

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	7.25 mm ² (methods)
	☐ No	<i>Explain why this information is not reported/not relevant.</i>
Method used to determine the device area	☒ Yes	Defined by the aperture.
	☐ No	<i>Explain why this information is not reported/not relevant.</i>

2. Current-voltage characterization

Current density-voltage (J-V) plots in both forward and backward direction	☒ Yes	Figure 4c
	☐ No	<i>Explain why this information is not reported/not relevant.</i>
Voltage scan conditions <i>For instance: scan direction, speed, dwell times</i>	☒ Yes	J-V curves were measured with a scanning rate of 10 mV/s (voltage step of 20 mV and delay time of 100 ms)
	☐ No	<i>Explain why this information is not reported/not relevant.</i>
Test environment <i>For instance: characterization temperature, in air or in glove box</i>	☒ Yes	All device are measured in air at room temperature.
	☐ No	<i>Explain why this information is not reported/not relevant.</i>
Protocol for preconditioning of the device before its characterization	☐ Yes	<i>State where this information can be found in the text.</i>
	☒ No	No preconditioning is required before characterization.
Stability of the J-V characteristic <i>Verified with time evolution of the maximum power point or with the photocurrent at maximum power point; see ref. 7 for details.</i>	☒ Yes	Supplementary Figure 19
	☐ No	<i>Explain why this information is not reported/not relevant.</i>

3. Hysteresis or any other unusual behaviour

Description of the unusual behaviour observed during the characterization	☒ Yes	Figure 4c
	☐ No	<i>Explain why this information is not reported/not relevant.</i>
Related experimental data	☒ Yes	Figure 4c
	☐ No	<i>Explain why this information is not reported/not relevant.</i>

4. Efficiency

External quantum efficiency (EQE) or incident photons to current efficiency (IPCE)	☒ Yes	Figure 4d
	☐ No	<i>Explain why this information is not reported/not relevant.</i>
A comparison between the integrated response under the standard reference spectrum and the response measure under the simulator	☒ Yes	Figure 4d
	☐ No	<i>Explain why this information is not reported/not relevant.</i>
For tandem solar cells, the bias illumination and bias voltage used for each subcell	☐ Yes	<i>State where this information can be found in the text.</i>
	☒ No	Single-layer solar cell

5. Calibration

Light source and reference cell or sensor used for the characterization

☒ Yes
☐ No

The light source was a 300 W collimated xenon lamp (Newport) calibrated with the light intensity to 100 mW cm⁻² under AM 1.5G solar light conditions by a certified silicon solar cell.

Explain why this information is not reported/not relevant.

Confirmation that the reference cell was calibrated and certified

☒ Yes
☐ No

The light intensity was calibrated by reference solar cell by Enli Tech.

Explain why this information is not reported/not relevant.

Calculation of spectral mismatch between the reference cell and the devices under test

☒ Yes
☐ No

Mismatch factor of 1 was used in our measurements.

Explain why this information is not reported/not relevant.

6. Mask/aperture

Size of the mask/aperture used during testing

☒ Yes
☐ No

7.25 mm²

Explain why this information is not reported/not relevant.

Variation of the measured short-circuit current density with the mask/aperture area

☐ Yes
☒ No

State where this information can be found in the text.

Only measured the J-V curve at a fixed aperture

7. Performance certification

Identity of the independent certification laboratory that confirmed the photovoltaic performance

☒ Yes
☐ No

Supplementary Figure 20

Explain why this information is not reported/not relevant.

A copy of any certificate(s)

Provide in Supplementary Information

☒ Yes
☐ No

Supplementary Figure 20

Explain why this information is not reported/not relevant.

8. Statistics

Number of solar cells tested

☒ Yes
☐ No

20

Explain why this information is not reported/not relevant.

Statistical analysis of the device performance

☒ Yes
☐ No

Supplementary Figure 18

Explain why this information is not reported/not relevant.

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

Figure 5

Explain why this information is not reported/not relevant.