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Solar Cells Reporting Summary

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Experimental design

Please check: are the following details reported in the manuscript?

1. Dimensions

Area of the tested solar cells	☒ Yes ☐ No	Methods Section; 0.096 cm2
Method used to determine the device area	☒ Yes ☐ No	Methods Section; measured by optical microscope

2. Current-voltage characterization

Current density-voltage (J-V) plots in both forward and backward direction	☒ Yes ☐ No	Figure 3d, Figure 4e, Figure 6f
Voltage scan conditions *For instance: scan direction, speed, dwell times*	☒ Yes ☐ No	Methods Section; Reverse (1.2 to -0.2V), Forward (-0.2 to 1.2V), delay time of 10 ms.
Test environment *For instance: characterization temperature, in air or in glove box*	☒ Yes ☐ No	Ambient environment (25 °C, 30-40% RH)
Protocol for preconditioning of the device before its characterization	☐ Yes ☒ No	No preconditioning step was used.
Stability of the J-V characteristic *Verified with time evolution of the maximum power point or with the photocurrent at maximum power point; see ref. 7 for details.*	☒ Yes ☐ No	Figure 4f; Maximum powerpoint tracking measurement

3. Hysteresis or any other unusual behaviour

Description of the unusual behaviour observed during the characterization	☒ Yes ☐ No	No unusual behavior was observed during measurement. A small amount of hysteresis was observed.
Related experimental data	☒ Yes ☐ No	Figure 3d, Figure 4e, Figure 6f

4. Efficiency

External quantum efficiency (EQE) or incident photons to current efficiency (IPCE)	☒ Yes ☐ No	Supplementary Figure 15
A comparison between the integrated response under the standard reference spectrum and the response measure under the simulator	☒ Yes ☐ No	Short-circuit current density was well-matched with the value obtained from external quantum efficiency measurement. (Figure 4f and Supplementary Figure 15)
For tandem solar cells, the bias illumination and bias voltage used for each subcell	☐ Yes ☒ No	No tandem cells were fabricated in this manuscript.

5. Calibration

Light source and reference cell or sensor used for the characterization	☒ Yes ☐ No	Methods Section; Solar simulator (Newport, Oriel Class A, 91195A)
Confirmation that the reference cell was calibrated and certified	☒ Yes ☐ No	Methods Section; Light intensity was calibrated Si-reference cell certified by the NREL, USA.

Calculation of spectral mismatch between the reference cell and the devices under test	☒ Yes ☐ No	It has been calibrated.

6. Mask/aperture

Size of the mask/aperture used during testing	☒ Yes ☐ No	Methods Section; 0.096 cm2 of mask was used for testing.
Variation of the measured short-circuit current density with the mask/aperture area	☐ Yes ☒ No	We don't added the data; but we observed that there is no obvious changes in short-circuit current upon varying the size of active area.

7. Performance certification

Identity of the independent certification laboratory that confirmed the photovoltaic performance	☐ Yes ☒ No	It was not certified.
A copy of any certificate(s) *Provide in Supplementary Information*	☐ Yes ☒ No	It was not certified.

8. Statistics

Number of solar cells tested	☒ Yes ☐ No	At least 24 devices each for glass-based, table-top gravure-printed, and R2R gravure-printed devices were tested.
Statistical analysis of the device performance	☒ Yes ☐ No	Figure 3a-c, Supplementary Figure 16-17, 21.

9. Long-term stability analysis

Type of analysis, bias conditions and environmental conditions *For instance: illumination type, temperature, atmosphere humidity, encapsulation method, preconditioning temperature*	☒ Yes ☐ No	Section "Pilot-scale R2R gravure-printing of flexible PSCs" and Supplementary Figure 22.