Electronic Supplementary Information for

Insights into charge carrier dynamics in organo-metal halide perovskites: from neat films to solar cells

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Table S1. Transport parameters calculated by various transient and steady-state measurements

Sample	Method	Frequency (Hz)	light pulse (ns)	Time window or resolution	Light Intensity (mJ cm^{-2})	Wavelength (nm)	μ ($cm^2 V^{-1} s^{-1}$)	Carrier lifetime (μs)	Diffusion coefficient ($cm^2 s^{-1}$)	Diffusion length (μm)	Carrier concentration or trap density (cm^{-3})	Conductivity ($\Omega^{-1} cm^{-1}$)	Ref.
1-$MAPbI_3$ film	CELIV	2.5×10^4	3–7		0.1	532	3.2×10^{-4}						ACS Appl. Mater. Interfaces, 2015, 7, 4471–4475
1-$MAPbI_3$/PCBM bilayer	CELIV	2.5×10^4	3–7		0.1	532	7.1×10^{-4}						ACS Appl. Mater. Interfaces, 2015, 7, 4471–4475
2-$MAPbI_3$/PCBM bilayer	CELIV	2.5×10^4	3–7		0.1	532	5.29×10^{-4}						ACS Energy Lett., 2016, 1, 1000–1006
$MAPbI_3$ film	CELIV	2.5×10^4	3×10^4		$< 5 \times 10^{-5}$	473	0.67×10^{-3} 1.07×10^{-3}						Nano Energy, 2016, 27, 569–576.
HC 2D $\{(MA)_{n-1}Pb_nI_{3n+1}\}^{2-}$ film	Dark-CELIV	3.1×10^4					0.011						Nature, 2016, 536, 312–316
2D $\{(MA)_{n-1}Pb_nI_{3n+1}\}^{2-}$ film	Dark-CELIV	3.1×10^4					0.0015						Nature, 2016, 536, 312–316
$MAPbI_3$	CELIV	2.5×10^4 1.0×10^4	4		0.062–2.47	532	10^{-4}–10^{-3}						Adv. Energy Mater. 2017, 1602610
1-$MAPbI_3$/PCBM bilayer	TOF	10	3–7		0.1	532	5.4×10^{-4} 4.5×10^{-4}						ACS Appl. Mater. Interfaces, 2015, 7, 4471–4475
2-$MAPbI_3$/PCBM bilayer	TOF	10	3–7		0.1	532	8.65×10^{-5} 9.38×10^{-5}						ACS Energy Lett., 2016, 1, 1000–1006
$MAPbBr_3$ single crystals	TOF	200	5			355	115						Science, 2015, 347, 519–522
$MAPbI_3$ single crystals	TOF	> 100	4			337	24.0						Science, 2015, 347, 967–970
PbS-$MAPbI_3$ CQDs	TOF	10	3–7		0.1	532	8.04×10^{-5} 2.68×10^{-5}						Adv. Sci., 2016, 3, 1500432
PbS-$MAPbI_3$/PbS-EDT CQDs	TOF	10	3–7		0.1	532	9.91×10^{-5} 1.04×10^{-4}						Adv. Sci., 2016, 3, 1500432
$MAPbI_3$	FET						2.1×10^{-2} 7.2×10^{-2}						Nat. Commun., 2015, 6, 7383

CH_3NH_2 treated $MAPbI_3$	FET						22.75					ACS Appl. Mater. Interfaces, 2016, **8**, 31413−31418
$MAPbI_3$ microplate crystals	FET						3 4					Adv. Mater., 2016, 29, 1601959
$MAPbBr_3$ single crystals	Hall						20–60			5×10^9–5×10^{10}		Science 2015, 347, 519-522
$MAPbI_3$ single crystals	Hall						105			9×10^9		Science, 2015, 347, 967−970
$MAPbI_3$ single crystals	TPV or IS	Nan	4	1500 us	10-100 mWcm-2	337		82 or 95	175			Science, 2015, 347, 967−970
$MASnI_3$ single crystals	Hall						200			9×10^{17}	0.01–0.04	J. Solid State Chem., 2013, 205, 39−43
$MAPbI_3$ film	Hall									$4–10 \times 10^{13}$		Energy Environ. Sci., 2014, 7, 2619−2623
vapor- and solution-grown $MAPbI_3$ films	Hall						0.5	30	23	10^{15}–10^{16}	10^{-8}–10^{-7}	Nat. Commun., 2016, 7, 12253
$MAPbBr_3$ single crystals	Hall						60	2700	650	10^{11}–10^{12}	10^{-6}–10^{-5}	Nat. Commun., 2016, 7, 12253
$MAPbBr_3$ single crystals	Hall						10 20			10^9–10^{12}	5×10^{-9}–8×10^{-7}	Adv. Mater. 2016, 28, 6509–6514
$MAPbI_3$ single crystals	SCLC						164 24.8			3.6×10^{10} 4.5×10^{10}		Science, 2015, 347, 967−970
$MAPbI_3$ polycrystalline films	SCLC									2.0×10^{15}		Science, 2015, 347, 967−970
$MAPbBr_3$ single crystals	SCLC						38			5.8×10^9		Science, 2015, 347, 519−522
$MAPbI_3$ single crystals	SCLC						2.5			3.3×10^{10}	1×10^{-8}	Science, 2015, 347, 519−522
α-phase $FAPbI_3$ single crystals	SCLC						4.4			6.2×10^{11}	1.1×10^{-7}	Adv. Mater., 2016, 28, 2253−2258
$MAPbBr_3$ ISC	SCLC and Hall effect						60			2×10^{11}	2×10^{-8}	Nat. Commun., 2015, 6, 8724
$MAPbI_3$ thin film	TRPL	500	7	80 ns	0.025	532		0.010				J. Phys. Chem. Lett., 2016, 7, 2450–2455
$MAPbI_xCl_{3-x}$ thin film	TRPL	??						> 0.100				Energy Environ. Sci., 2015, 8, 208–215
$MAPbI_3$ polycrystalline film $MAPbI_3$/PCBM $MAPbI_3$/ Spiro-OMeTAD	TRPL	1000	0.15×10^{-3}		1.3×10^{-3}	600		4.5×10^{-3} 3.7×10^{-4} 6.4×10^{-4}	0.011 0.017	0.09 0.13		Science, 2013, 342, 344–347

$MAPbI_xCl_{3-x}$ film	TRPL	1×10^6	6×10^{-3}		6.5×10^{15} cm^{-3}		10^{-1}-10^{-2}	7×10^{-3}	0.04–0.05 0.1–2.5	1	Adv. Funct. Mater., 2016, 26, 4283–4292
$MAPbI_3$	TRPL	5×10^4	3×10^{-4}	20 ps	2×10^{-4}			0.14			J. Am. Chem. Soc., 2014, 136, 11610–11613
$MAPbI_3$ polycrystalline films	TRPL	1×10^6	1.4×10^{-4}		4×10^{16} cm^{-3}	700		0.02–0.1			J. Am. Chem. Soc., 2014, 136, 17730–17733
$MAPBI_xCl_{1-x}$ film $MAPBI_3$ film	TRPL	0.3–10 × 10^6			0.03	507		0.2727 9.6×10^{-3}	0.042, 0.054 0.017, 0.011	1.069, 1.213 0.129, 0.105	Science, 2013, 342, 341–344
$MAPbBr_{3-x}Cl_x$ films	TRPL	100K	1	400 ns	NAN	377		0.1– 0.446			Chem. Commun., 2014, 50, 11727–11730
$MAPbI_{3-x}$ Cl_x/PMMA Al_2O_3/$MAPbI_{3-x}$ Cl_x /PMMA TiO_2/$MAPbI_{3-x}$ Cl_x/PMMA TiO_2/ $MAPbI_{3-x}$ Cl_x/ Spiro-OMeTAD	TRPL	NAN	0.1	300 ns	<0.1	635		0.35 0.02/0.32 0.004 0.002			Energy Environ. Sci., 2014, 7, 1889–1894
$MAPbBr_3$ single crystals	TA + TRPL		0.7	ns–μs		355		0.041 0.375		3 17	Science 2015, 347, 519-522
$MAPbI_3$ single crystals	TA + TRPL		0.8	ns–μs		633		0.022 1.032		2 8	Science 2015, 347, 519-522
$MAPbI_3$/PCBM $MAPbI_3$/Spiro-OMeTAD	TA	1000	3.5×10^{-5}		1.4×10^{-3}	450		6×10^{-6} 8×10^{-6}			J. Phys. Chem. Lett., 2016, 7, 5056–5061
$MAPbI_3$ films	TA	1000	0.13E-3	400 ps	0.019	377		97, 105, 313 × 10^{-6}			Energy Environ. Sci., 2015, 8, 208–215
$MAPbI_3$	TA	5×10^4	0.3×10^{-3}		2×10^{-4}	1.8 eV		0.1–1 × 10^{-3}			J. Am. Chem. Soc., 2014, 136, 11610–11613
$MAPBI_xCl_{1-x}$ film	TA	1000	0.15E-3	2000 ps	0.0013	500		0.283 0.288			Science, 2013, 342, 341–344
$MAPbI_3$ thin film	TA	1000	0.13 × 10^{-3}		8×10^{-3}	387			0.05–0.08		Nat. Commun., 2015, 6, 7471
$MAPbI_3$ film	TRTS	5000	3.5×10^{-5}		0.2 × 10^{-3} 0.121	800	35				Adv. Funct. Mater. 2015, 25, 6218–6227
$MAPbI_3$ embed in mesoporous Al_2O_3	TRTS	1000	8×10^{-5}		0.4/pluse	796	20 25				J. Am. Chem. Soc. 2014, 136, 5189–5192
$MAPbI_3$ embed in mesoporous Al_2O_3	TRTS	1100	1E-3	2500 ps	6E-3~0.32	550	11.6 8.1 8.2				Adv. Mater. 2014, 26, 1584–1589
$MAPbI_3$ single crystal	TRTS	1000	1E-3	1000ps	0.08-0.14	400	800				Energy Environ. Sci. 2015, 8, 3700–3707

1-$MAPbI_3$ film and $MAPbI_3$ in mesoporous Al_2O_3 scaffolds	TRMC	8.45×10^9	3		410	3	1			J. Am. Chem. Soc. 2014, 136, 5189–5192
2-$MAPbI_3$ film	TRMC	10	5–8		355	20 10				J. Am. Chem. Soc. 2014, 136, 13818–13825
$MAPbI_xCl_{3-x}$ films	TRMC	10		10^9 to 10^{13} photons/cm^2	600	30		10	5×10^{14}	J. Phys. Chem. Lett. 2015, 6, 3082–3090
$MAPbI_3$ single crystal	TRMC	10	3.5	4×10^{12} photons/cm^2	405		15	> 50		J. Phys. Chem. Lett., 2016, 7, 923–929