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

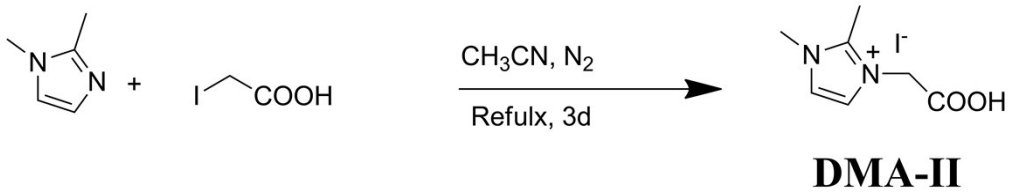
Imidazolium iodide salt as a bifunctional co-adsorbent for quasi-solid-state dye-sensitized solar cells: improvements of electron lifetime and charge collection efficiency

Haoliang Cheng, Min Wang, Yaru Li, Guanyu Zhao, Zhong-Sheng Wang*

Department of Chemistry, Shanghai Key Laboratory of Molecular Catalysis and Innovative Materials, Laboratory of Advanced Materials, iChEM (Collaborative Innovation Center of Chemistry for Energy Materials), Fudan University, 2205 Songhu Road, Shanghai 200438, China

*Corresponding author.

E-mail address: zs.wang@fudan.edu.cn



DMA-II

Figure S1 The synthetic route of **DMA-II**.

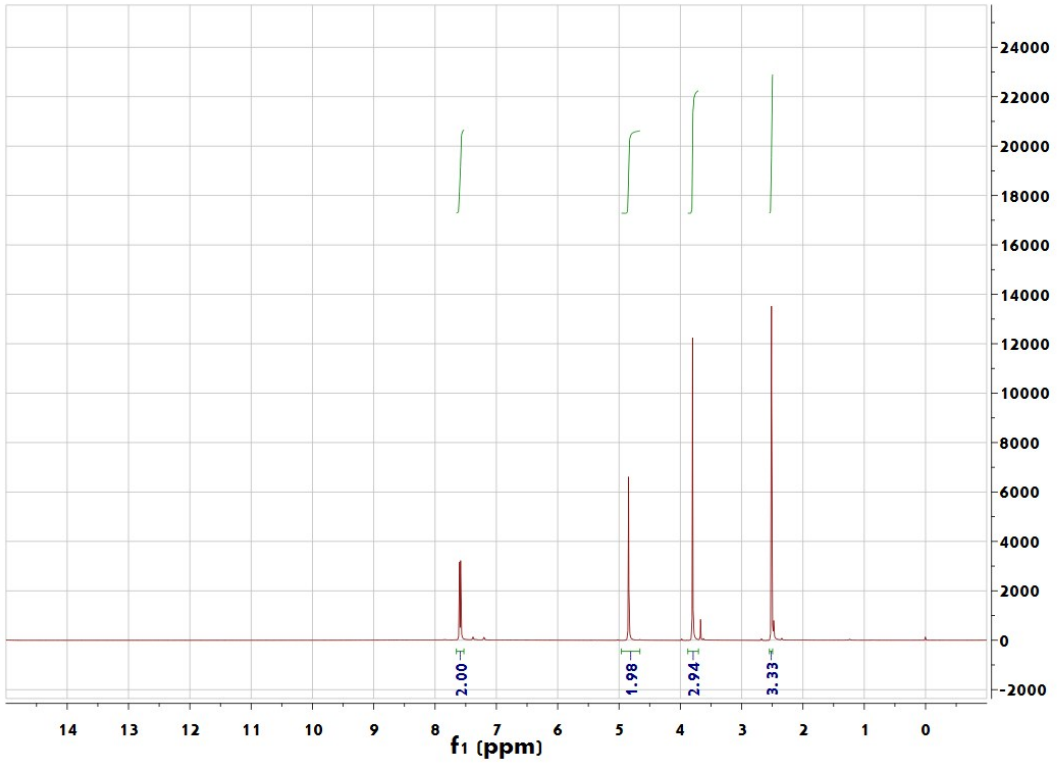


Figure S2. ^{1}H NMR of DMA-II.

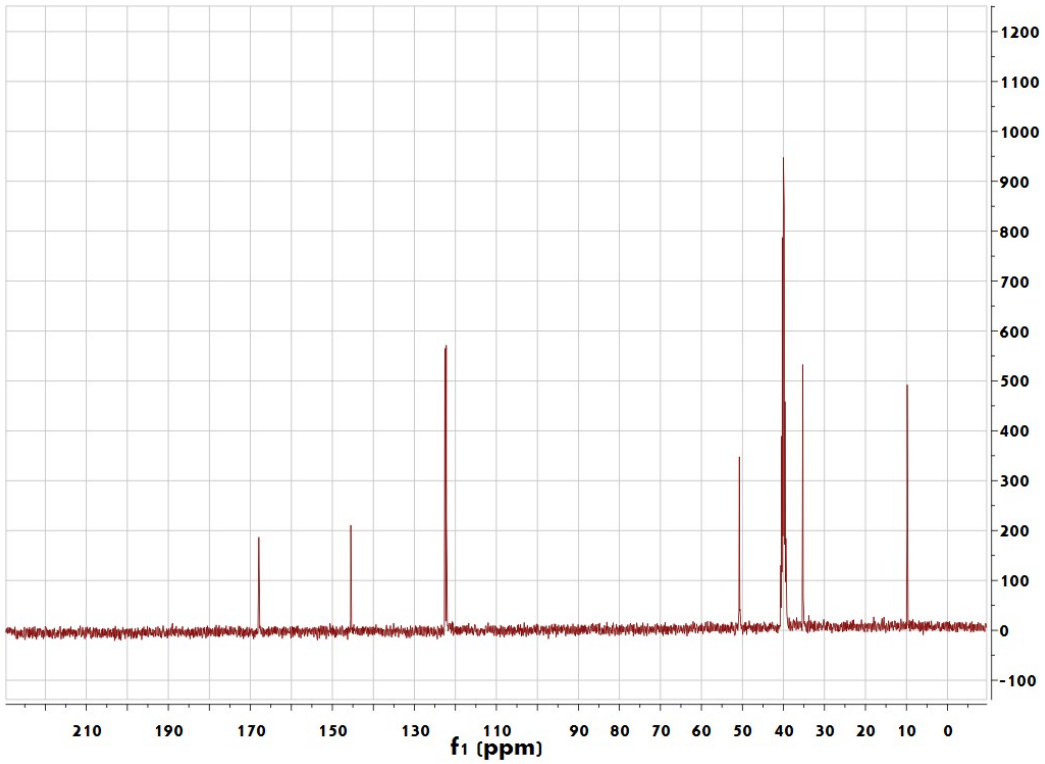


Figure S3. ^{13}C NMR of DMA-II.

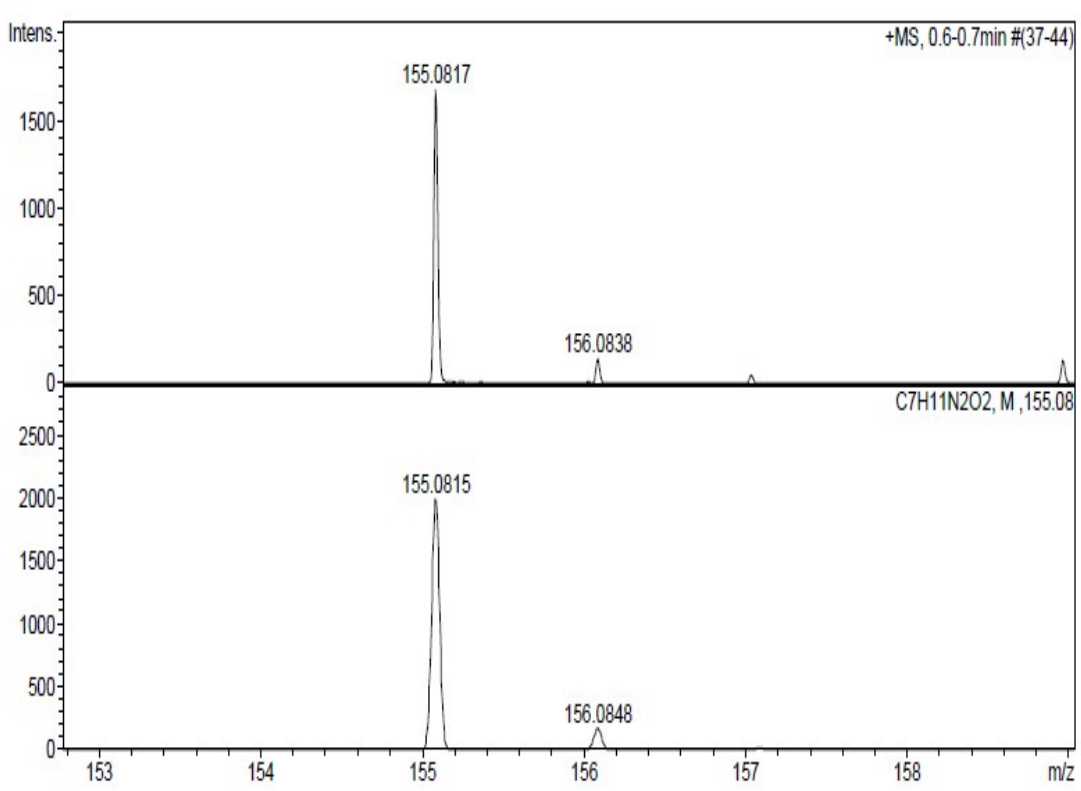


Figure S4. HRMS of DMA-II.

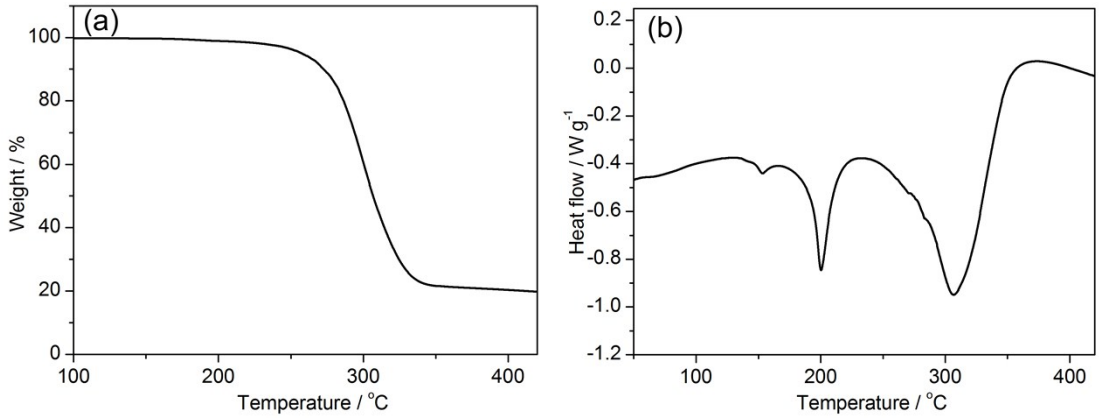


Fig. S5 (a) TG and (b) DSC curves of DMA-II.

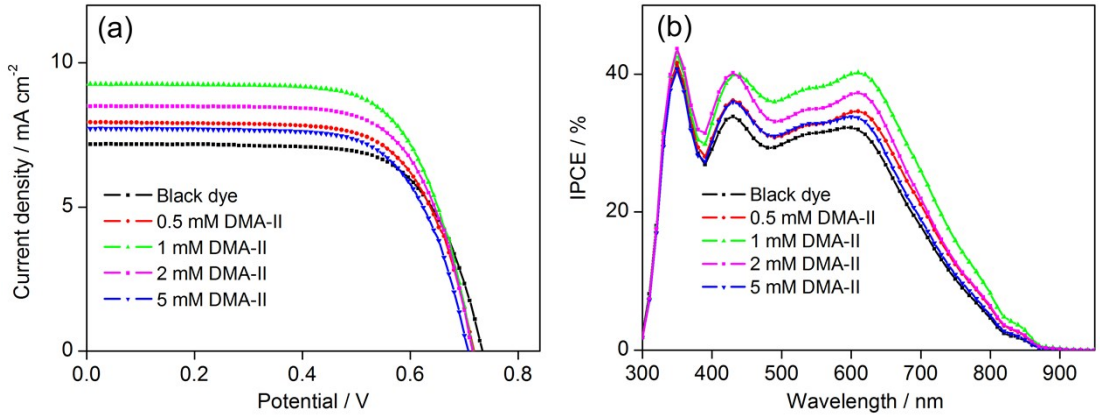


Fig. S6 (a) Current-potential curves and (b) IPCE action spectra of the DSSCs with a film thickness of 5 μm.

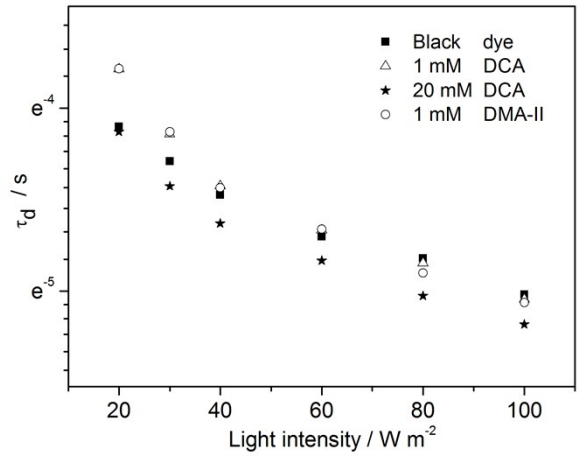


Fig. S7 Electron transport time as a function of light intensity.

Table S1. Photovoltaic performance of DMA-II under different concentrations with a film thickness of 5 μm.

Coadsorption	V_{oc} (mV)	J_{sc} (mA cm^{-2})	*FF*	*PCE* (%)
No	735	7.18	0.694	3.66
0.5 mM DMA-II	719	7.93	0.686	3.92
1 mM DMA-II	716	9.26	0.689	4.57
2 mM DMA-II	715	8.49	0.694	4.22
5 mM DMA-II	707	7.72	0.688	3.76

Table S2. Contributions to V_{oc} gain *vs*. the experimental change of V_{oc}

Coadsorption	ΔE_{CB} (mV)[a]	Q (μC cm^{-2})[b]	$m_c\ln(Q_2/Q_1)$ (mV)[c]	$\Delta E_{CB}+m_c\ln(Q_2/Q_1)$ (mV)	ΔV_{oc} (mV)[d]
No	0	125.08	0	0	0
1 mM DCA	-65	184.24	48	-17	-21
20 mM DCA	-86	170.84	39	-47	-39
1 mM DMA-II	-102	235.32	79	-23	-18

[a] $\Delta E_{CB} = E_{CB}$(adsorbent-dye)- E_{CB}(black dye) is obtained from Fig. 4(a). The negative value indicates a positive shift of CB. [b] The charge density at open circuit is obtained at 100 W m^{-2} LED light (532 nm). [c] m_c is 125 mV obtained from Fig. 4(a). [d]$\Delta V_{OC} = V_{OC}$(adsorbent-dye) - V_{OC}(black dye). The V_{OC} for the DSSCs is measured under AM 1.5G illumination sun-light (100 W m^{-2}).