Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary information

The measurement range of AFM 2D topography images in Figure 3c is consistent. We show in supplementary information that different AFM of Cs base tin-lead mixed perovskite and their RMS. Fig S1 shows the AFM of $CsPb_{0.75}Sn_{0.25}I_3$. And the RMS is 50.62 nm.

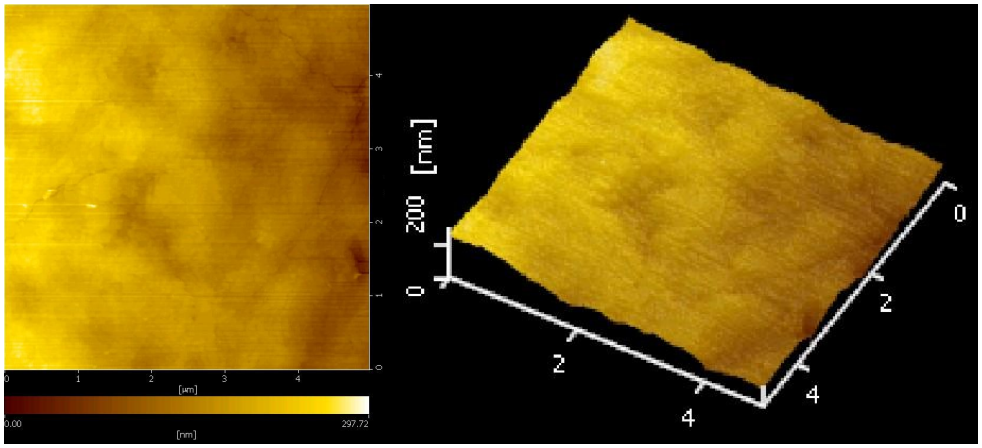

Fig S1. AFM top view and 3D topography images with $CsPb_{0.75}Sn_{0.25}I_3$

Fig S2 shows the AFM of $CsPb_{0.5}Sn_{0.5}I_3$. And the RMS is 41.75 nm.

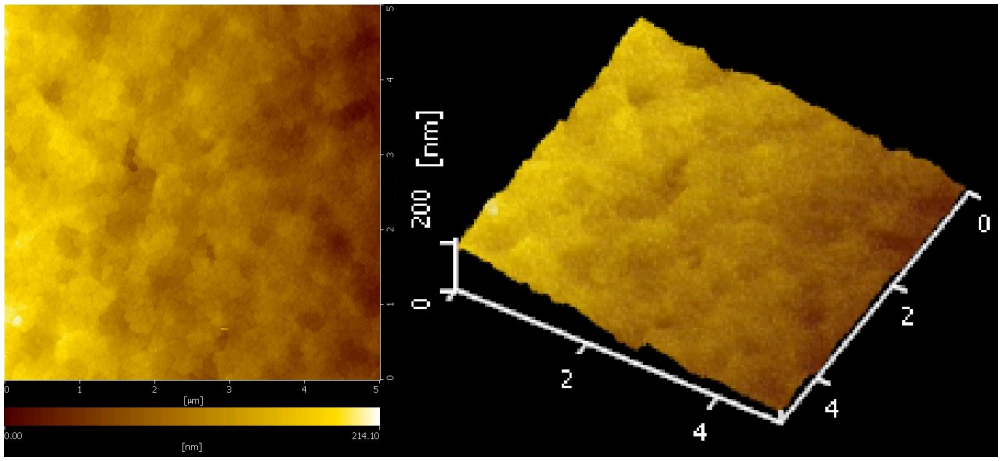

Fig S2. AFM top view and 3D topography images with $CsPb_{0.5}Sn_{0.5}I_3$

Fig S3 shows the AFM of $CsPb_{0.5}Sn_{0.5}I_3$. And the RMS is 51.43nm.

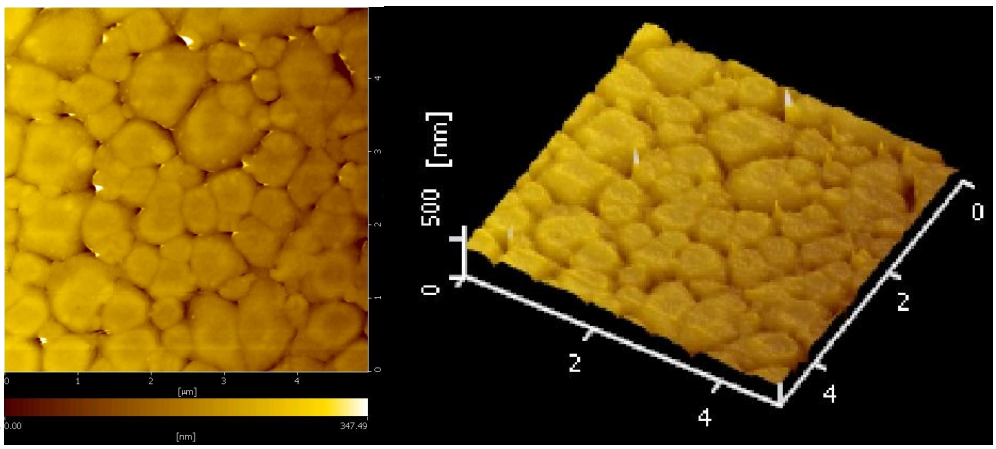

Fig S3. AFM top view and 3D topography images with $CsPb_{0.25}Sn_{0.75}I_3$

We measured XRD to determine the crystal structure parameters of the all-inorganic lead-tin mixed perovskite as follows.

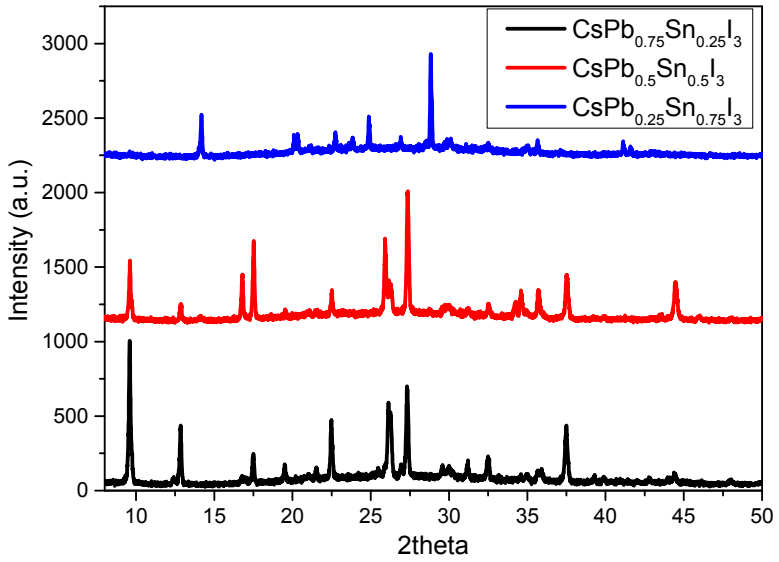

Fig S4. XRD of $CsPb_{0.75}Sn_{0.25}I_3$, $CsPb_{0.5}Sn_{0.5}I_3$ and $CsPb_{0.25}Sn_{0.75}I_3$

Fig.S5 is the SEM cross-view and surface image of the all-inorganic perovskite solar cell with a lead-tin ratio of 0.25:0.75. From the figure, we can see that the crystal grains are larger.

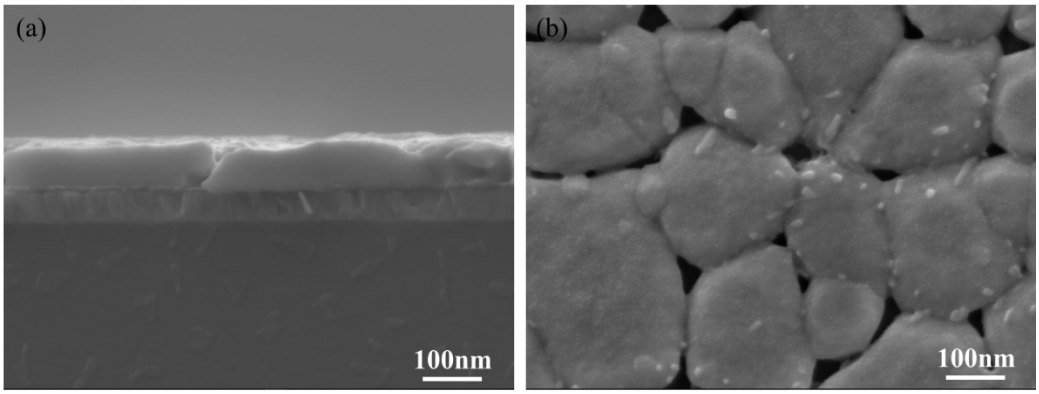

Fig S5 SEM (a) cross-view and (b) surface with $CsPb_{0.25}Sn_{0.75}I_3$

Fig.S6 is the SEM cross-view and surface image of the all-inorganic perovskite solar cell with a lead-to-tin ratio of 0.5:0.5. From the figure, we can see that the grains are small and loose.

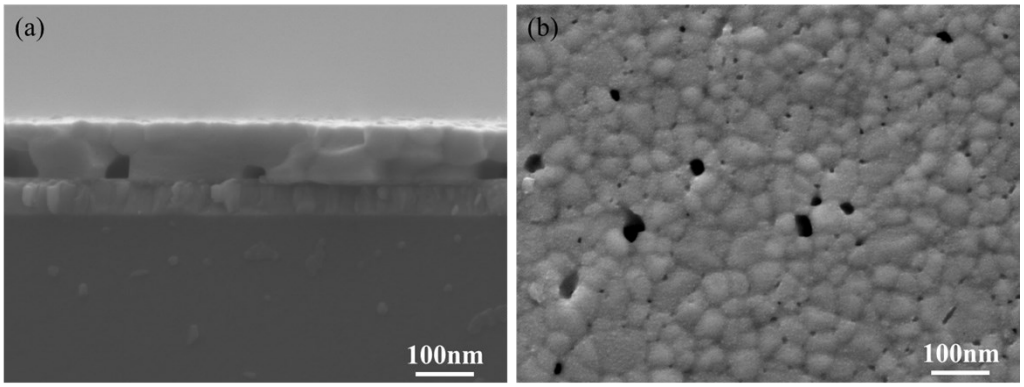

Fig S6 SEM (a) cross-view and (b) surface with $CsPb_{0.5}Sn_{0.5}I_3$

Fig.S7 is the SEM cross-view and surface image of the all-inorganic perovskite solar cell with a lead-tin ratio of 0.5:0.5. From the figure, we can see that the grains are smaller but denser.

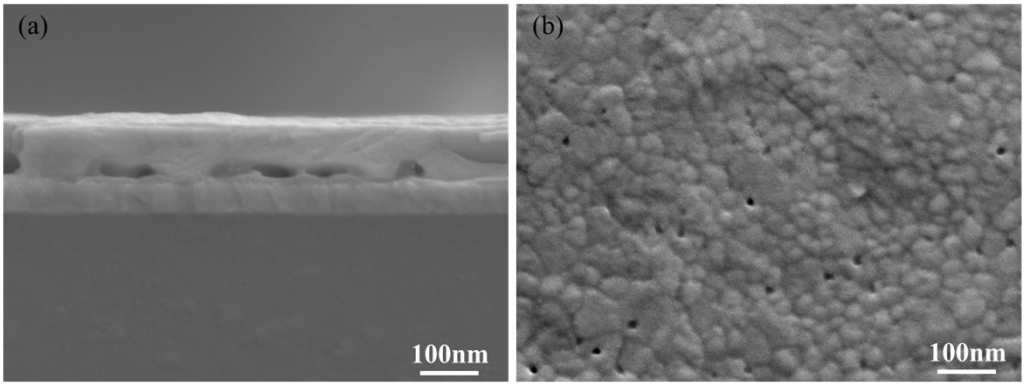

Fig S7 SEM (a) cross-view and (b) surface with $CsPb_{0.75}Sn_{0.25}I_3$

Figure S8 shows the PL spectra of our measured lead-to-tin ratios of 0.75:0.25, 0.5:0.5, 0.25:0.75, and the emission band is about 850nm.

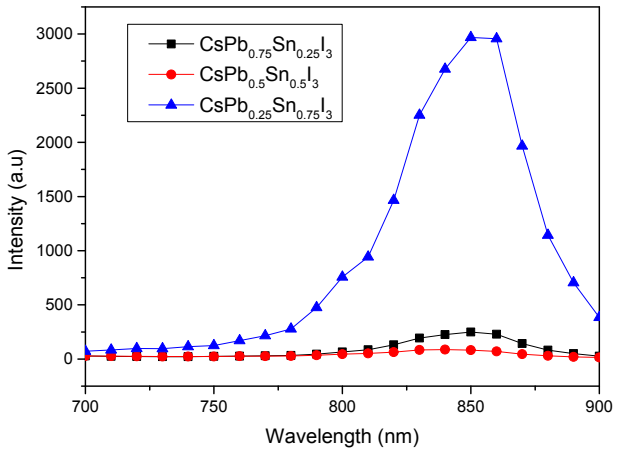

Figure S8. PL of $CsPb_{0.75}Sn_{0.25}I_3$, $CsPb_{0.5}Sn_{0.5}I_3$ and $CsPb_{0.25}Sn_{0.75}I_3$

Table S1. Cs-based inorganic perovskite process temperature in previous publications

	Bandgap	Process temperature (℃)	Process method	Year	Group
$CsPbI_3$	~1.73 eV	335	Spin-coating	2015	H. Snaith[1]
$CsPbI_3$	~1.73 eV		Quantum-dot	2016	J. Luther[2]
$CsPbI_2Br$	~1.92 eV	230	Spin-coating	2016	H. Snaith[3]
$CsPbI_2Br$	~1.92 eV	280	Spin-coating	2017	J. Park[4]
$CsPbIBr_2$	~2.05 eV	250	Evaporation	2016	S. Huang[5]
$CsPbIBr_2$	~2.05 eV	300	Spray	2016	A. Ho-Baillie[6]
$CsPbI_3$	~1.72eV	100	Spin-coating	2017	J. Huang[7]
$CsPb_{1-x}Bi_xI_3$	~1.55eV	100	Spin-coating	2017	S. Zhang[8]
$CsPbI_2Br$	~1.90eV	100	Spin-coating	2017	A. Ho-Baillie[9]
$CsPb_{0.9}Sn_{0.1}IBr_2$	~1.79 eV		Spin-coating	2017	Z. Jin[10]
$CsPbI_3$	~1.73 eV	150	Spin-	2017	Y. Zhao[11]

			coating		
$CsPb_xSn1_{-x}I_3$	**≤1.44 eV**	100	Spin-coating	2017	This work