

## Electronic Supplementary Information

### Cesium Carbonate as surface modification material for organic-inorganic hybrid perovskite solar cells with enhanced performance

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Table S1. Atomic ratio of films without and with  $\text{Cs}_2\text{CO}_3$  surface modification test by XPS

device	Ti <sub>2p</sub>	O <sub>1s</sub>	Cs <sub>3d</sub>
control	26.89%	56.41%	0.01%
$\text{Cs}_2\text{CO}_3$ modified	26.29%	56.58%	3.84%

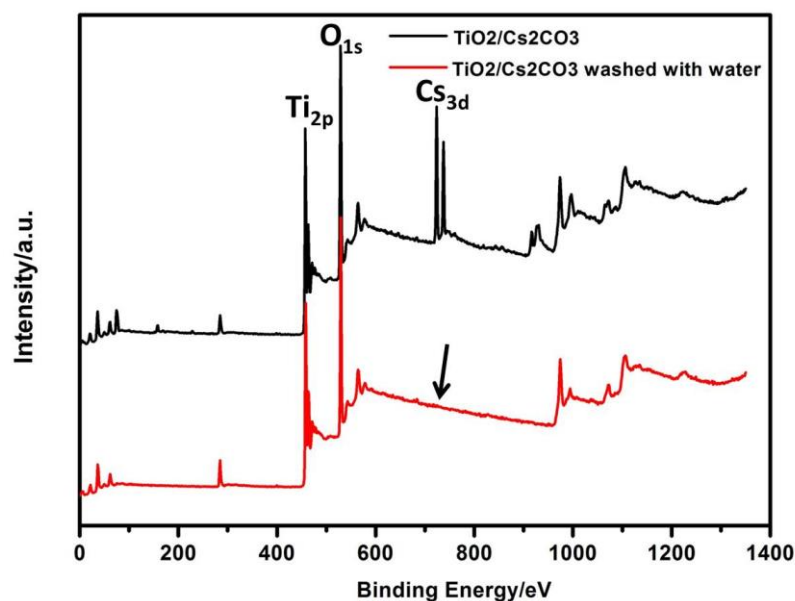


Figure S1. XPS result of modified film washed with DI water for three times.

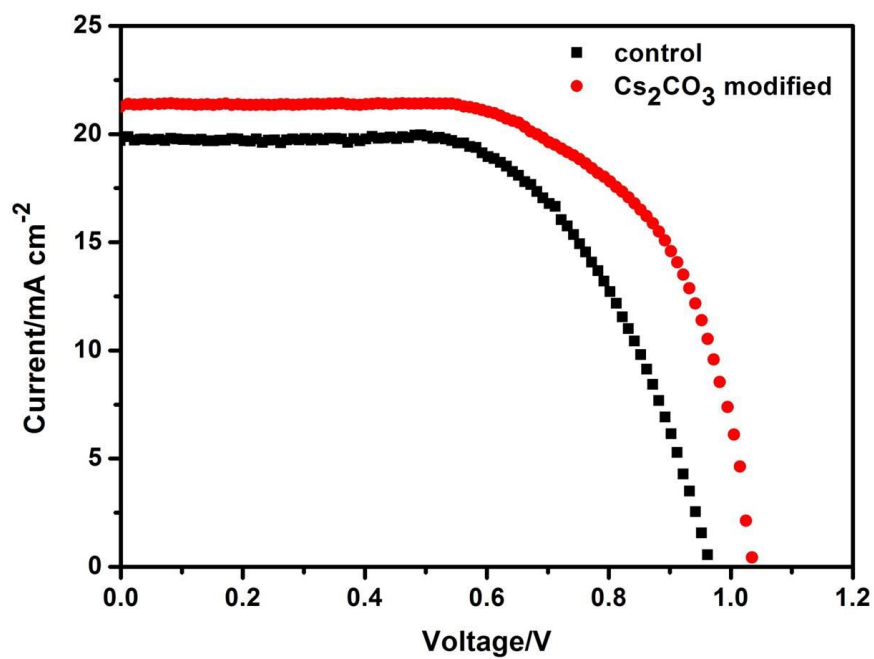


Figure S2. *J-V* curves of perovskite solar cells without and with Cs<sub>2</sub>CO<sub>3</sub> modification under AM 1.5, 100mW/cm<sup>2</sup> sun light irradiance.

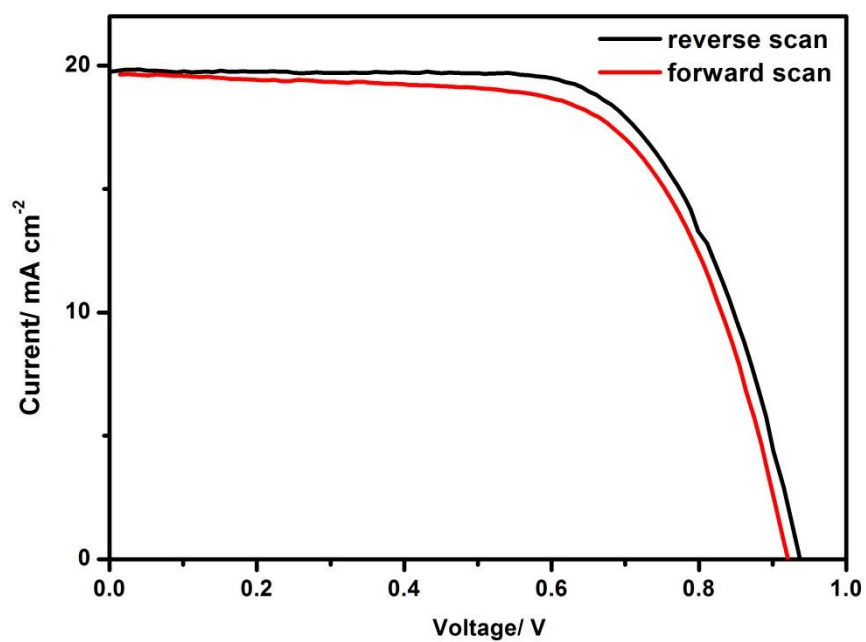


Figure S3. *J-V* curves of Cs<sub>2</sub>CO<sub>3</sub> modified perovskite solar cell tested under forward and reverse scan.

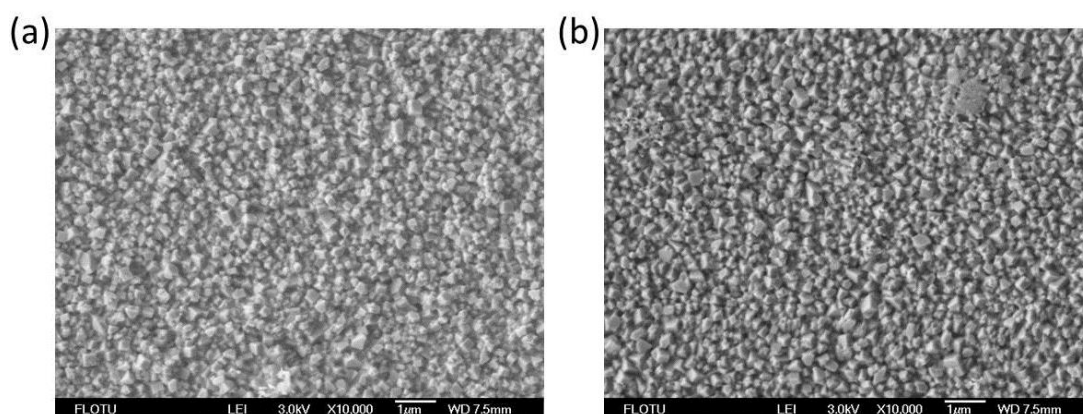


Figure S4. (a),(b) SEM results of perovskite films without and with  $\text{Cs}_2\text{CO}_3$  surface modification respectively;

Table S2. parameters of (a) control devices and (b) devices modified with 30mM  $\text{Cs}_2\text{CO}_3$ .

a) unmodified	$V_{oc}/\text{V}$	$J_{sc}/\text{mA cm}^{-2}$	$FF/\%$	$\text{PCE}/\%$
1	0.99	20.3	60.7	12.2
2	0.95	20.6	64.4	12.6
3	0.95	19.7	63.1	11.8
4	0.94	18.9	64.7	11.5
5	0.94	19.6	63.5	11.7
6	0.97	19.0	64.6	11.9
average	0.96	19.7	63.5	12.0

b) modified	$V_{oc}/\text{V}$	$J_{sc}/\text{mA cm}^{-2}$	$FF/\%$	$\text{PCE}/\%$
1	1.02	21.4	61.4	13.4
2	1.02	20.4	68.2	14.2
3	1.05	20.0	68.6	14.4
4	0.98	20.4	65.5	13.1
5	1.04	21.3	64.1	14.2
6	0.98	21.5	61.7	13.0
average	1.02	20.8	64.9	13.7

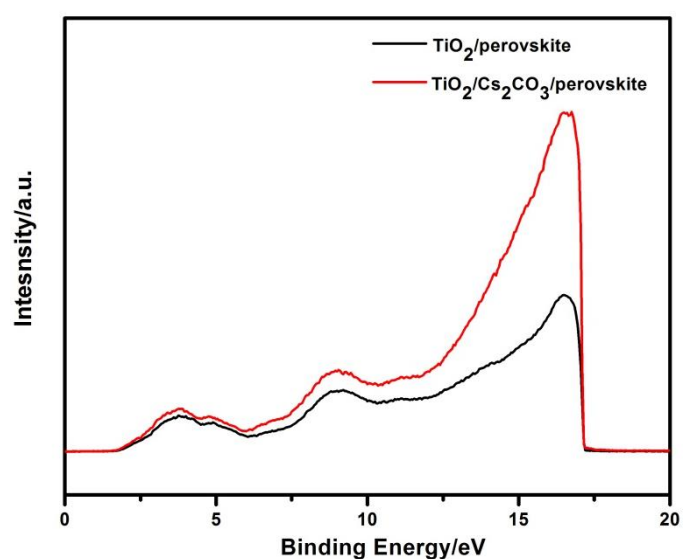


Figure S5. UPS curves of  $\text{TiO}_2/\text{perovskite}$  and  $\text{TiO}_2/\text{Cs}_2\text{CO}_3/\text{perovskite}$  films.