Electronic Supplementary Material (ESI) for Reaction Chemistry & Engineering.

Metal halide perovskites as an emergent catalyst for CO_2 photoreduction: a minireview

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Electronic Supplementary Information

Table S1. Reaction parameters involved and the reaction product rates or yields of all the works reported.

Material	Solvents	Light source	Reaction time (h)	Reaction products	CO yield (μmol g^{-1})	CH_4 Yield (μmol g^{-1})	H_2 Yield (μmol g^{-1})	CO rate (μmol g^{-1} h^{-1})	CH_4 rate (μmol g^{-1} h^{-1})
$CsPbBr_3$ Fe: $CsPbBr_3$ [1]	Ethyl acetate/water	450 W, Xe lamp, 150 Mw cm^{-2}	3	CO and CH_4	-	-		4.6 3.2	1.9 6.1
$CsPbBr_3$ $CsPb(Br_{0.7}/Cl_{0.3})_3$ $CsPb(Br_{0.5}/Cl_{0.5})_3$ $CsPb(Br_{0.3}/Cl_{0.7})_3$ $CsPbCl_3$ [2]	Ethyl acetate	300 W, Xe lamp, 200 Mw cm^{-2}	9	CO and CH_4	135 156 767 204 65	60 72 108 63 31		15.0 17.3 85.2 22.7 7.2	6.7 8.0 12.0 7.0 3.4
Polyedron/$CsPbBr_3$ Hexapod/$CsPbBr_3$	Ethyl acetate/water		4		130.7 79.5	58.8 38.4		-	-

Cube/$CsPbBr_3$ [3]		450 W, Xe lamp, 150 Mw cm^{-2}		CO and CH_4	16.4	7.6			
$CsPbBr_3$/Cs_4PbBr_6 $Co_{0.5\%}$@$CsPbBr_3$/Cs_4PbBr_6 $Co_{1\%}$@$CsPbBr_3$/Cs_4PbBr_6 $Co_{2\%}$@$CsPbBr_3$/Cs_4PbBr_6 $Co_{3\%}$@$CsPbBr_3$/Cs_4PbBr_6 [4]	Water	300 W, Xe lamp, 100 mw cm^{-2}	20	CO and CH_4	48 95 175 239 148	7 7 7 7 7		-	-
11.6nm-$CsPbBr_3$ 8.5nm-$CsPbBr_3$ 6.1nm-$CsPbBr_3$ 3.8nm-$CsPbBr_3$ [5]	Ethyl acetate/water	300 W, Xe lamp	8	CO and CH_4	24 34 28 18	9 12 10 7		-	-
$CsPbBr_3$ Mn(4:1):$CsPb(Br/Cl)_3$ Mn (2:1):$CsPb(Br/Cl)_3$ Mn(2:3):$CsPb(Br/Cl)_3$ Mn(3:7):$CsPb(Br/Cl)_3$ [6]	Ethyl acetate	300 W, Xe lamp	9	CO and CH_4	140 767 1917 1732 164	59 108 82 63 47			
$CsPbBr_3$ $Cs_3Sb_2Br_9$ [7]	Dried octadecene	AM 1.5 G	4	CO	50 510	- -			
$Cs_2AgBiBr_6$ NCs Washed $Cs_2AgBiBr_6$ NCs [8]	Ethyl acetate	100 W, Xe lamp	6	CO and CH_4	5.5 14.1	0.65 9.6			
$Rb_3Bi_2I_9$ $Cs_3Bi_2I_9$ $MA_3Bi_2I_9$ [9]	Trichloroethane	32 W, UV lamp	10	CO and CH_4	18.2 77.6 7.2	17.0 14.9 9.8			
$Cs_3Bi_2Br_9$ $Cs_3Bi_2Cl_9$ [10]	Multiple solvents	300 W, Xe lamp AM 1.5 G	5	CO	134.7 83.06			26.95 21.01	
$CsPbBr_3$ $CsPbBr_3$ /BP (1.0 %wt) $CsPbBr_3$ /BP (5.0 %wt) $CsPbBr_3$ /BP (10.0 %wt) BP [11]	Ethyl acetate/water	200 W, Xe lamp, 200 Mw cm^{-2}	3	CO and CH_4	31 80 134 70 19	13 30 32 9 3			
$CsPbBr_3$ Bi_2WO_6 $CsPbBr_3Bi_2WO_6$ (1:1) $CsPbBr_3Bi_2WO_6$ (1:2) $CsPbBr_3Bi_2WO_6$ (1:5) $CsPbBr_3Bi_2WO_6$ (1:8)	Ethyl acetate/water	300 W, Xe lamp, 100 mw cm^{-2}	10	CO and CH_4	50 0 290 320 503 350	5 40 10 17 20 20			

$CsPbBr_3Bi_2WO_6$ (1:10)[12]					240	17			
$CsPbBr_3$ α-Fe_2O_3 $CsPbBr_3$/α-Fe_2O_3 $CsPbBr_3$/USGO $CsPbBr_3$/USGO/α-Fe_2O_3 [13]	Acetonitrile/water	Simulated Sunlight	4	CO				3.7 0.0 5.8 14.6 73.8	
TiO_2 TiO_2/0.5$CsPbBr_3$ TiO_2/1$CsPbBr_3$ TiO_2/2$CsPbBr_3$ TiO_2/3$CsPbBr_3$ TiO_2/4$CsPbBr_3$ $CsPbBr_3$[14]	Acetonitrile/water	300 W, Xe lamp	1	CO and H_2	6.6 7.97 11.45 13.49 11.33 9.89 6.2		0.1 0.11 0.23 0.43 0.28 0.28 0.0		
$CsPbBr_3$ QDs $CsPbBr_3$ QD/GO[15]	Ethyl acetate	100 W, Xe lamp, 150 mW cm^{-2}	12	CO and CH_4	49.5 58.7	22.9 29.6			
ZIF-8 ZIF-67 $CsPbBr_3$ $CsPbBr_3$ @ ZIF-8 $CsPbBr_3$ @ ZIF-67[16]	Water	100 W, Xe lamp	3	CO and CH_4	0 1.5 1 1.3 1.5	2 3 3.5 5 10			
$CsPbBr_3$ QDs g-C_3N_4 10-g-C_3N_4 /$CsPbBr_3$ QDs 20- g-C_3N_4 /$CsPbBr_3$ QDs 30- g-C_3N_4 /$CsPbBr_3$ QDs[17]	Ethyl acetate/water or acetonitrile /water	300 W, Xe lamp	2	CO				12/20 30/42 40/80 70/149 50/120	
$CsPbBr_3$ QDs $CsPbBr_3$ 5%-UiO-66(NH_2)-$CsPbBr_3$ 10%-UiO-66(NH_2)-$CsPbBr_3$ 15%-UiO-66(NH_2)-$CsPbBr_3$ 30%-UiO-66(NH_2)-$CsPbBr_3$ [18]	Ethyl acetate/water	300 W, Xe lamp		CO and CH_4	40 15 62 80 100 70	12 0 2 3 3 3			
CsPbBr3 NC, CsPbBr3 NC/MRGO CsPbBr3 NC/BZNW/MRGO[19]	Water	150 W, Xe lamp AM 1.5 G	3	CO and CH_4	2 2.7 3.8	3.7 11 19			10.44 31.52 52.02
CN $CsPbBr_3$ 2Br−CN 3Br−2CN	Acetonitrile/water	300 W, Xe lamp	2	CO				5.5 5.0 7.4 28.5	

Br−CN Br−4CN[20]								25.2 10.6	
$CsPbBr_3$ Ni(tpy) $CsPbBr_3$-0.06Ni(tpy) $CsPbBr_3$ -0.12Ni(tpy) $CsPbBr_3$ -0.24Ni(tpy) $CsPbBr_3$ -0.48Ni(tpy)[21]	Ethyl acetate/water	300 W, Xe lamp, 100 mw cm^{-2}	4	CO and CH_4	50 0 780 150 1600 1490	0 0 40 50 60 55			
$CsPbBr_3$ TiO-CN $CsPbBr_3$@CN $CsPbBr_3$@TiO-CN[22]	Ethyl acetate/water	300 W, Xe lamp	10	CO	20 40 50 129				
PCN-221 $MAPbI_3$@PCN-221 PCN-221($Fe_{0.2}$) $MAPbI_3$@PCN-221($Fe_{0.2}$) PCN-221($Fe_{0.4}$) $MAPbI_3$@PCN-221($Fe_{0.4}$) PCN-221($Fe_{0.6}$) $MAPbI_3$@PCN-221($Fe_{0.6}$) PCN-221($Fe_{0.8}$) $MAPbI_3$@PCN-221($Fe_{0.8}$) PCN-221(Fe) $MAPbI_3$@PCN-221(Fe)[23]	Ethyl acetate/water	300 W, Xe lamp 100 mw cm^{-2}	25	CO and CH_4	15 20 35 104 40 160 20 250 15 300 10 360	0 0 40 445 50 450 50 440 50 460 50 500			
$CsPbBr_3$ $CsPbBr_3/MoS_2$, (0.25%) $CsPbBr_3/MoS_2$, (0.5%) $CsPbBr_3/MoS_2$, (1.0%) $CsPbBr_3/MoS_2$, (2.0%) $CsPbBr_3/MoS_2$, (1.5%) $CsPbBr_3/MoS_2$, (2.5%) $CsPbBr_3/MoS_2$, (5.0%)} MoS_2[24]	Ethyl acetate	200 W, Xe lamp, 200 mw cm^{-2}	30	CO and CH_4	27 30 58 70 27 18 15 9 5	10 12 19 30 49 35 22 7 3			
$CsPbBr_3$ MIL-100(Fe) $CsPbBr_3$/ MIL-100(Fe)[25]	Water	300 W, Xe lamp (>420 nm)	4	CO				9 10 41	
$CsPbBr_3$ CTF-1 $CsPbBr_3$ / CTF-1	Ethyl acetate	300 W, Xe lamp (>400 nm)	4	CO				9.7 13 48.2	

$CsPbBr_3$ / CTF-1-Ni[26]								86.5	
$CsPbBr_3$ $CsPbBr_3$ $CsPbBr_3$ $CsPbBr_3$ $CsPbBr_3$/Pt[27]	Toluene Ethyl acetate Iso-propanol Acetonitrile Ethyl acetate	150 W, Xe lamp	6	CO, CH_4 and H_2	0.33 4.21 0.01 0.57 1.6	0 0.86 0.75 0 9	0 0.39 0.43 0 1.8		
$CsPbBr_3$ C/Cs_4PbBr_6 $CsPbBr_3$/Cs_4PbBr_6 $Co_{0.5\%}$@$CsPbBr_3$/Cs_4PbBr_6 $Co_{1\%}$@$CsPbBr_3$/Cs_4PbBr_6 $Co_{2\%}$@$CsPbBr_3$/Cs_4PbBr_6[28]	Acetonitrile /water/methanol Acetonitrile /water Acetonitrile /water/methanol Acetonitrile /water/methanol Acetonitrile /water/methanol Acetonitrile /water/methanol	300 W, Xe lamp, 100 mw cm^{-2}	15	CO	2.58 µmol 2.69 µmol 2.96 µmol 7.21 µmol 7.34 µmol 7.28 µmol				
NS $CsPbBr_3$ NS $CsPbBr_3$ – RGO Cu-RGO Ex situNS $CsPbBr_3$ –Cu-RGO NS $CsPbBr_3$ –Cu-RGO NR1 $CsPbBr_3$ –Cu-RGO NR2 $CsPbBr_3$ –Cu-RGO[29]	Water	300 W, Xe lamp, 100 mw cm^{-}	4	CO, CH_4 and H_2				2.5 3 0 0.8 0.5 0.5 0.5	0.5 0.5 1 7.5 12.5 6 9
$CsPbBr_3$ NC $CsPbBr_3$ NC/Pd NS (100) $CsPbBr_3$ NC/Pd NS (300) $CsPbBr_3$ NC/Pd NS (600) $CsPbBr_3$ NC/Pd NS (900)[30]	Water	150 W, Xe lamp, 150 mW cm^{-2}	3	CO, CH_4 and H_2	3.67 7.92 12.63 5.76 3.89	2.79 3.06 3.93 10.41 5.25	0 0.52 1.16 3.28 1.4		
$CsPbBr_3$ $CsPbBr_3$-Au $CsPbBr_3$ $CsPbBr_3$-Au[31]	Acetonitrile /propanol	100 W, Xe lamp, 100 mW cm^{-2} (λ>420nm/λ>580 nm)		CO and CH_4	5 10 0 1	0 5 0 .5			
$CsPbBr_3$ $CsPbBr_3$ Re(300) $CsPbBr_3$ Re(600) $CsPbBr_3$ Re(900)[32]	Tolueno/Isopropanol	150 W, Xe lamp, 150 mW cm^{-2}	3	CO, CH_4 and H_2	2 30 100 80	0 0 0 0	0 2 5 7		
$CsPbBr_3$ NCs/MXene-20[33]	Ethyl acetate	300 W, Xe lamp	5	CO and CH_4	- 140	- 35		26.3 -	- 7.25

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