Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels. This journal is © The Royal Society of Chemistry 2020



**Figure S1.** XPS spectra for (a, c) Pb 4*f* and (b, d) I 3*d* in  $Cs_{0.24}FA_{0.76}PbI_{3-x}Br_x$  perovskite films with different thickness of SrI<sub>2</sub>.



Figure S2. SEM images of PbI<sub>2</sub> films with different thickness of SrI<sub>2</sub> layer on the bottom.



**Figure S3.** The distribution diagram of photovoltaic parameters of PSCs based on dirrerent  $Srl_2$ -doped perovsktie, a)  $J_{sc}$ , b)  $V_{oc}$ , c) *FF* and d) PCE.

**Table S1** J-V parameters of the champion PSCs with different Sr-doped  $Cs_{0.24}FA_{0.76}PbI_{3-x}Br_x$  perovskite films.

Srl <sub>2</sub> thickness	J <sub>sc</sub> (mA cm <sup>-2</sup> )	V <sub>oc</sub> (V)	FF	PCE (%)
0	20.66	1.055	0.670	14.60

1 nm	21.05	1.014	0.687	14.67	
2 nm	21.83	1.006	0.736	16.15	
4 nm	21.94	1.021	0.789	17.66	
8 nm	18.97	1.033	0.621	12.71	
16 nm	18.06	0.896	0.392	6.35	



Figure S4. Long-term stability of the PSCs modules based on different Sr-doped  $Cs_{0.24}FA_{0.76}PbI_{3-x}Br_x$  perovskite film.