Supplementary information

Fully Scalable Perovskite/CIGS Thin-Film Solar Module with Power Conversion Efficiency of 17.8%

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Spectral response of the subcells in 4T configuration:

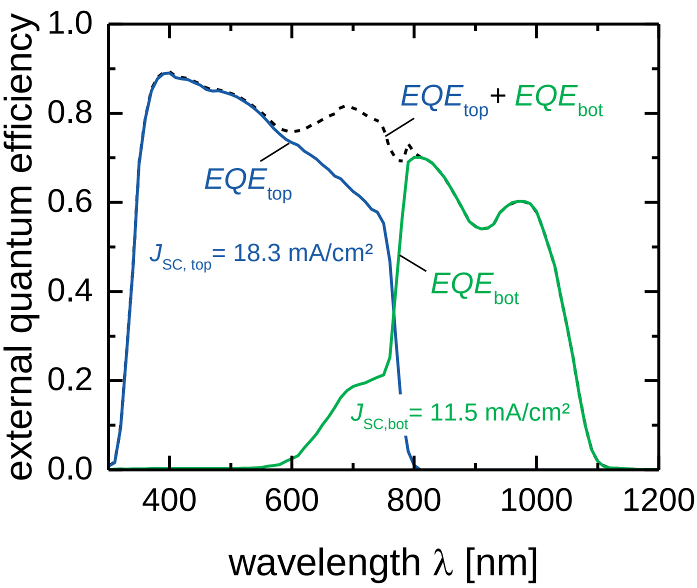

Figure S1: External quantum efficiency spectra of a small-area semi-transparent $CH_3NH_3PbI_3$ solar cell and the CIGS bottom solar cell measured in 4T configuration.

Histogram of the aperture efficiency of semitransparent perovskite solar modules:

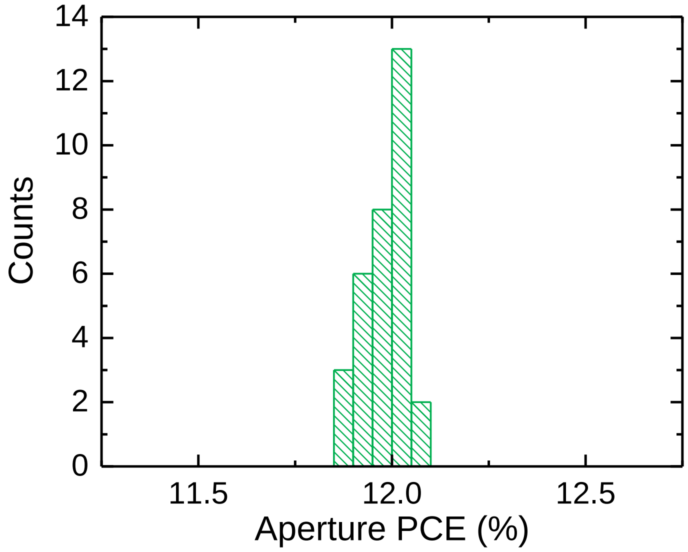

Figure S2: Histogram showing the aperture power conversion efficiencies (*PCE*) of 32 semi-transparent perovskite solar modules that were fabricated in the same run. Those modules that showed obvious production related failures like shunted cell stripes and false interconnection were removed from the statistics.

Influence of the radiative luminescence of the perovskite top solar module on the performance of CIGS bottom solar module

Configuration of semitransparent perovskite top solar module	**Parameters of the CIGS bottom solar module**				
	Area	*FF*	I_{SC}	V_{OC}	*PCE*
Short circuit	3.76 cm²	75,7 %	11.2 mA	2.576 V	5.7
Open circuit	3.76 cm²	75,5 %	11.0 mA	2.578 V	5.8

Table T1: Influence of the radiative luminescence of the perovskite top solar module on the performance of CIGS bottom solar module.

Solar Cell and Solar Module Parameters used for the loss analyses (i.e. Figure 4)

		Parameters of the Perovskite top solar module					
	IV sweep direction	*Area*	*FF*	I_{SC}	V_{OC}	$V_{OC}/\#_{subcells}$	*PCE*
Semi-transparent perovskite top solar module in 4T architecture	**Voc → Jsc**	4.0 cm²	**73%**	**10.3 mA**	**6.41 V**	0.916 V	**12.0 %**
	Jsc → Voc		72%	10.3 mA	6.36 V	0.918 V	11.8 %
Opaque perovskite solar module	**Voc → Jsc**	4.0 cm²	**79%**	**19.8 mA/cm²**	**3.90 V**	0.975 V	**15.7 %**
	Jsc → Voc		77%	19.8 mA/cm²	3.90 V	0.975 V	14.8 %
Perovskite solar cell	**Voc → Jsc**	0.13 cm²	**77%**	**22.0 mA/cm²**	**0.97 V**	n.a.	**16.4 %**
	Jsc → Voc		76%	22.0 mA/cm²	0.95 V		15.9 %

Table T2: Photovoltaic device parameters of semi-transparent and opaque perovskite solar modules compared to small scale reference perovskite solar cell. The number in bold are used for the loss analyses in Figure 4.

	Parameters of the CIGS bottom solar module					
	Area	*FF*	I_{SC}	V_{OC}	$V_{OC}/\#_{subcells}$	*PCE*
CIGS bottom solar module	**3.76 cm²**	**75 %**	**11.2 mA**	**2.58 V**	0.645 V	**5.8 %**
CIGS reference solar module	**3.76 cm²**	**75 %**	**29.2 mA**	**2.70 V**	0.675 V	**15.7 %**
CIGS solar cell	**0.25 cm²**	**76 %**	**32.1 mA**	**0.680 V**	n.A.	**16.6 %**

Table T3: Photovoltaic device parameters of the reference CIGS solar cell, the plain reference CIGS solar module and the CIGS bottom solar module in 4T configuration, placed below a semi-transparent perovskite semi-transparent perovskite solar module.

Performance of Solar Cells processed on ebeam evaporated TiO_2 layers of different thicknesses:

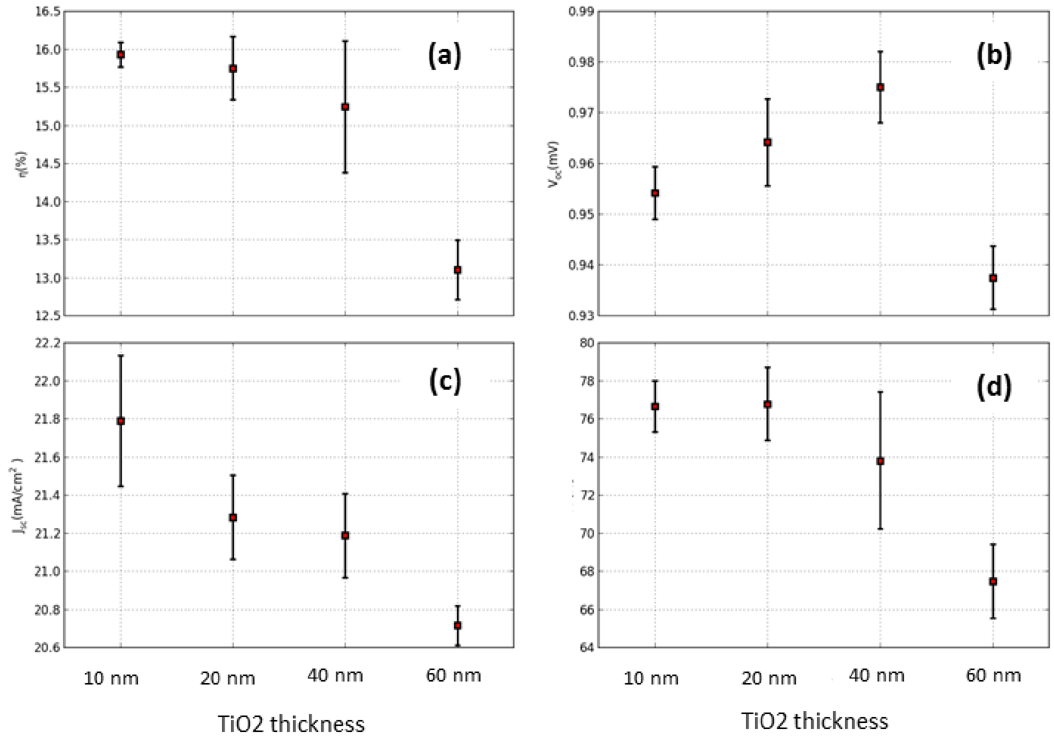

Figure S2: Solar cell characteristics of perovskite solar cells processed on ebeam evaporated TiO2 layers of different thicknesses. The recipe is identical to the one used in the manuscript to fabricate the semi-transparent perovskite solar modules. The power conversion efficiency (a), the open-circuit voltage (b), the short-circuit current density (c), and the fill factor (d) are shown.