ_2 [ns]/[%]	τ_3[ns]/[%]	τ_{Avg} [ns]
0 min	385	0.63/81.68	2.92/13.52	15.39/4.80	1.65
30 min	385	0.96/83.03	2.23/12.47	11.52/4.50	1.60
60 min	385	1.06/81.12	2.61/15.63	10.54/3.25	1.61
90 min	385	0.66/77.34	2.43/16.32	11.34/6.34	1.63

Table S4. Multi-exponential fitting for time-resolved phosphorescence dynamics of Zn-CDs-LDH sample at different illumination times.

illumination	Emission [nm]	τ_1 [ns]/[%]	τ_2 [ns]/[%]	τ_3[ns]/[%]	τ_{Avg} [ns]
0 min	490	46.50/6.69	497.30/21.56	849.7/71.75	719.9
30 min	490	100.43/7.21	493.54/11.23	803.63/81.56	718.1
60 min	490	121.36/7.81	475.32/13.56	821.35/78.63	719.7
90 min	490	55.36/4.20	325.31/15.26	827.52/80.54	718.4