

A Facile Co-crystallization Approach to Fabricate Two-component Carbon Dots Composites Showing Time-Dependent Evolutive Room Temperature Phosphorescence Colors

Jian Qu^a, Xin Zhang^{a,b,*}, Shuyan Zhang^c, Zhongjie Wang^a, Yejian Yu^a, Huajun Ding^a, Zhiyuan Tang^a, Xiangjun Heng^a, Ruiqi Wang^c, Su Jing^{c,*}

^a School of Materials Science and Engineering, Yancheng Institute of Technology, Yancheng 224051, PR China, E-mail: xinzhang@ycit.edu.cn;

^b School of Chemistry and Chemical Engineering, Southeast University, Nanjing, 211189, China, E-mail: xinzhang@ycit.edu.cn;

^c School of Chemistry and Molecular Engineering, Nanjing Tech University, Nanjing 211816, P.R. China. E-mail: sjing@njtech.edu.cn;

* Corresponding author

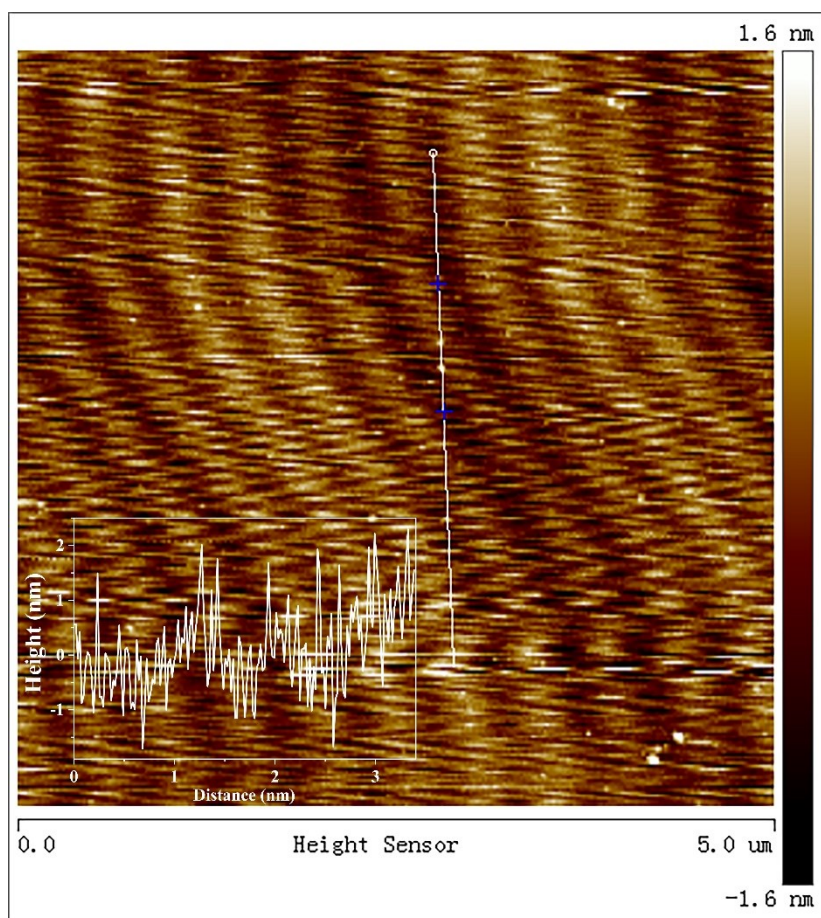


Fig. S1 AFM image of CDs

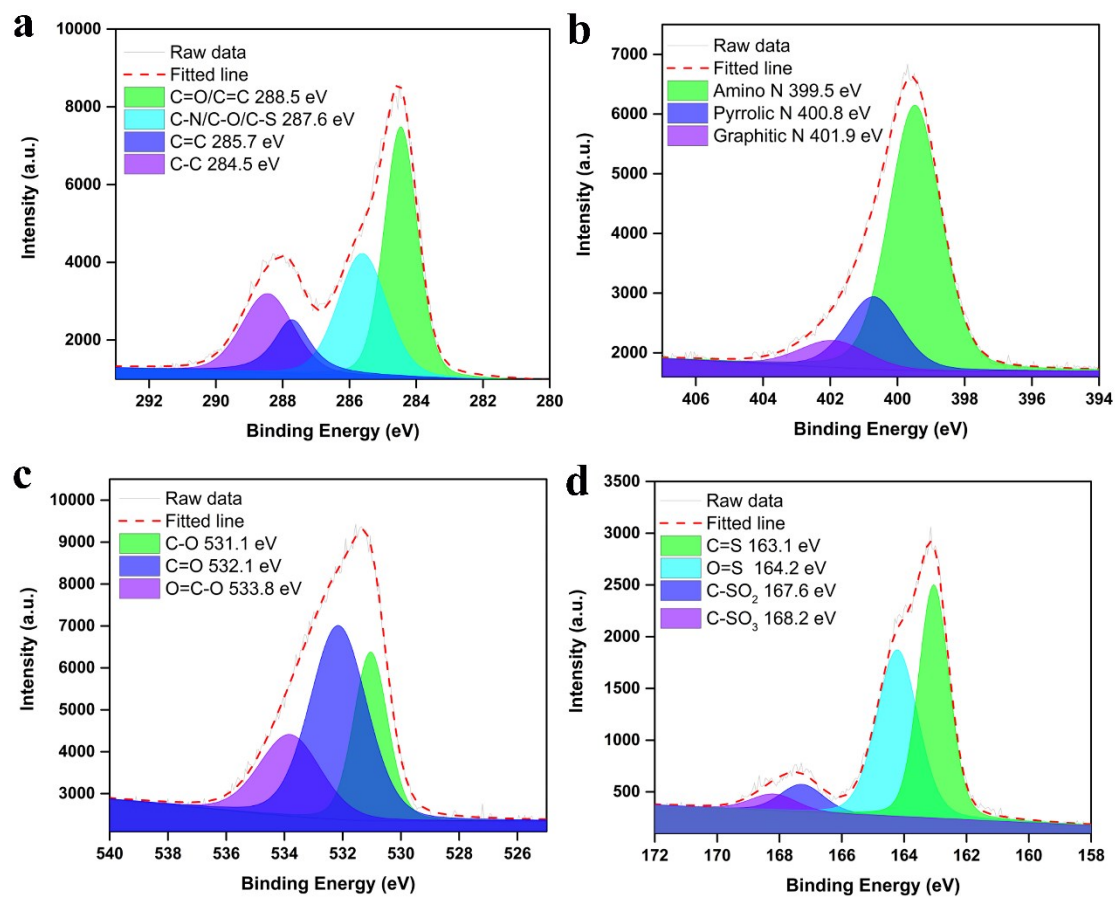


Fig. S2 a) C1s spectrum b) N1s spectrum c) O1s spectrum d) S2p spectrum of CDs, respectively.

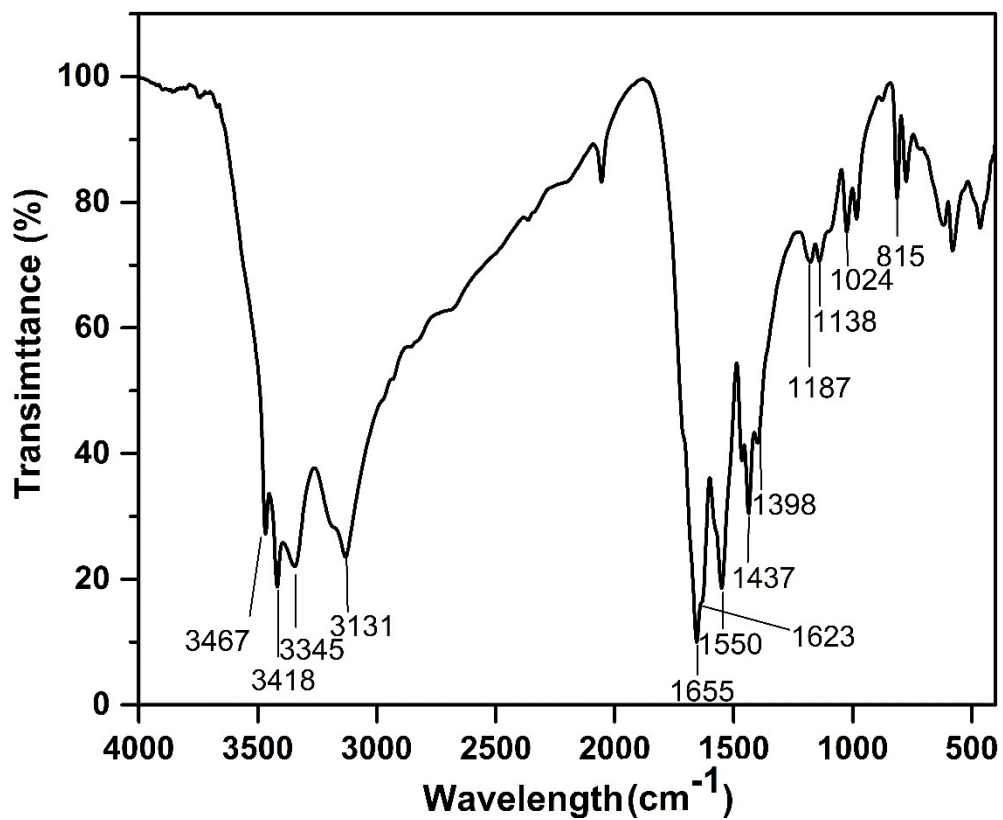


Fig. S3 FT-IR spectrum of CDs.

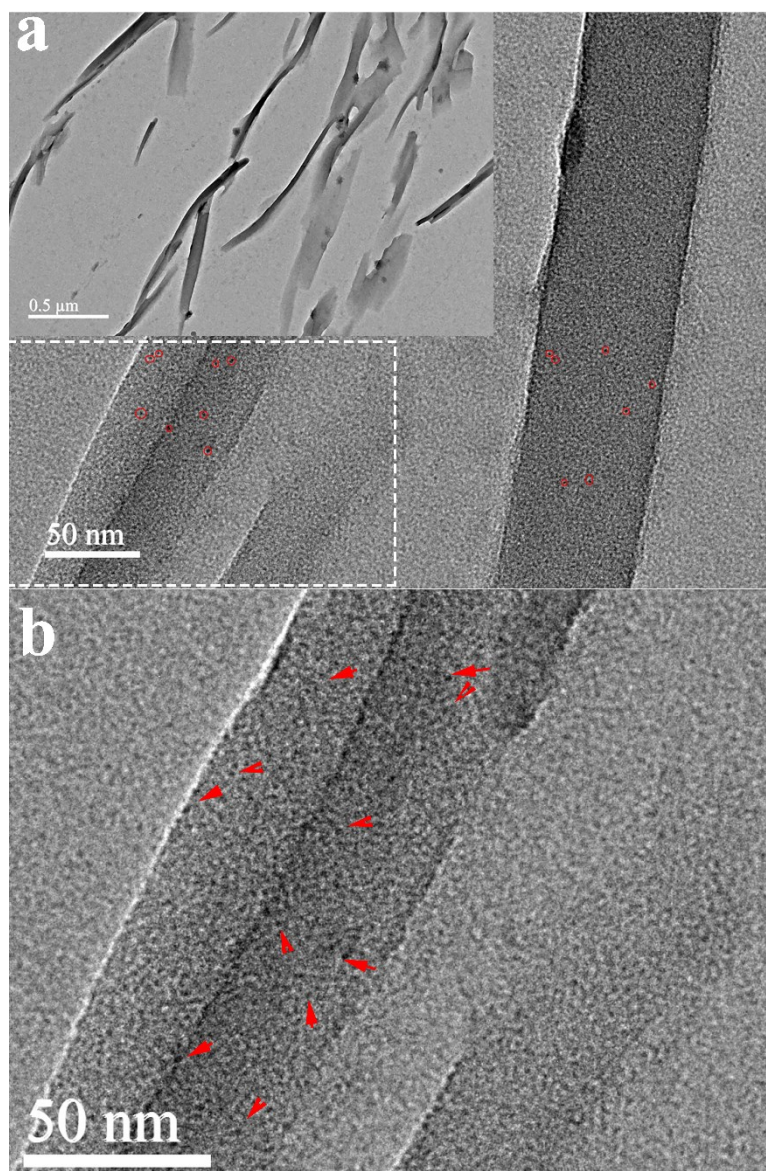


Fig. S4 TEM images of CDs@IPA under 0.5 μm and 50 nm scale bar. b) The local TEM image of CDs@IPA.

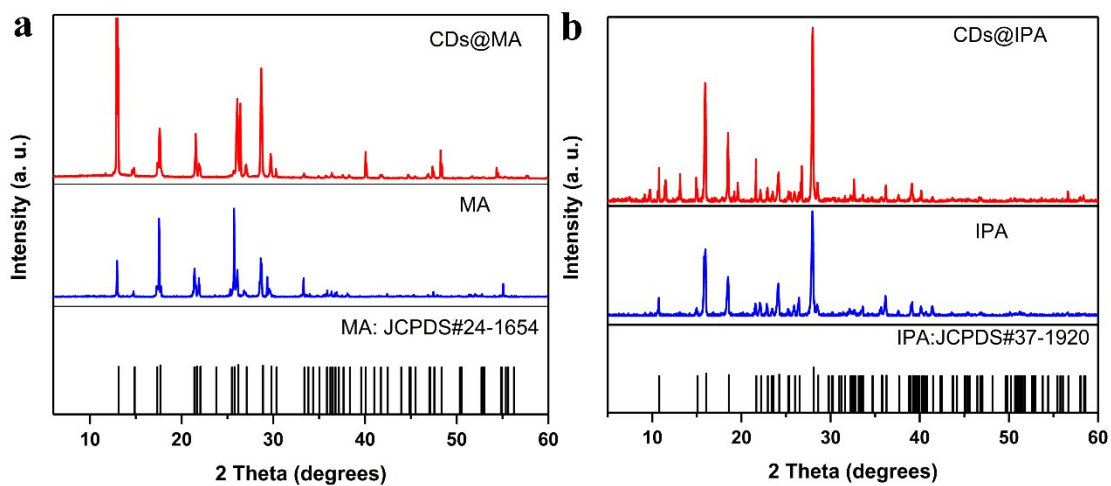


Fig. S5 a) XRD pattern of the CDs@MA, MA and MA XRD card. b) XRD pattern of the CDs@IPA, IPA and IPA XRD card.

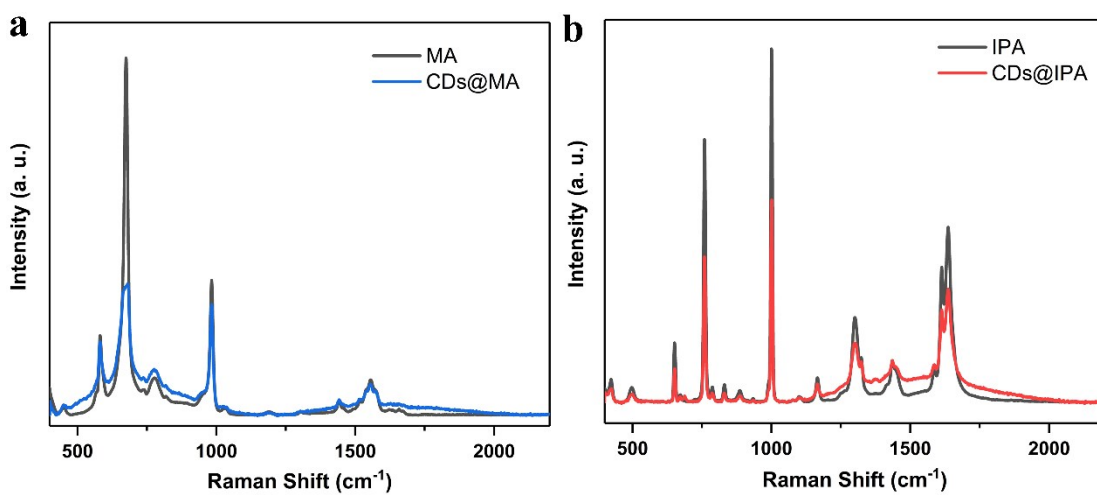


Fig. S6 a) Raman spectra of CDs@MA and MA. b) Raman spectra of CDs@IPA and IPA.

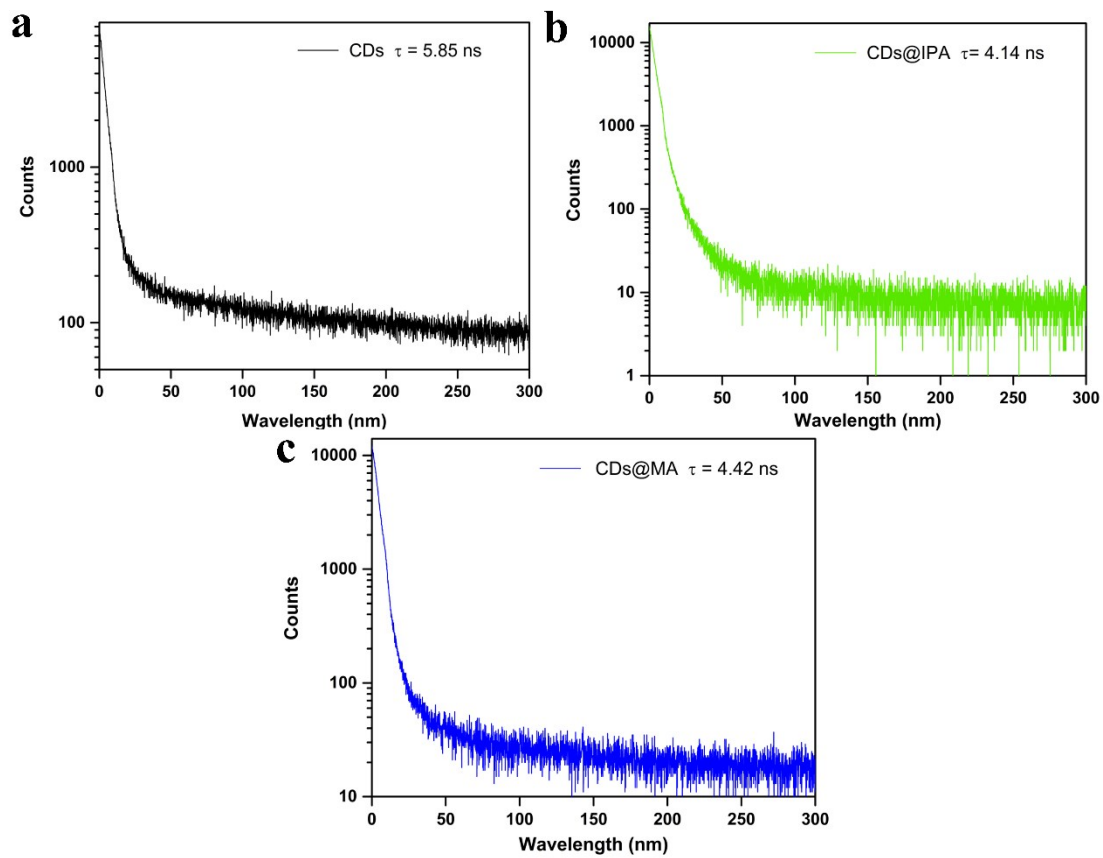


Fig. S7 FL decay curves of a) CDs, b) CDs@IPA and c) CDs@MA

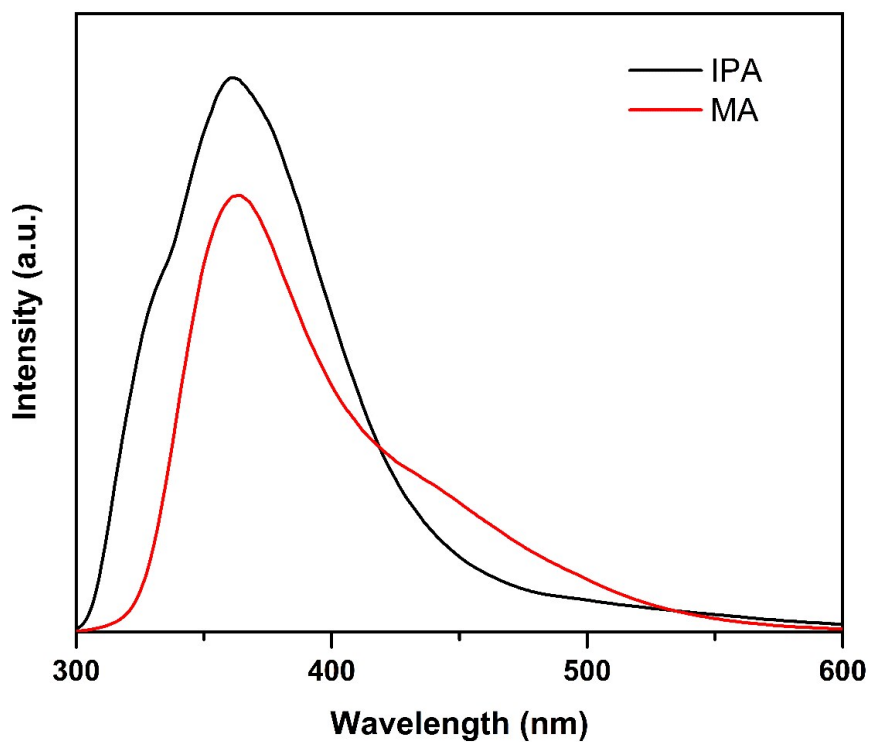


Fig. S8 The FL emission spectra of IPA and MA ($\lambda_{\text{ex}}=280$ nm).

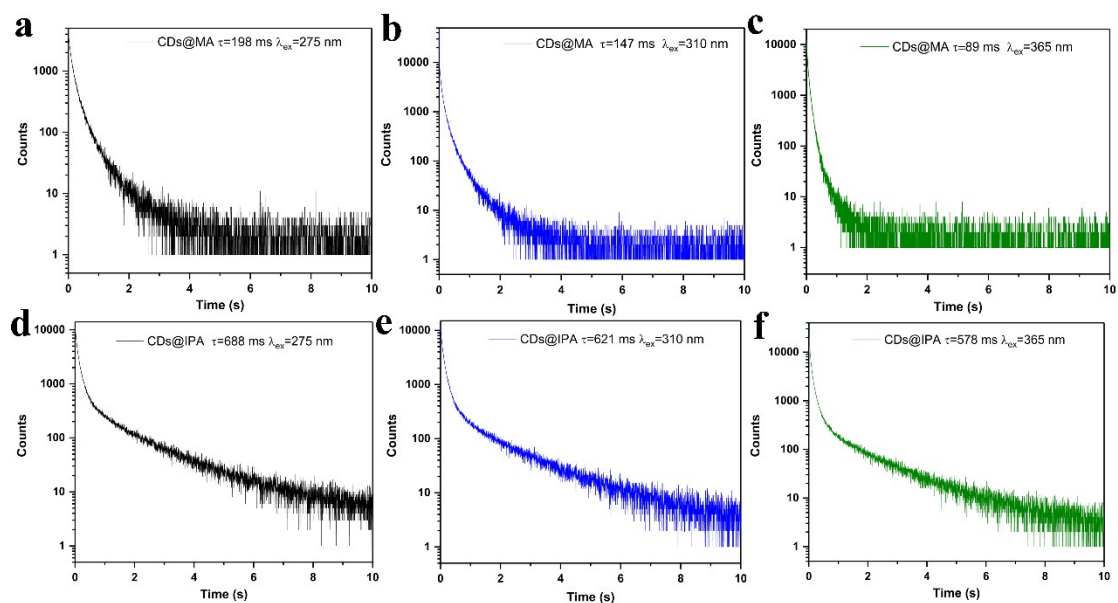


Fig. S9 RTP decay profiles of CDs@MA under excitation wavelength at a) 275 nm, b) 310 nm and c) 365 nm. RTP decay profiles of CDs@IPA under excitation wavelength at d) 275 nm, e) 310 nm and f) 365 nm.

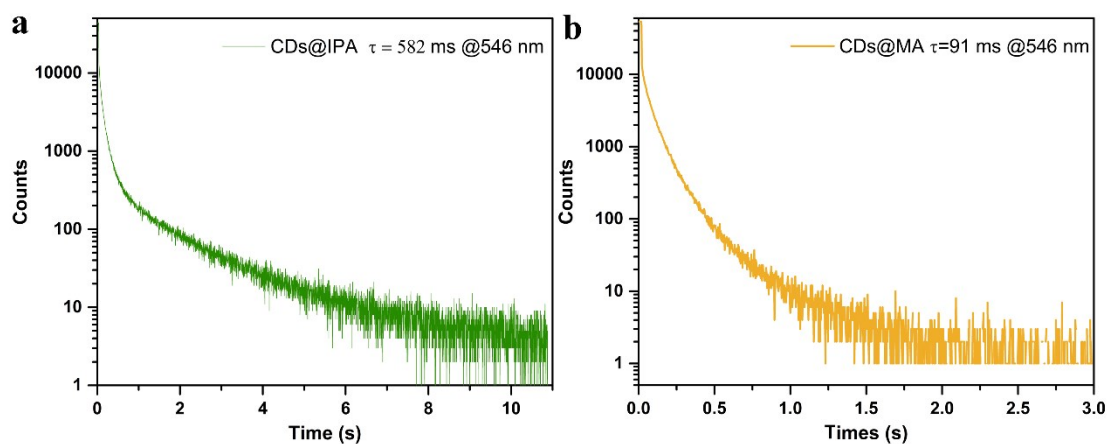


Fig. S10 RTP decay profiles of a) CD@IPA and b) CD@MA.

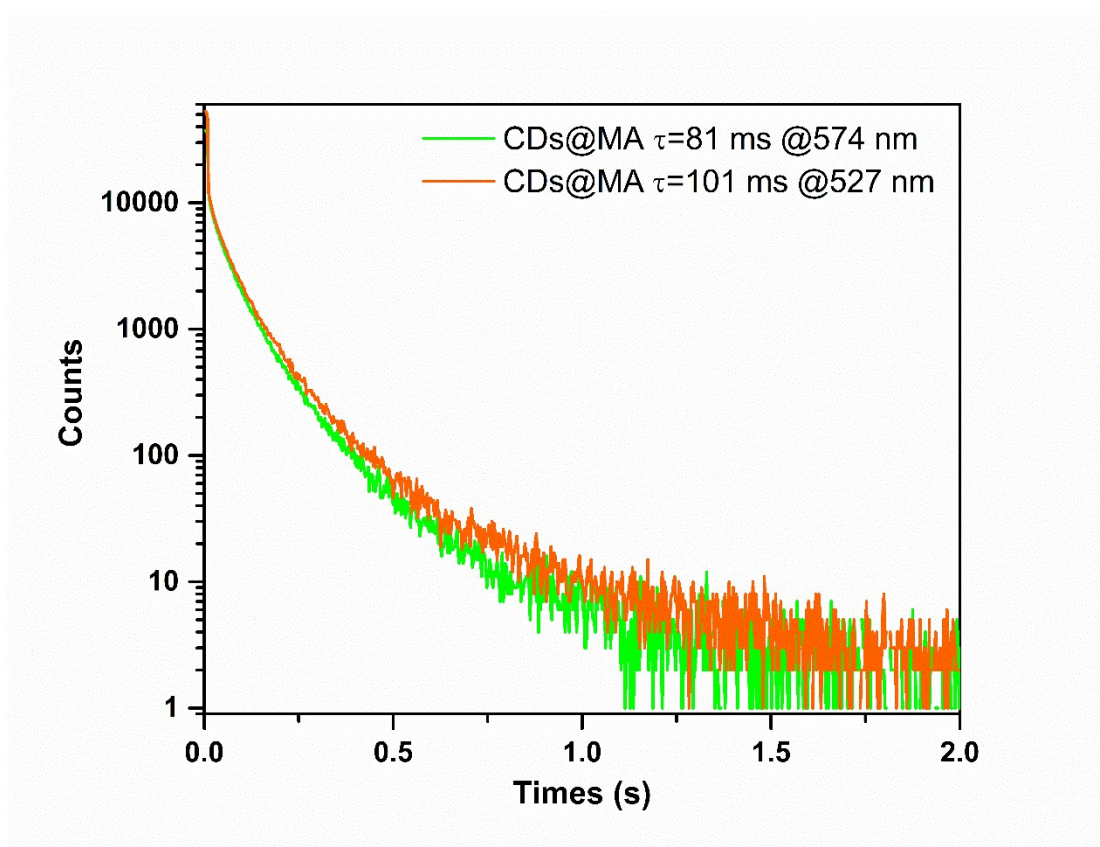


Fig. S11 Corresponding RTP decay profiles of CD@MA ($\lambda_{\text{ex}} = 360$ nm).

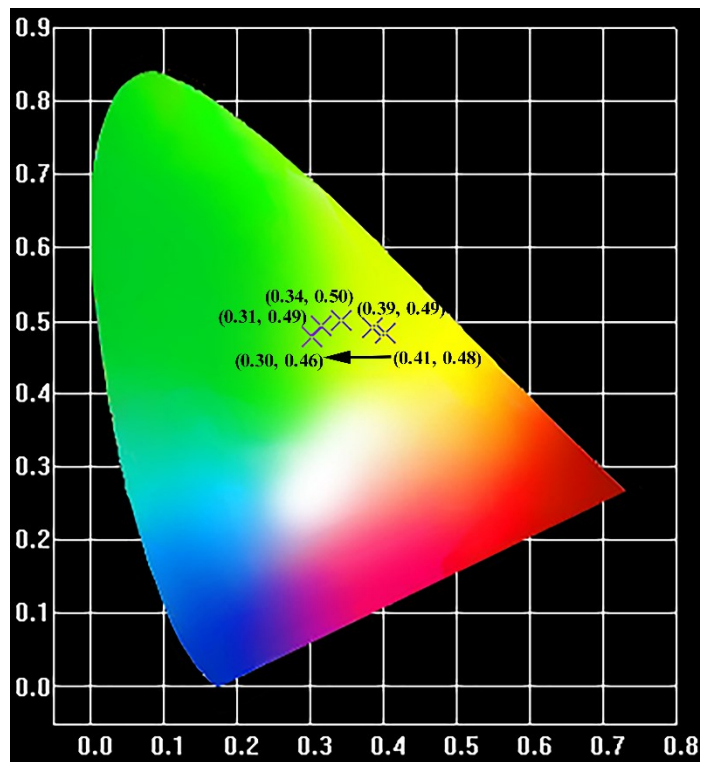


Fig. S12 CIE coordinates of time-dependent color of CDs@MA.

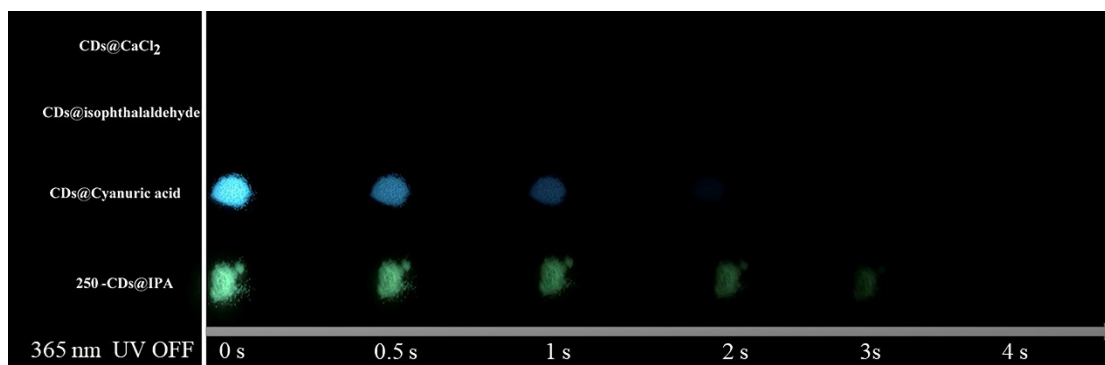


Fig. S13 Photographs of CDs@CaCl₂, CDs@isophthalaldehyde, CDs@cyanuric acid and 250°C-CDs@IPA.

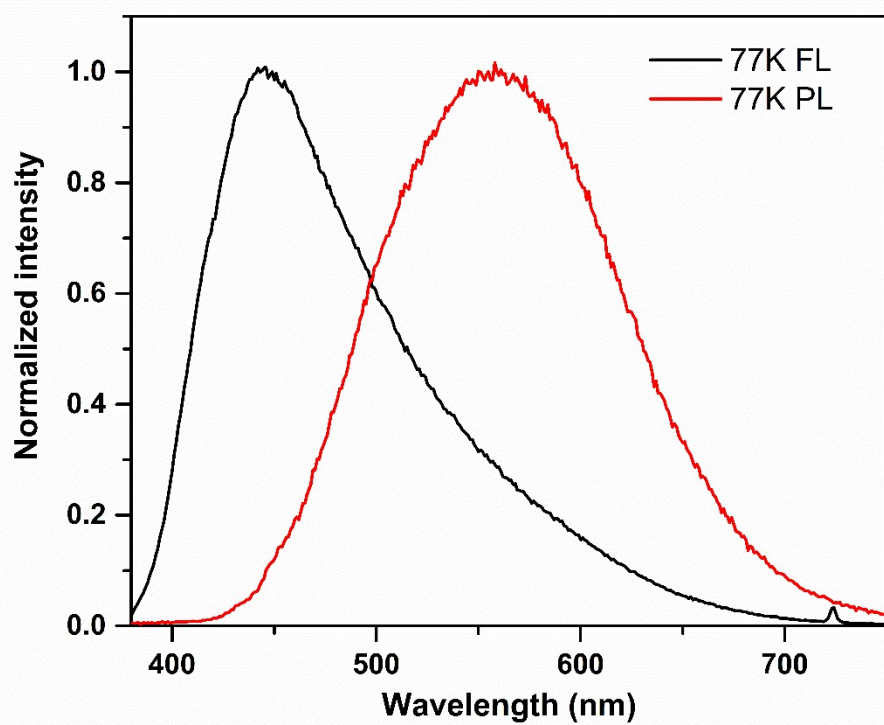


Fig. S14 Normalized fluorescence and phosphorescence spectra of CDs@IPA at 77 K ($\lambda_{\text{ex}} = 360 \text{ nm}$).

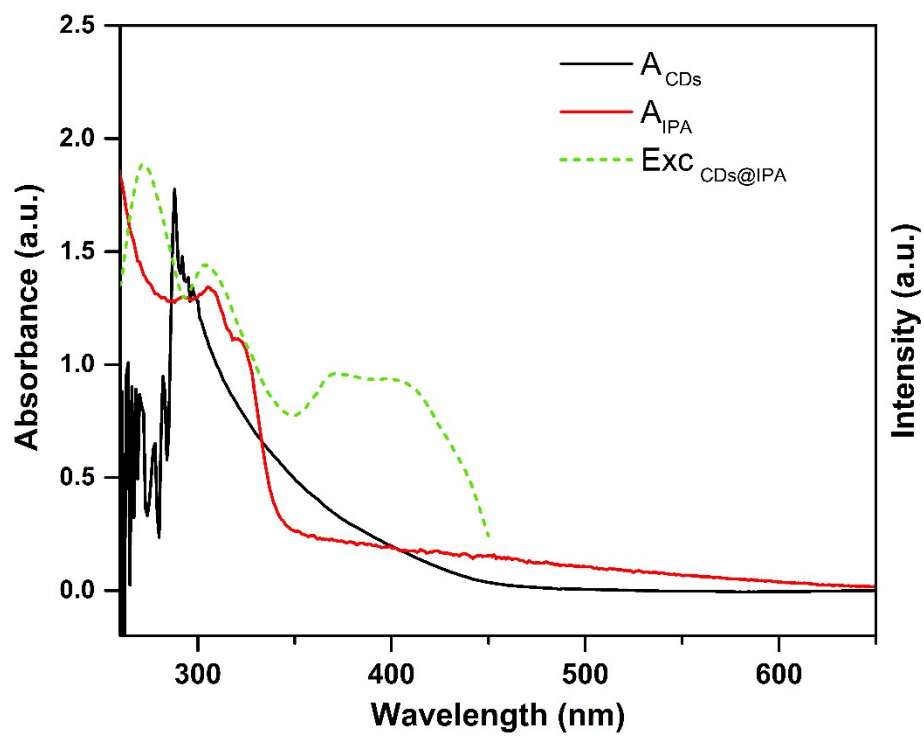


Fig. S15 UV-vis absorbance spectra of CDs and IPA matrix, and the RTP excitation spectrum of CDs@IPA at 546 nm.

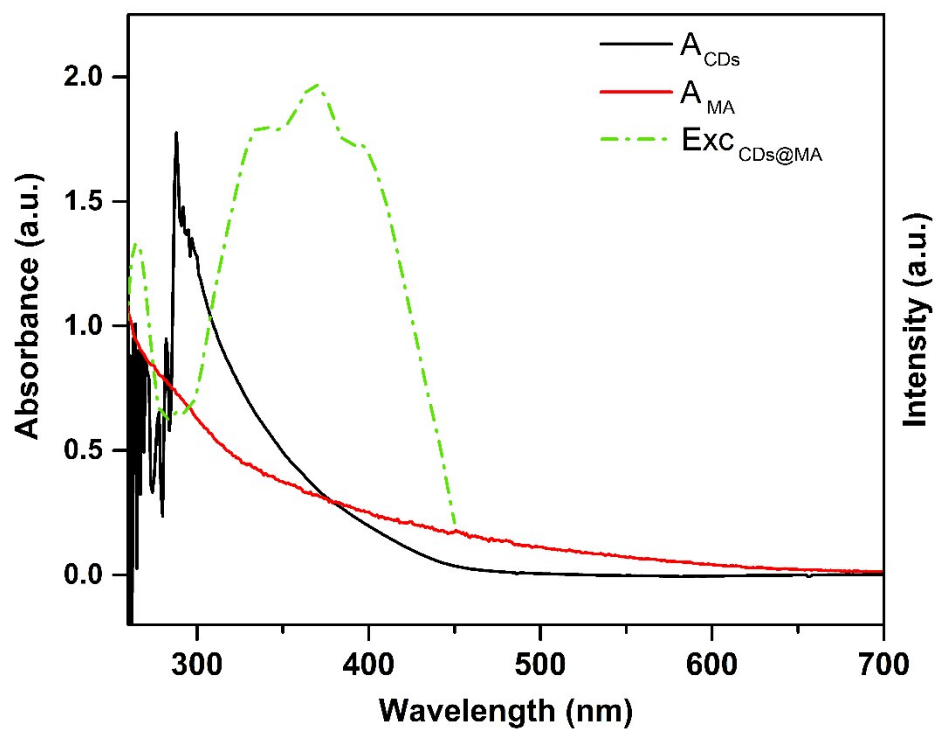


Fig. S16 UV-vis absorbance spectra of CDs and MA matrix, and the RTP excitation spectrum of CDs@MA at 546 nm.

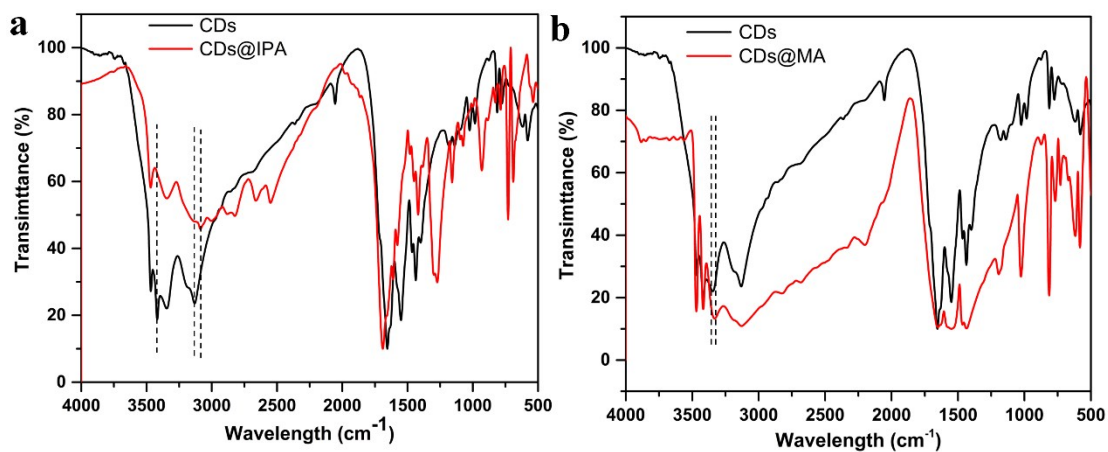


Fig. S17 FT-IR spectrum of CDs@IPA and CDs@MA.

Table S1. The RTP decay profiles of the CDs@IPA and CDs@MA at different emission wavelength.

| Composite | λ_{em} (nm) | τ_1 (ms) | B_1 (%) | τ_2 (ms) | B_2 (%) | τ_3 (ms) | B_3 (%) | τ_{avg} (ms) |
|-----------|------------------------|------------------|--------------|------------------|--------------|------------------|--------------|----------------------|
| CDs@IPA | 546 | 179.85 | 39.00 | 1509.00 | 32.90 | 50.87 | 28.10 | 582 |
| | 532 | 190.75 | 36.26 | 1552.57 | 39.13 | 53.65 | 24.61 | 686 |
| | 578 | 146.34 | 44.51 | 4.12 | 32.19 | 1366.61 | 23.30 | 395 |
| CDs@MA | 546 | 18.47 | 13.97 | 67.39 | 71.73 | 207.55 | 18.64 | 91 |
| | 527 | 20.35 | 14.70 | 76.34 | 66.25 | 244.08 | 19.05 | 101 |
| | 574 | 16.16 | 12.71 | 65.16 | 68.75 | 188.72 | 18.54 | 81 |