Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supplementary information:

Reflective Perovskite Solar Cells for Efficient Tandem Applications

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1. Tandem performance of three different angles between Si cell and perovskite cell.

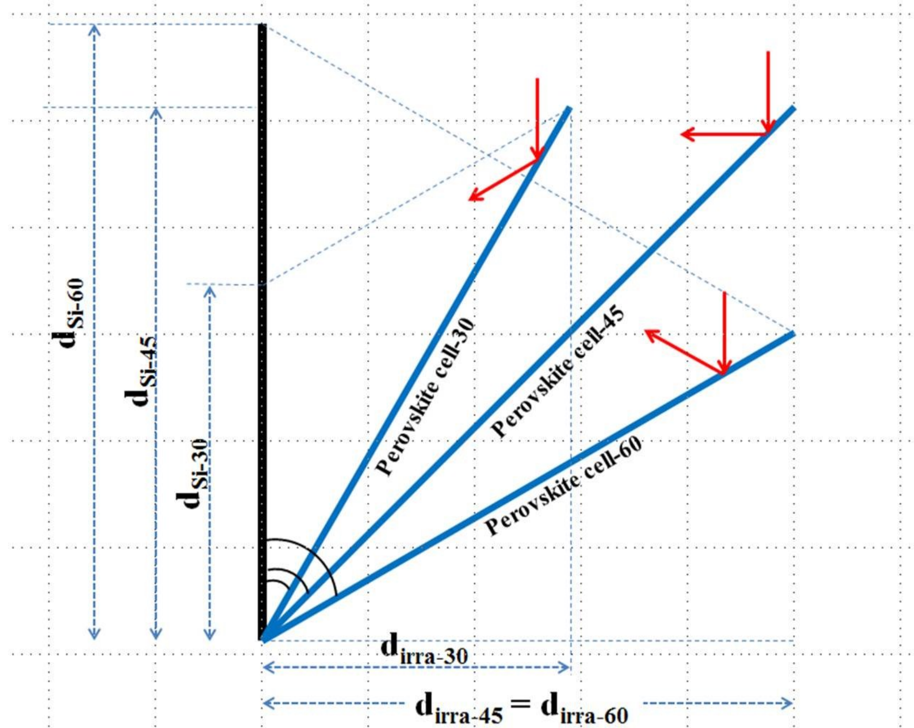

Fig.S1 Three configurations of perovskite/Si reflective tandem with different angles (30°, 45° and 60°). Black line represents Si cell with diameters used in three angles (d_{Si-30}, d_{Si-45} and d_{Si-60} for 30°, 45° and 60°). d_{irra} is the diameters of incident light in three angles.

Table S1 The performance of three configurations and a summary of cell module area.

Configuration angle	*PCE* of perovskite cell	*PCE* of Si cell	Total PCE	Si module area*	Perovskite cell module area*
30°	14.9%	6.5%	21.4%	1.15	2
45°	16.4%	6.7%	23.1%	1	1.41
60°	16.5%	6.5%	23.0%	1.15	1.15

*the module area is normalized to the incident light area and all PCE are based on the incident light area.

The 45° configuration possesses the highest combination efficiency of 23.1% with the least Si module area among the three configurations investigated.
In the 60° and 30° configurations, the reflected light incident Si cell with a larger angel than normal incidence, which require a larger Si module area than irradiation area. The diluted

photons on Si cell caused a slightly lower photocurrent density and lower open circuit voltage subsequently. This explains the lower efficiency in these two cases. The efficiency/incident angle relation of perovskite and Si cells can be found elsewhere (***Energy Environ. Sci.***, 2015,**8**, 602-609).

2. The vertical dimension of a reflective tandem is equal to the height of Si cell, as shown in figure.1 and figure S2.

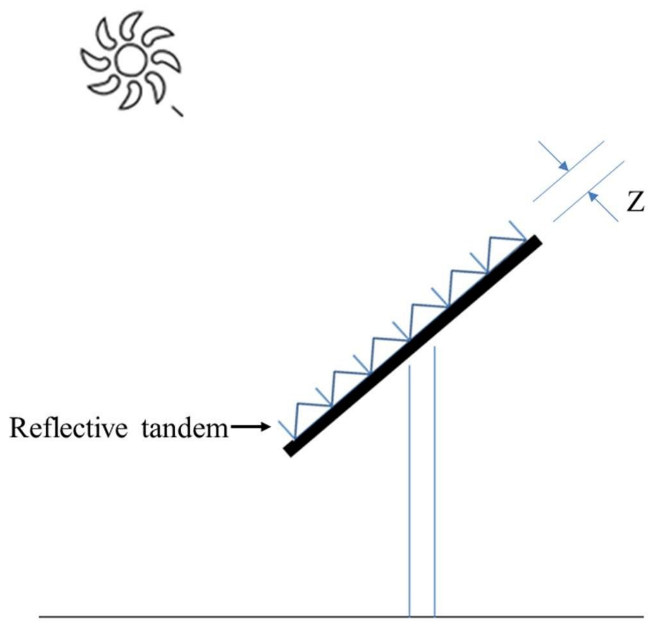

Figure S2 The projected reflective tandem system mounted on a solar plant. The vertical thickness (Z) is equal to the Si cell height.

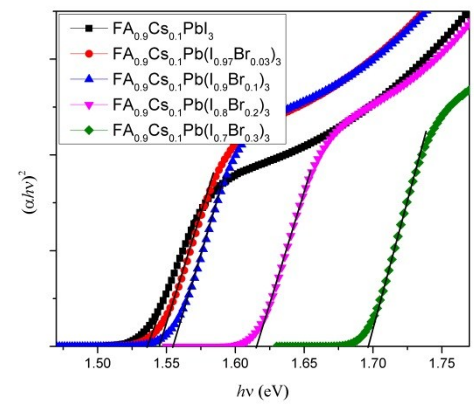

Figure S3. Absorption of perovskite materials with different compositions.

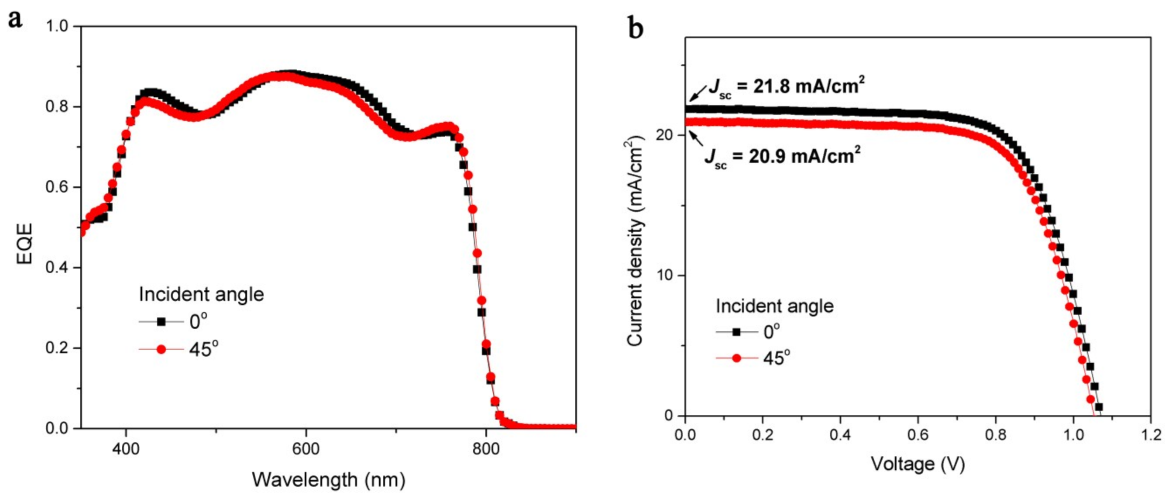

Figure S4. Angular dependence of perovskite solar cell performance: EQE spectra (a) and *J*-*V* curves (b).

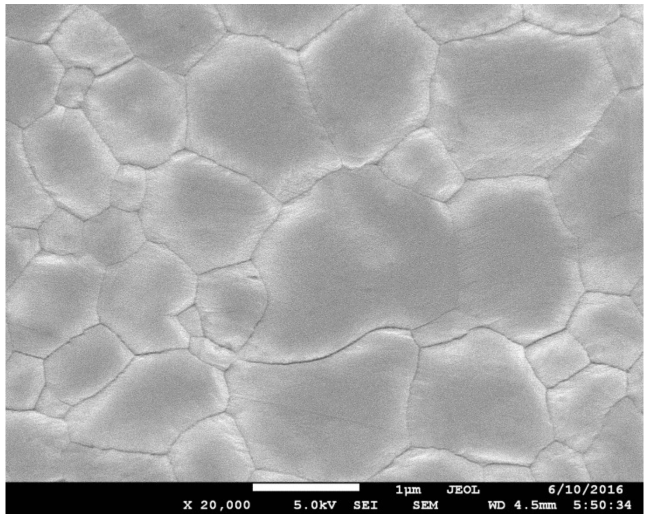

Figure S5. Scanning electron morphology of perovskite surface with grain size above 1 μm.

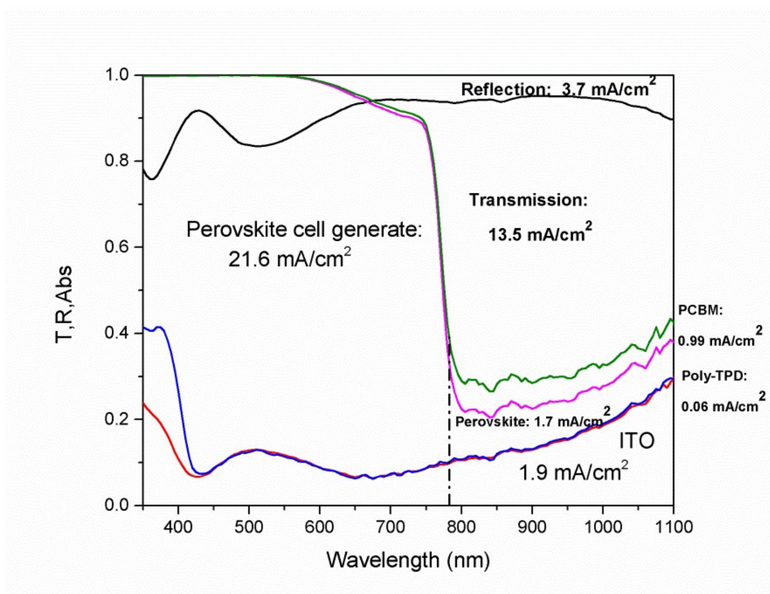

Figure S6. A layer by layer analysis of the parasitic loss inside a perovskite cell. The major optical loss at NIR region is caused by the free carrier absorption of ITO which corresponds to a photon current loss of 1.9 mA/cm^2;