Supporting Information

Suppressing intrinsic self-doping of $CsPbIBr_2$ films for high-performance all-inorganic, carbon-based perovskite solar cells

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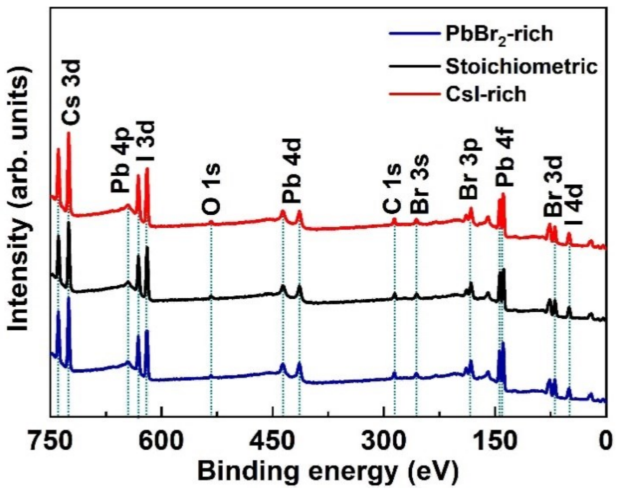

Fig. S1 XPS survey spectra of $CsPbIBr_2$ films prepared with $PbBr_2$-rich, stoichiometric, and CsI-rich precursors, respectively.

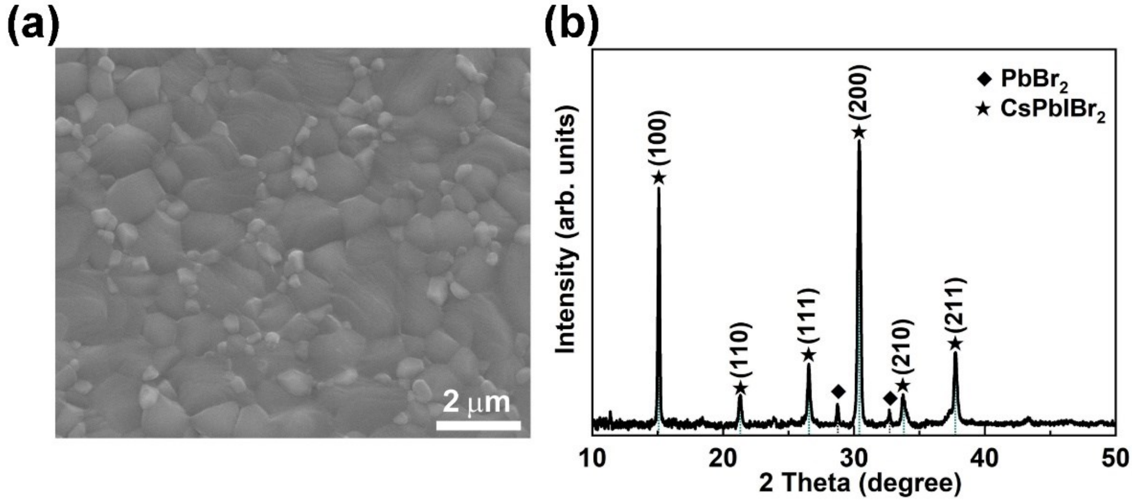

Fig. S2 (a) SEM image and (b) XRD pattern of $CsPbIBr_2$ film prepared with the precursor with $CsI/PbBr_2$ stoichiometric ratio of 0.8:1.0.

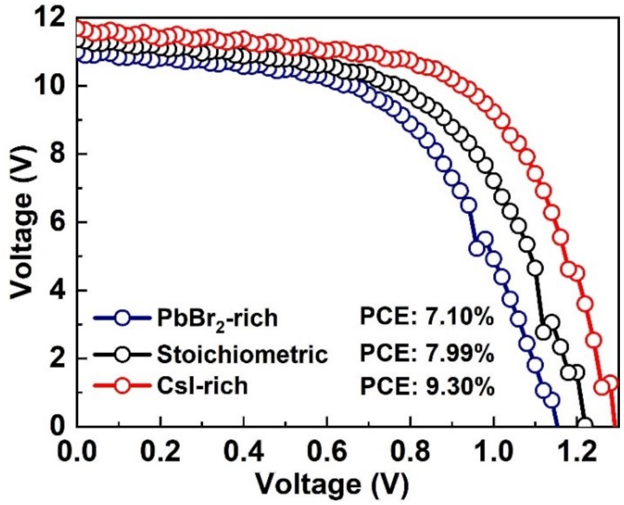

Fig. S3 Light J-V curves recorded under RS voltage scan for the optimized $CsPbIBr_2$ PSCs based on the typical $PbBr_2$-rich, stoichiometric, and CsI-rich precursors, respectively.

Table S1. Detailed parameters of (100) and (200) peaks for $CsPbIBr_2$ films obtained with $PbBr_2$-rich, stoichiometric, and CsI-rich precursors, respectively.

Samples	Peak of (100) plane			Peak of (200) plane		
	Position (2θ)	Intensity	FWHM	Position (2θ)	Intensity	FWHM
$PbBr_2$-rich	15.00°	4012	0.1737°	30.23°	5906	0.2184°
Stoichiometric	15.01°	3622	0.1383°	30.24°	6605	0.1832°
CsI-rich	15.07°	6002	0.1136°	30.35°	8334	0.1784°

Table S2. Summary of PCE and V_{oc} values of $CsPbIBr_2$-based PSCs reported previously.

Cell configuration	V_{oc} [V]	PCE [%]	Ref.
FTO/c-TiO_2/$CsPbIBr_2$/Carbon	**1.32**	**10.48**	**This work**
FTO/TiO_2/$SmBr_3$/Sm-doped $CsPbIBr_2$/spiro-OMeTAD/Au	1.14	10.88	[1]
FTO/c-TiO_2/$CsPbIBr_2$/Carbon	1.323	10.82	[2]
ITO/SnO_2/ $CsPbIBr_2$/Spiro-OMeTAD/Ag	1.27	10.81	[3]
FTO/c-TiO_2/CsBr/$CsPbIBr_2$/Carbon	1.261	10.71	[4]
FTO/TiO_2/CsPb(SO3)IBr_2/spiro-OMeTAD/Au	1.21	10.55	[5]
FTO/TiO_2/CsPb(Ba)IBr_2/spiro-OMeTAD/Au	1.19	10.51	[6]
ITO/ZnO-NH_4Cl/$CsPbIBr_2$/Spiro-OMeTAD/Ag	1.27	10.16	[7]
ITO/SnO_2/$CsPbIBr_2$/YD_2-o-C8/ spiro-OMeTAD/Ag	1.37	10.13	[8]
ITO/SnO_2/S-doped $CsPbIBr_2$/P3HT/Au	1.30	9.78	[9]
FTO/Cs-NiO_x/N749/$CsPbIBr_2$/ $PC_{61}BM$/BCP/Ag	1.19	9.49	[10]
FTO/SnO_2/TiO_2/CsBr/$CsPbIBr_2$/Carbo n	1.273	9.31	[11]
FTO/c-TiO_2/Li-$CsPbIBr_2$/CuPc/Carbon	1.22	9.25	[12]
FTO/c-TiO_2/$CsPbIBr_2$/spiro-OMeTAD/Au	1.20	9.17	[13]
FTO/c-TiO_2/$CsPbIBr_2$/Carbon	1.245	9.16	[14]
FTO/c-TiO_2/$CsPbIBr_2$/Carbon	1.253	9.12	[15]
FTO/c-TiO_2/$CsPbIBr_2$/Carbon	1.258	9.06	[14]
FTO/c-TiO_2/$CsPbIBr_2$/Carbon	1.26	9.04	[16]
FTO/c-TiO_2/$CsPbIBr_2$/CuPc/Carbon	1.289	8.76	[17]
FTO/c-TiO_2/$CsPbIBr_2$/Carbon	1.283	8.60	[18]
ITO/SnO_2/$CsPbIBr_2$/spiro-OMeTAD/Ag	1.15	8.54	[19]
FTO/c-TiO_2/$CsPbIBr_2$/Carbon	1.05	8.31	[20]
FTO/c-TiO_2/m-TiO_2/$CsPbIBr_2$/Carbon	1.08	8.25	[21]
FTO/c-TiO_2/$CsPbIBr_2$/spiro-OMeTAD/Au	1.227	8.02	[22]
FTO/ZnO/$CsPbIBr_2$/Carbon	1.03	7.60	[23]
ITO/SnO_2/C60/$CsPbIBr_2$/spiro-OMeTAD/Au	1.18	7.34	[24]
FTO/TiO_2/$CsPbIBr_2$/spiro-OMeTAD/Ag	1.28	7.31	[25]

ITO/Passivated SnO_2/$CsPbIBr_2$/Carbon	1.23	7.00	[26]
FTO/c-TiO_2/$CsPbIBr_2$/Carbon	1.142	6.55	[27]
FTO/c-TiO_2/m-TiO_2/$CsPbIBr_2$/spiro-OMeTAD/Au	1.121	6.30	[28]
FTO/c-TiO_2/m-TiO_2/$CsPbIBr_2$/Carbon	0.96	6.14	[29]
ITO/NiO_x/$CsPbIBr_2$/CeO_x/Ag	1.01	5.60	[30]
FTO/In_2S_3/$CsPbIBr_2$/Spiro-OMeTAD/Ag	1.09	5.59	[31]
FTO/NiO_x/$CsPbIBr_2$/ZnO/Al	1.01	5.57	[32]
FTO/NiO_x/$CsPbIBr_2$/MoO_x/Au	0.85	5.52	[33]
ITO/SnO_2/$CsPbIBr_2$/P3HT/Au	1.07	5.16	[34]
ITO/ZnO/$CsPbIBr_2$/spiro-OMeTAD/Ag	1.04	4.8	[35]
FTO/c-TiO_2/$CsPbIBr_2$/Au	0.959	4.70	[36]

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