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

The supporting information

An enhanced fluorescent ZIF-8 film by capturing guest molecules for light-emitting applications

Qiufen Liu [a], Shouqin Tian [a,*], Xiujian Zhao [a], Gopinathan Sankar [b]

[a] State Key Laboratory of Silicate Materials for Architectures, Wuhan University of Technology (WUT), No. 122, Luoshi Road, Wuhan 430070, P. R. China

[b] Department of Chemistry, Materials Chemistry Centre, University College London, 20 Gordon St., London WC1H 0AJ, UK

*Corresponding author. Tel.: +86-027-87652553; Fax: +86-027-87883743.

E-mail address: tiansq@whut.edu.cn (S. Tian)

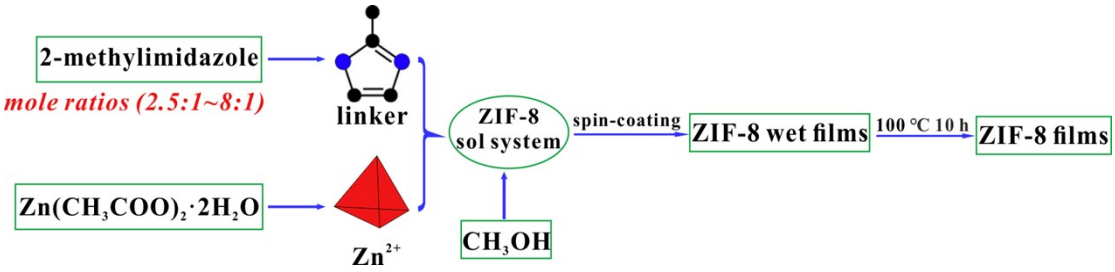

Figure S1. Experimental scheme for preparation of ZIF-8 films at different mole ratios of reactants.

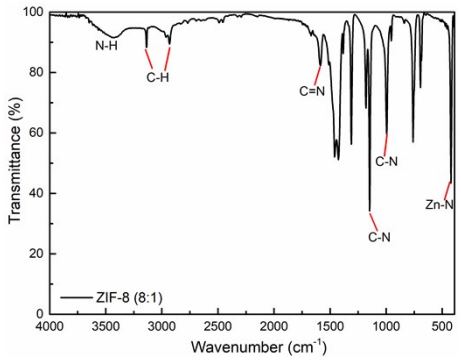

Figure S2. FTIR spectrum of the ZIF-8 film synthesized with the mole ratio of 8:1.

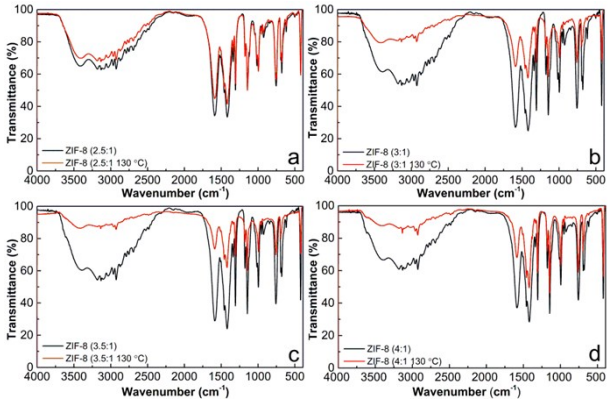

Figure S3. FTIR spectra of ZIF-8 films synthesized with low mole ratio before (black lines) and after (red lines) heat treatment.

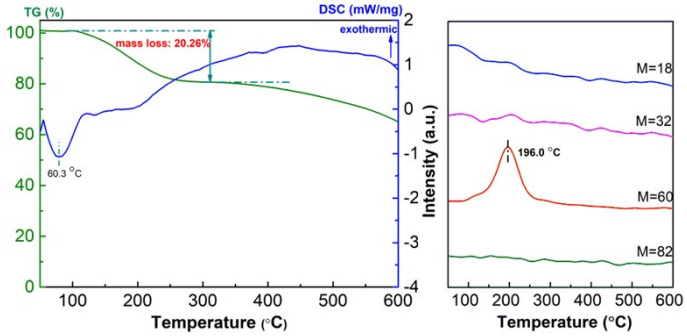

Figure S4. Thermo-gravimetric curve and traced guest molecules curves of the ZIF-8 film (2.5:1) in Ar.

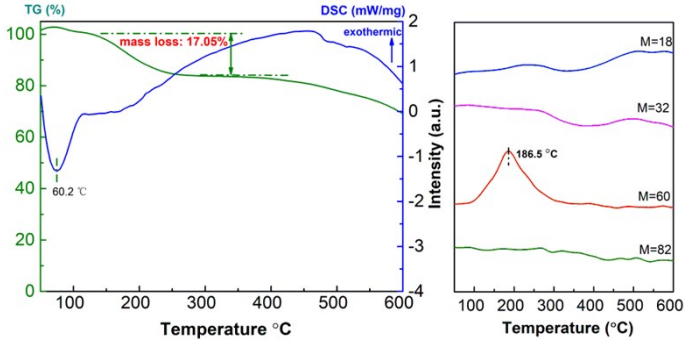

Figure S5. Thermo-gravimetric curve and traced guest molecules curves of the ZIF-8 film (3:1) in Ar.

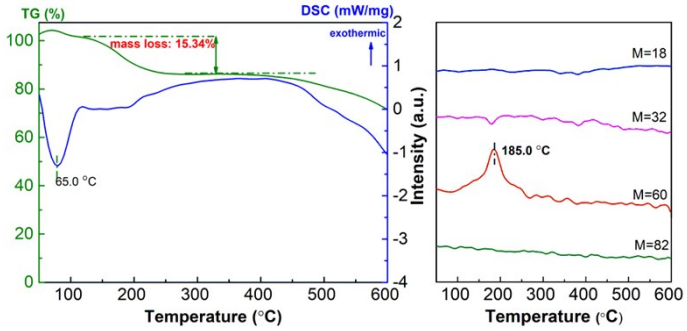

Figure S6. Thermo-gravimetric curve and traced guest molecules curves of the ZIF-8 film (3.5:1) in Ar.

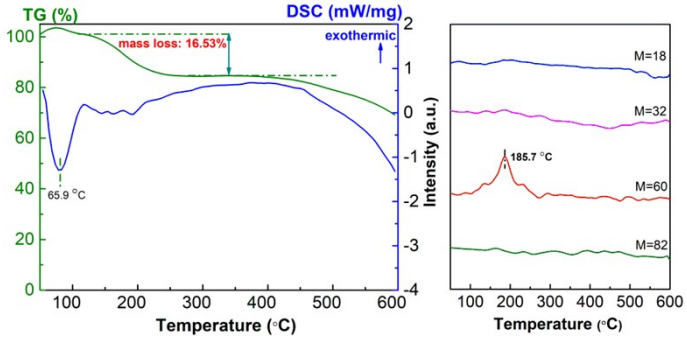

Figure S7. Thermo-gravimetric curve and traced guest molecules curves of the ZIF-8 film (4:1) in Ar.

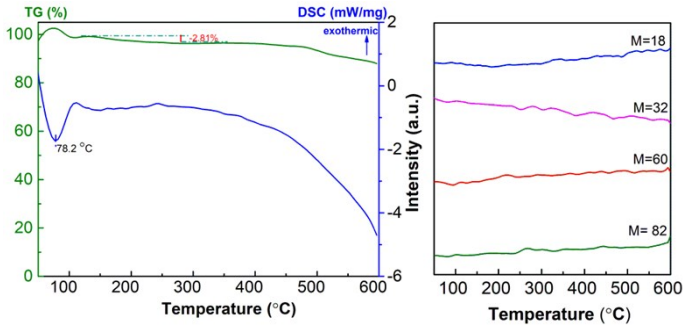

Figure S8. Thermo-gravimetric curve and traced guest molecules curves of the ZIF-8 film (5:1) in N_2.

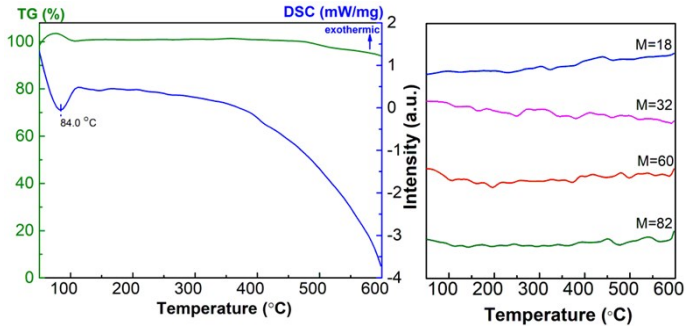

Figure S9. Thermo-gravimetric curve and traced guest molecules curves of the ZIF-8 film (6:1) in N_2.

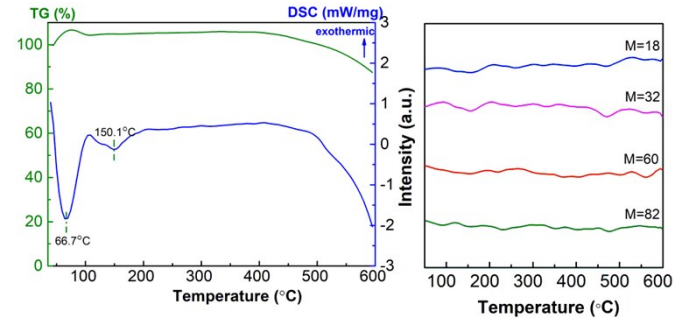

Figure S10. Thermo-gravimetric curve and traced guest molecules curves of the ZIF-8 film (8:1) in Ar.

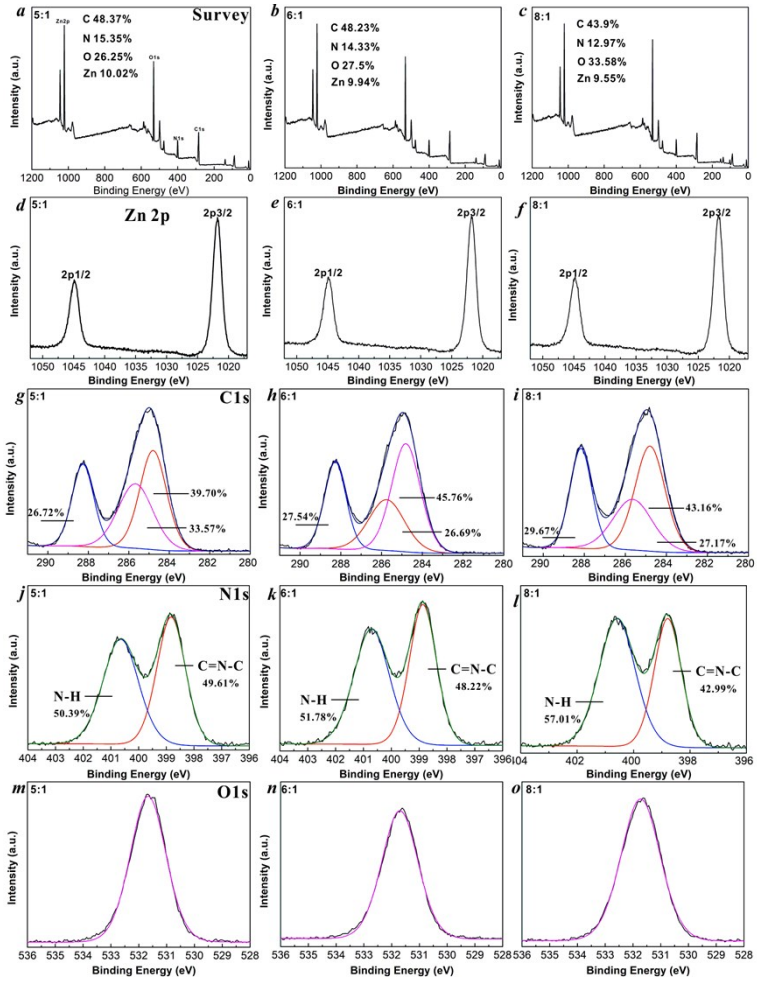

Figure S11. XPS survey spectra (a-c), high resolution Zn2p spectra (d-f), C1s spectra (g-i), N1s spectra (j-l) and O1s spectra (m-o) of ZIF-8 films synthesized with the mole ratio ratios of 5:1, 6:1 and 8:1.

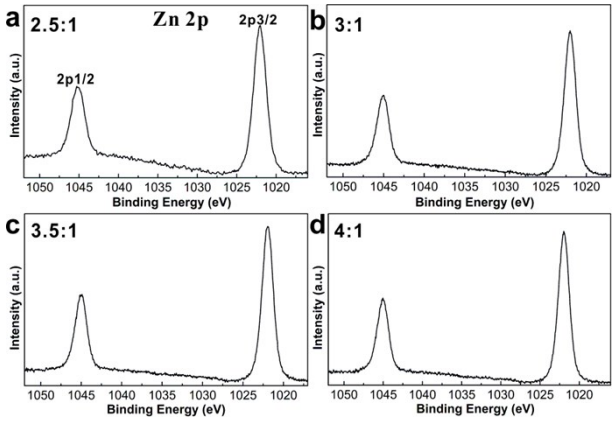

Figure S12. XPS high resolution Zn2p spectra of ZIF-8 films synthesized with different mole ratios, (a) 2.5:1, (b) 3:1, (c) 3.5:1 and (d) 4:1.

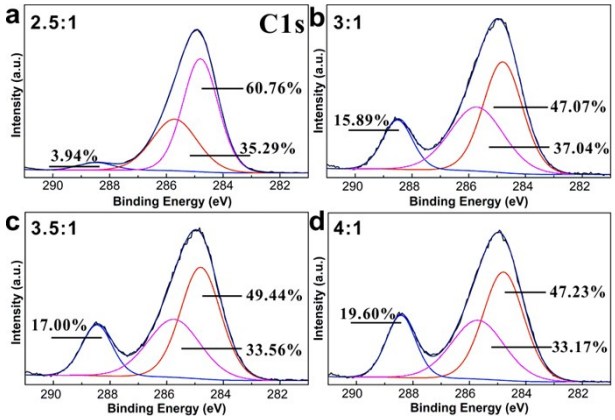

Figure S13. XPS high resolution C1s spectra of ZIF-8 films synthesized with different mole ratios, (a) 2.5:1, (b) 3:1, (c) 3.5:1 and (d) 4:1.

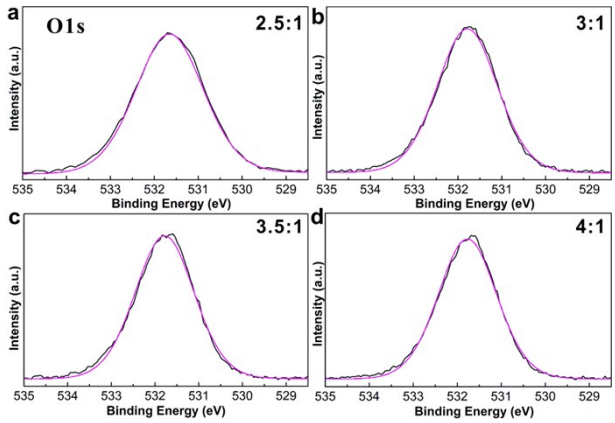

Figure S14. XPS high resolution O1s spectra of ZIF-8 films synthesized with different mole ratios, (a) 2.5:1, (b) 3:1, (c) 3.5:1 and (d) 4:1.

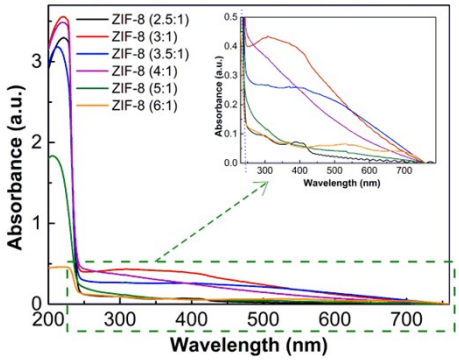

Figure S15. UV-vis absorption spectra of ZIF-8 films obtained through different mole ratios.

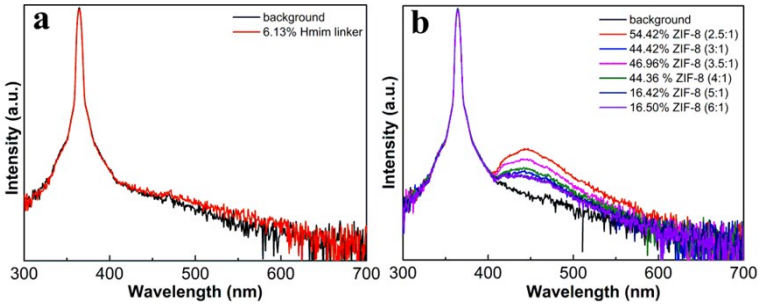

Figure S16. PLQY spectra of Hmim powders (a) and ZIF-8 films synthesized with different mole ratios (b). (λ_{ex}=365 nm)

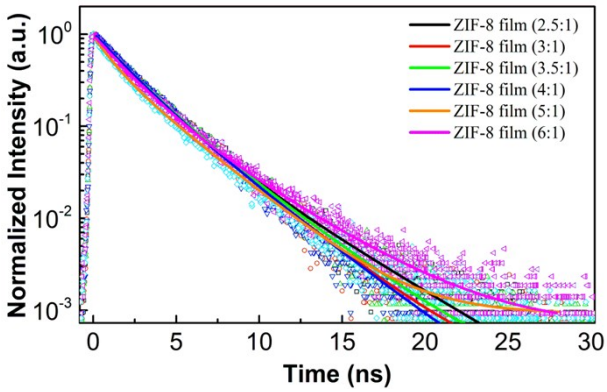

Figure S17. Fluorescence lifetime decay curves for ZIF-8 films synthesized with different mole ratios.

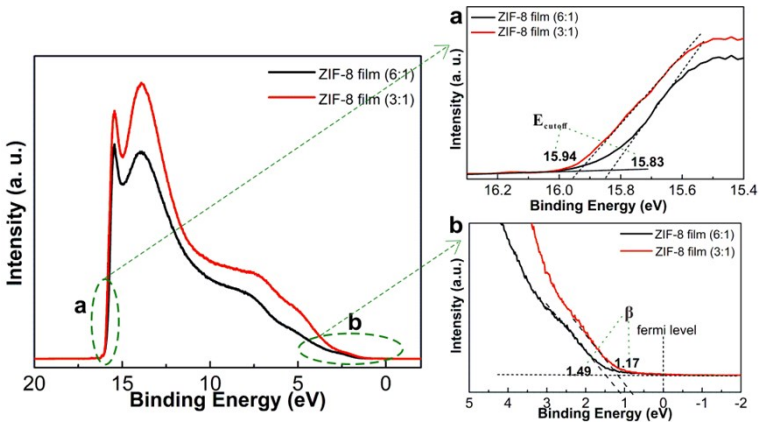

Figure S18. UPS patterns of ZIF-8 films synthesized with mole ratios of 6:1 and 3:1. (note: WF=hn-E_{cutoff}-E_F, HOMO=WF+β, hn=21.2 eV, WF: work function, E_{cotoff} : low kinetic energy cutoff edge, E_F: fermi level.)

Table S1 The infrared absorption characteristic peaks of ZIF-8 samples synthesized with the mole ratios of 8:1.

Wavenumber (cm^{-1})	The vibrations of the functional groups	Wavenumber (cm^{-1})	The vibrations of the functional groups
~3134	C-H in the imidazole ring	~2927	C–H in methyl group
~1585	C=N stretch modes	1350-1500	entire ring stretching
900-1350	in-plane bending of the ring	~1146, ~995	C-N stretching
below 800	out-of-plane bending of the ring	~421	Zn-N stretching

Table S2 Photoluminescence quantum yield ZIF-8 films synthesized with different mole ratios and Hmim powder using 365 nm excitation wavelength.

Mole ratio	PLQY (%)	Mole ratio	PLQY (%)
8:1	4.03	3.5:1	46.96
6:1	16.50	3:1	44.42
5:1	16.42	2.5:1	54.42
4:1	44.36	Hmim	6.13

Table S3 Results of fitting parameters of the PL lifetime decay measured for the ZIF-8 films at different mole ratios at 440 nm (λ_{ex}=365 nm).

Samples (mole ratios)	τ_1 / ns	A_1 / %	τ_2 / ns	A_2 / %	τ_{avg} / ns
2.5:1	2.1	82.12%	4.2	17.88%	2.74
3:1	1.9	58.65%	3.2	41.35%	2.61
3.5:1	1.9	61.02%	3.4	38.98%	2.70
4:1	1.8	55.12%	3.2	44.88%	2.63
5:1	1.1	44.68%	3.0	55.32%	2.57
6:1	1.7	66.46%	3.8	33.54%	2.81

note: $\tau_{avg=}$ $(A_1\times\tau_1^2+ A_2\times\tau_2^2) / (A_1\times\tau_1+ A_2\times\tau_2)$