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

Highly Efficient Carbon Dots and Their Nanohybrids for Trichromatic White LEDs

Biao Yuan,[a,b] Zheng Xie,*[a] Ping Chen[a] and Shuyun Zhou*[a]

[a]Key Laboratory of Photochemical Conversion and Optoelectronic Materials, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, 29 Zhongguancun East Road, Haidian District, Beijing, 100190, China

E-mail: zhengxie@mail.ipc.ac.cn; zhou_shuyun@mail.ipc.ac.cn

[b]University of Chinese Academy of Sciences, No.19A Yuquan Road, Beijing, 100049, China

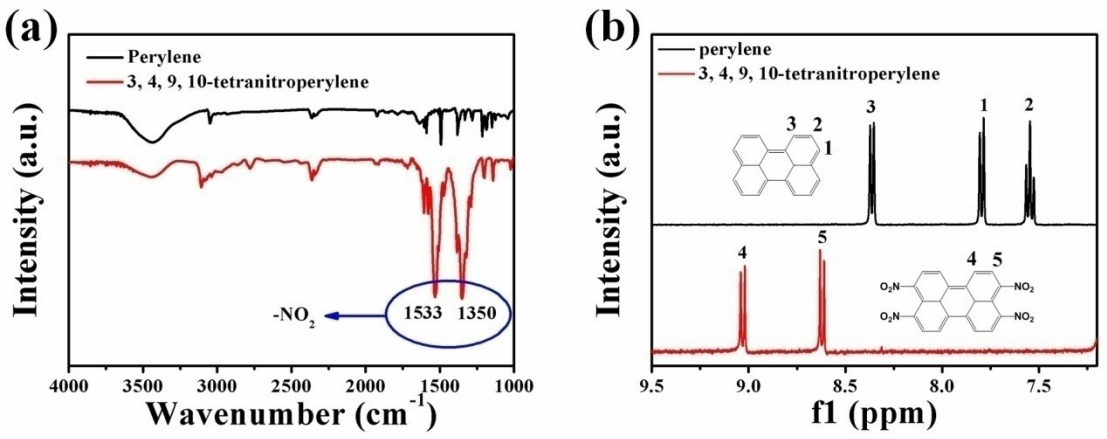

Fig. S1 The (a) FT-IR spectra and (b) ^{1}H NMR spectra of perylene and 3, 4, 9, 10-tetranitroperylene.

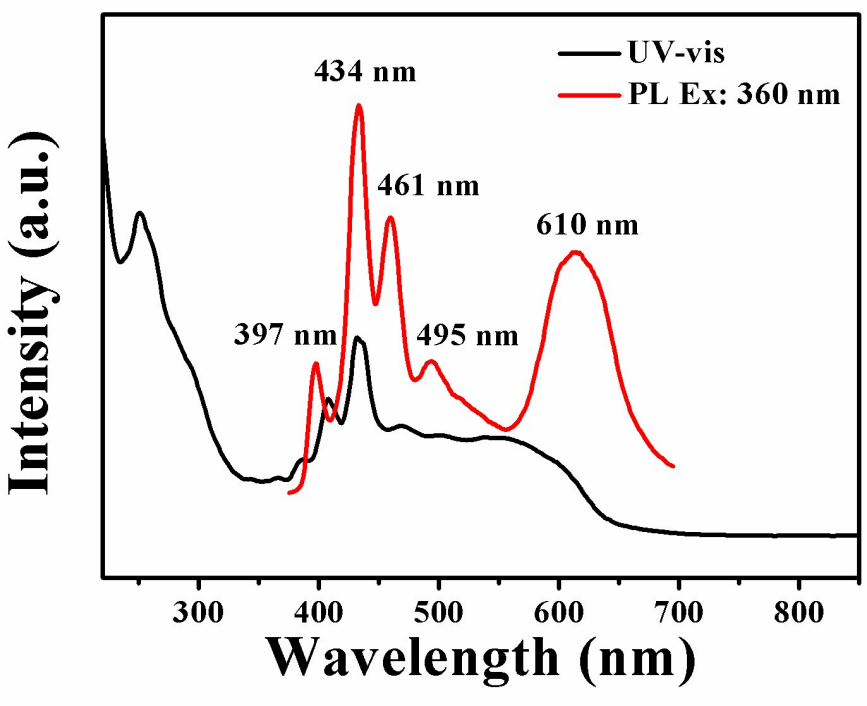

Fig. S2 The fluorescence and UV-vis absorption properties of the original CDs products.

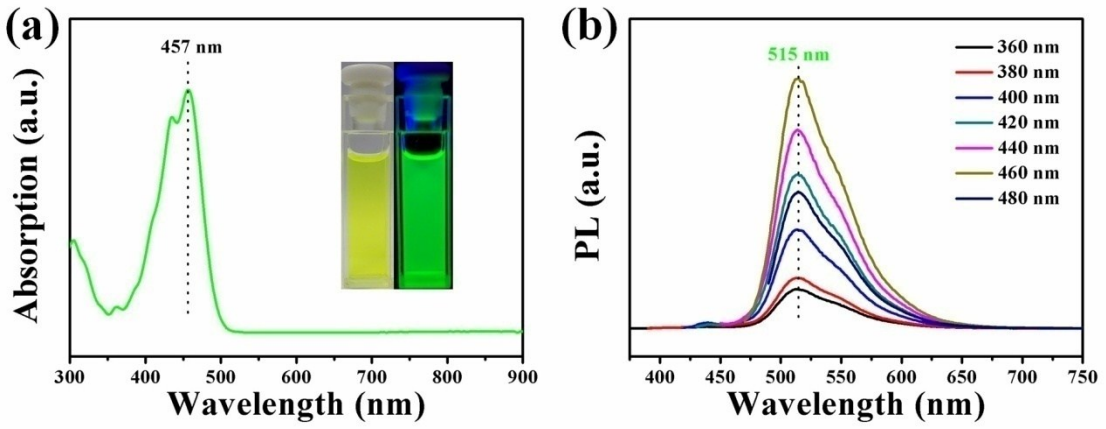

Fig. S3 (a) UV-vis absorption spectrum of G-CDs (inset: the photo of G-CDs under daylight (left) and 365 nm UV light (right)), (b) PL spectra of G-CDs excited at different wavelengths.

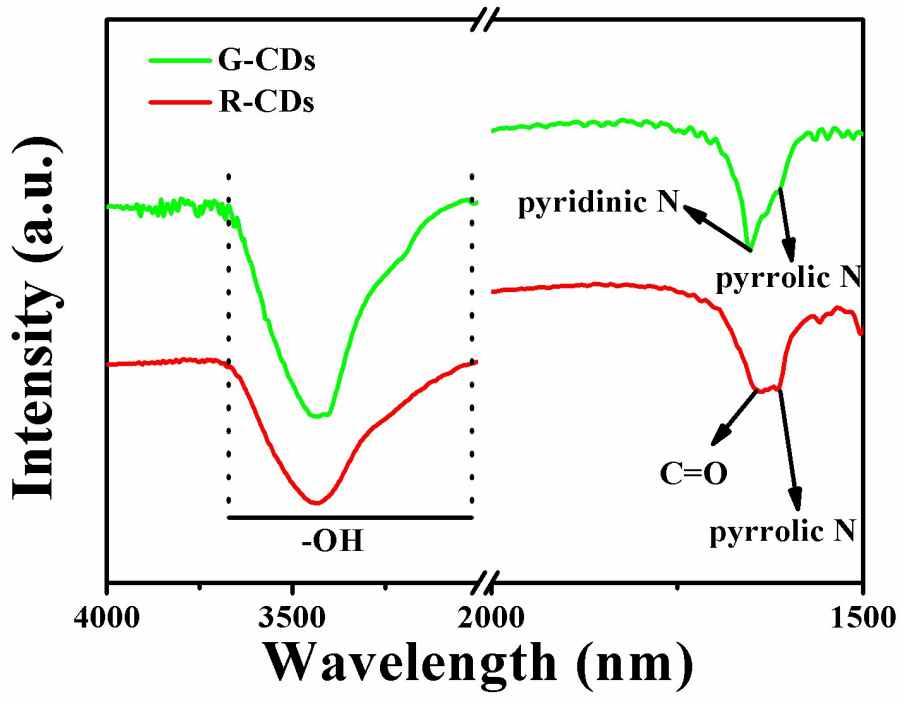

Fig. S4 The FT-IR spectra of R-CDs and G-CDs.

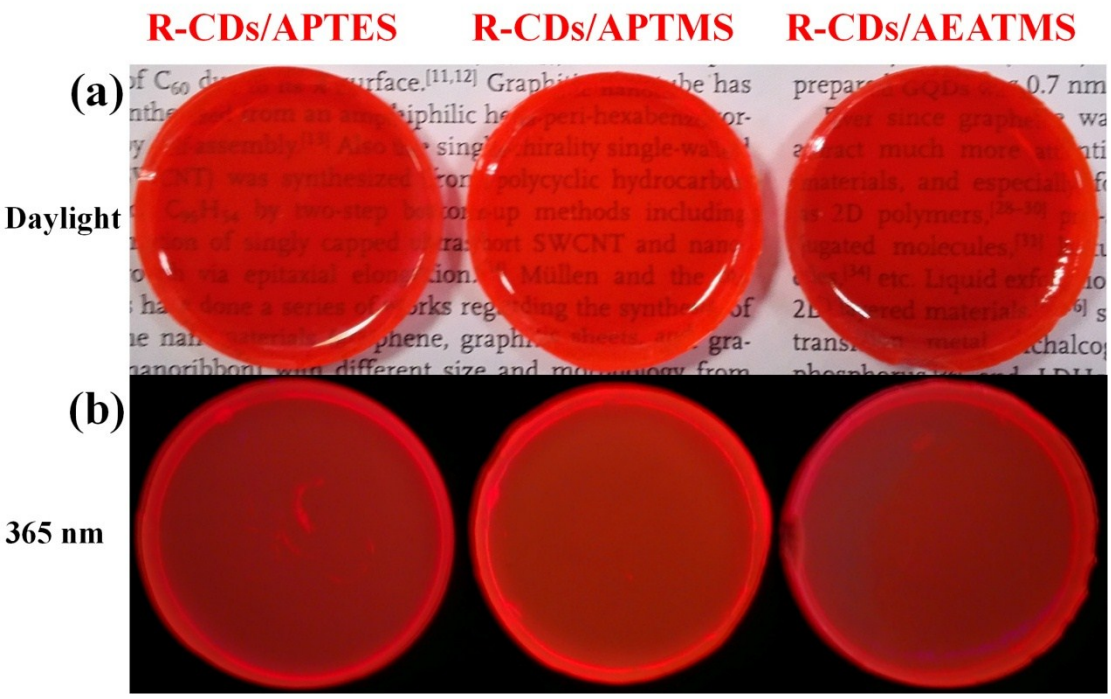

Fig. S5 The pictures of R-CDs/APTES, R-CDs/APTMS and R-CDs/AEATMS gel-glasses under (a) daylight and (b) 365 nm UV light.

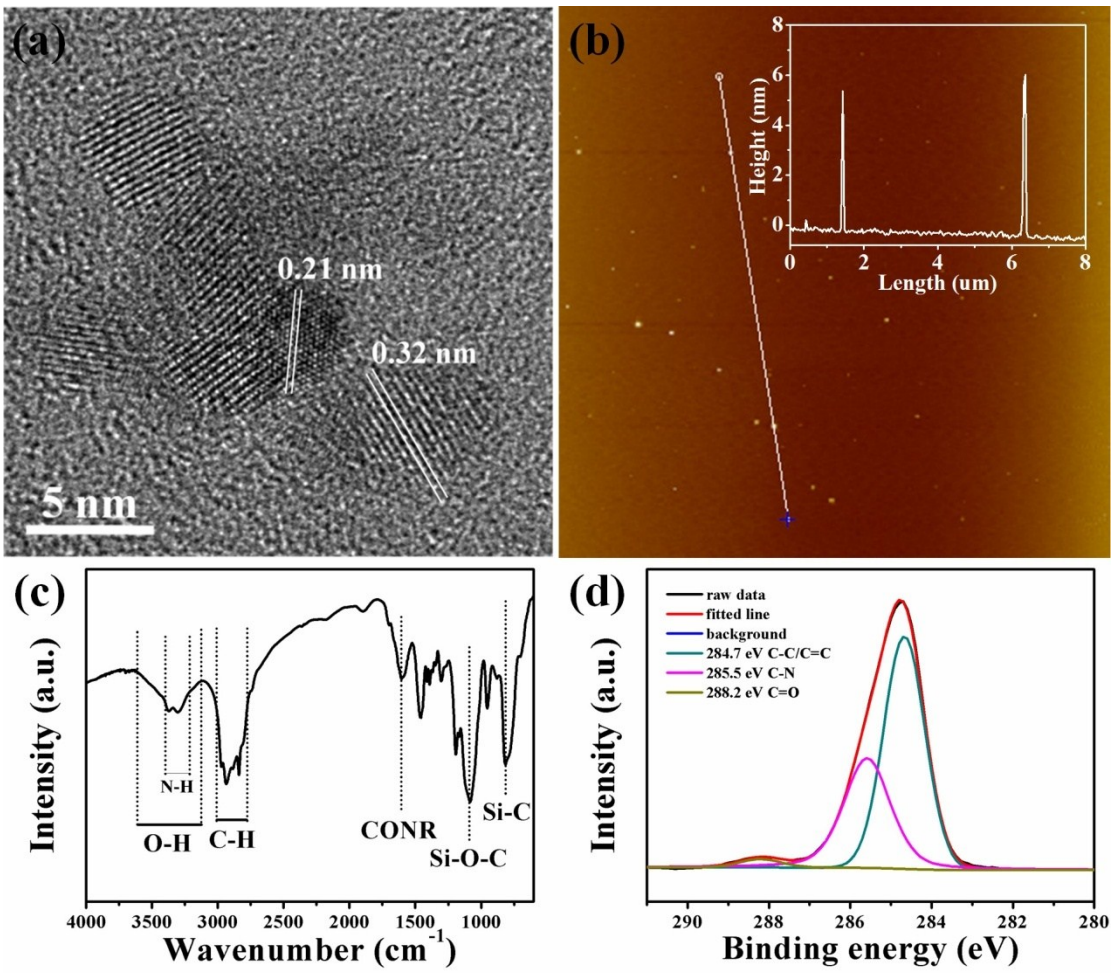

Fig. S6 (a) TEM image, (b) AFM image and height along the line (inset), (c) FT-IR spectrum and (d) XPS C1s spectra of G-SiCDs.

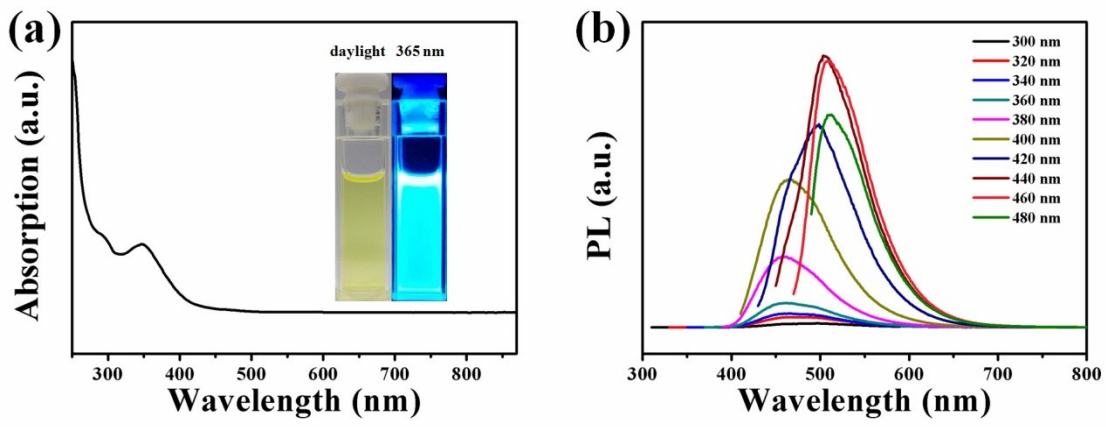

Fig. S7 (a) UV-vis absorption spectrum of G-SiCDs (inset: the photo of G-SiCDs under daylight (left) and 365 nm UV light (right)), (b) PL spectra of G-SiCDs excited at different wavelengths.

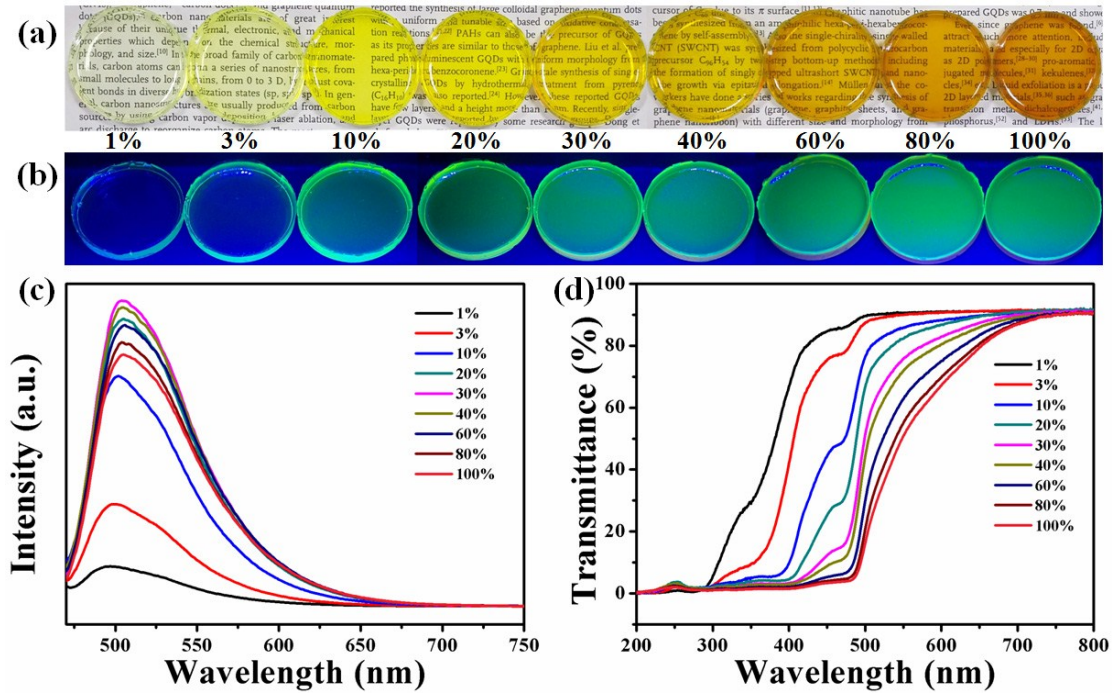

Fig. S8 The pictures of G-SiCDs gel-glasses at different concentration under (a) daylight and (b) 460 nm blue light. The (c) PL spectra excited at 460 nm and (d) transmittance spectra of G-SiCDs gel-glasses at different concentration.

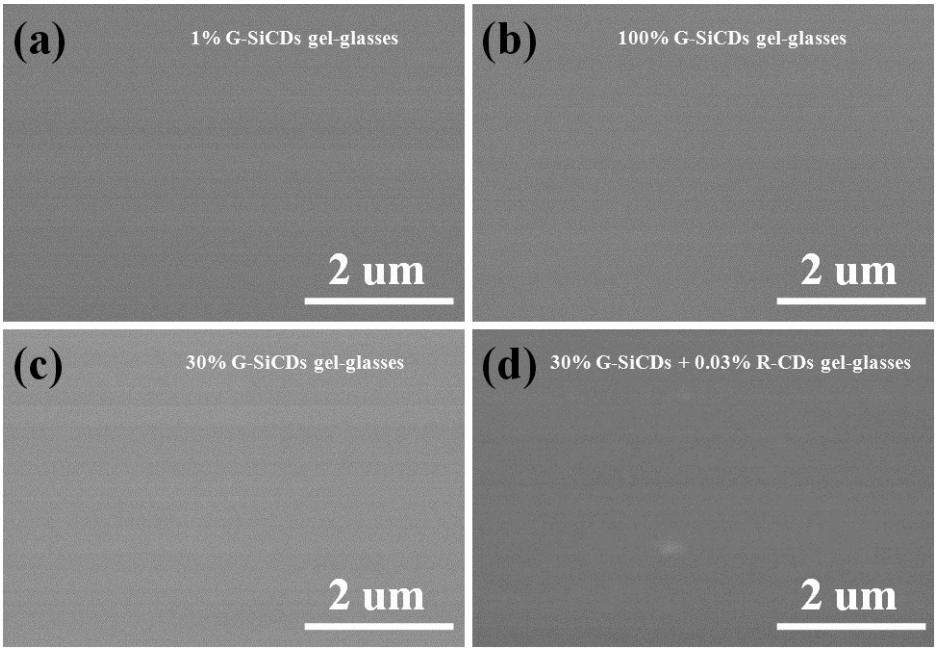

Fig. S9 SEM images of fractured sections of G-SiCDs gel-glasses (a) 1%, (b) 100% and (c) 30%, (d) G-SiCDs/R-CDs gel-glasses (30%+0.03%).

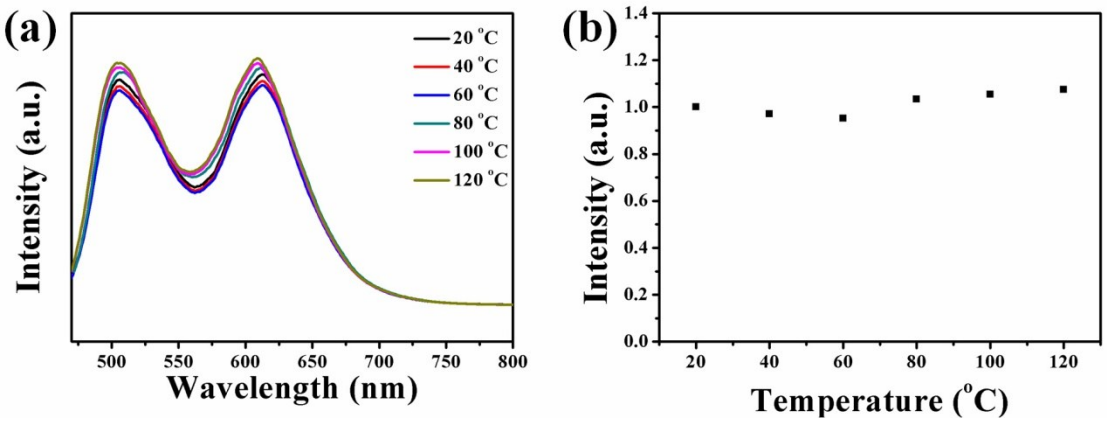

Fig. S10 The (a) PL spectra and (b) thermal stability of PL emission of G-SiCDs/R-CDs nanohybrids (30% + 0.01%) excited at 460 nm.

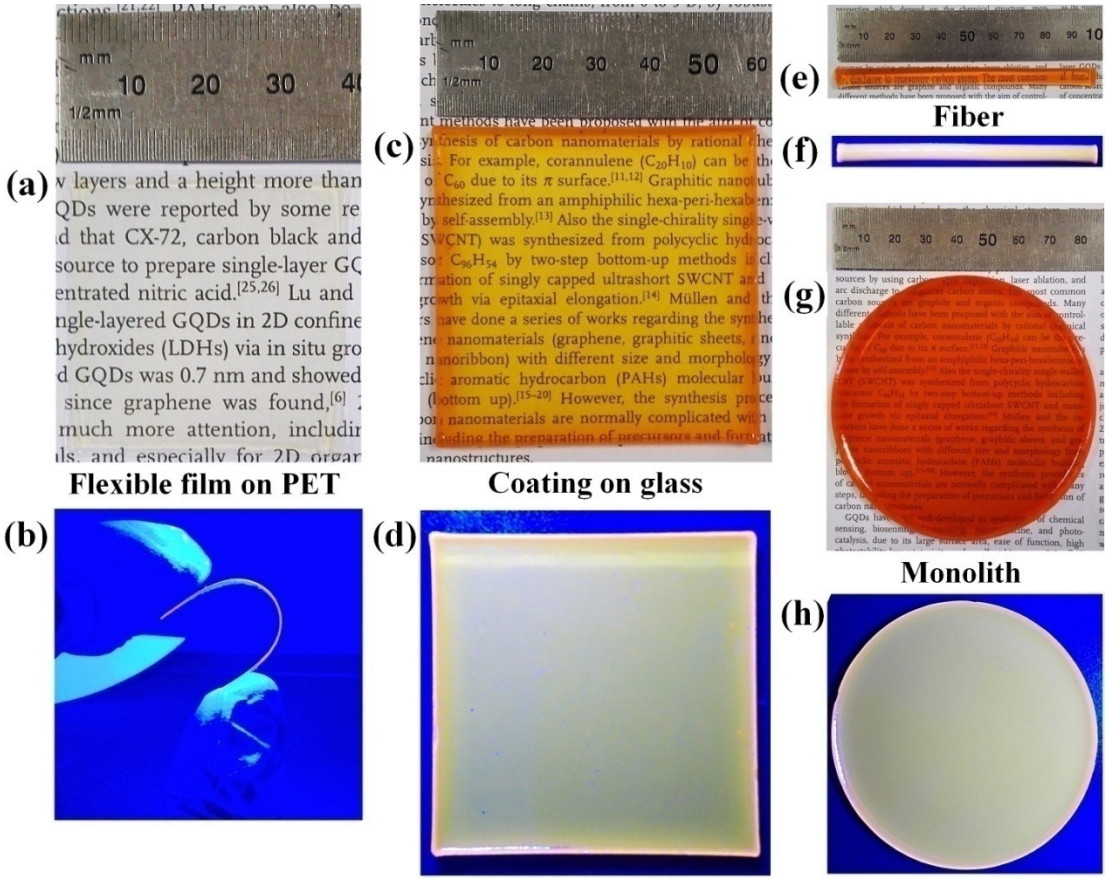

Fig. S11 The pictures of G-SiCDs/R-CDs in different nanohybrids solid structures, film (a) under daylight and (b) under 460 nm blue light, coating (c) under daylight and (d) under 460 nm blue light, fiber (e) under daylight and (f) under 460 nm blue light, monolith (g) under daylight and (h) under 460 nm blue light.

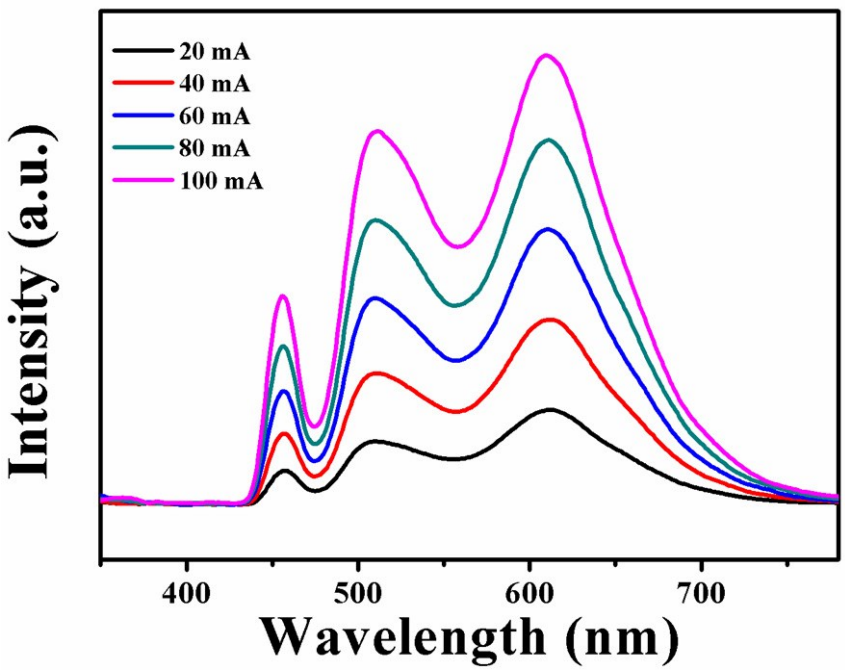

Fig. S12 The EL spectra of the warm WLED with enhancing the drive current from 20 to 100 mA.

Table S1 The luminous efficiency, CIE color coordinate, CCT and CRI of the warm WLED with enhancing the drive current from 20 to 100 mA.

Current (mA)	LE (lm/W)	x	y	CCT (K)	CRI
20	**68.58**	**0.4404**	**0.4306**	**3148**	**90.2**
40	**65.82**	**0.4343**	**0.4321**	**3260**	**90.6**
60	**63.39**	**0.428**	**0.432**	**3369**	**91.1**
80	**61.86**	**0.4233**	**0.4331**	**3460**	**91.5**
100	**60.22**	**0.4169**	**0.4348**	**3590**	**91.6**