Supplementary information

1 Sample preparation

1.1 Opaque device processing

Devices processed for this study are planar n-i-p architecture. Samples are processed in N_2 atmosphere, except for the 12 hour O_2 doping of the hole transport layer. The stack is processed on top of the 0.7 mm thick glass coated with 150 nm indium tin oxide. This top contact is followed by deposition of the electron transport and photoactive layers which are either solution processed 30 nm tin oxide followed by $Cs_{0.1}FA_{0.9}PbI_{2.865}Br_{0.135}$ [1] or electron beam deposited 20 nm compact titanium oxide followed by $CH_3NH_3PbI_{3-x}Cl_x$ [2] for cells or modules respectively. Hole transport layer is solution processed Spiro-OMeTAD doped with lithium bis(trifluoromethanesulfonyl) imide and 4-tert-butylpyridine. Final step is deposition of 80 nm gold back electrode. Opaque modules are fabricated by integration of these deposition steps and ablation steps.

1.2 Translucent device processing

Translucent devices are fabricated from opaque devices with P4 patterning, using laser or mechanical patterning.
For laser patterned translucent modules, the P4 width is kept at 50 μm, while for mechanical patterned modules P4 is 80 μm (10 % and 25 % transparent area ratio) or 300 μm (50 % transparent area ratio). Therefore, for laser patterned modules W is either 450, 150 to 50 μm, while for mechanical patterned modules W it is either 720, 240 or 300 μm depending on transparent area ration of 10, 25 or 50 %.
Translucent cells are processed in two sets, one with constant W of 180 μm and the other with cells with varying W from 20 to 180 μm. For cell set with constant W, P4 width is varied in order to vary the transparent area ration, while for the second set the P4 is kept at 40 μm.

2 Characterization

2.1 Electrical

The devices were illuminated with an AM1.5G spectrum generated by a class A solar simulator (Abet Sun 2000). For current-voltage measurements the voltage bias was varied in reverse (V_{OC} to J_{SC}) and forward (J_{SC} to V_{OC}) direction with a scan speed of 1.0 or 4.9 V/s for cells or modules respectively. The validity of measured device performance has been confirmed by external certification results based on maximum power point tracking on opaque modules. [3]
J-V curves of modules in opaque and translucent configuration with 10 and 50 % transparent are ratio for two patterning techniques are given in Fig.S 1.

2.2 Optical

The SEM images were obtained from FEI Nova 200 scanning electron microscope.
The total transmitted light following normal incidence is detected using an integrating sphere in a Bentham PVE300 optical characterization setup. For the specular transmission a two-beam photo-spectrometer Shimadzu UV1601 was used.

References

[1] W. Qiu, A. Ray, M. Jaysankar, T. Merckx, J. P. Bastos, D. Cheyns, R. Gehlhaar, J. Poortmans and P. Heremans, Adv. Funct. Mater., 2017, 27.

[2] W. Qiu, T. Merckx, M. Jaysankar, C. M. de la Huerta, L. Rakocevic, W. Zhang, U. W. Paetzold, R. Gehlhaar, L. Froyen, J. Poortmans, D. Cheyns, H. J. Snaith and P. Heremans, Energy Environ. Sci., 2016, 9, 484-489.

[3] Imec and Solliance's perovskite PV modules achieve 12.4 %, https://www.imec-int.com/en/articles/imec-and-solliance-s-perovskite-pv-modules-achieve-12-4, (accessed November 3, 2017).

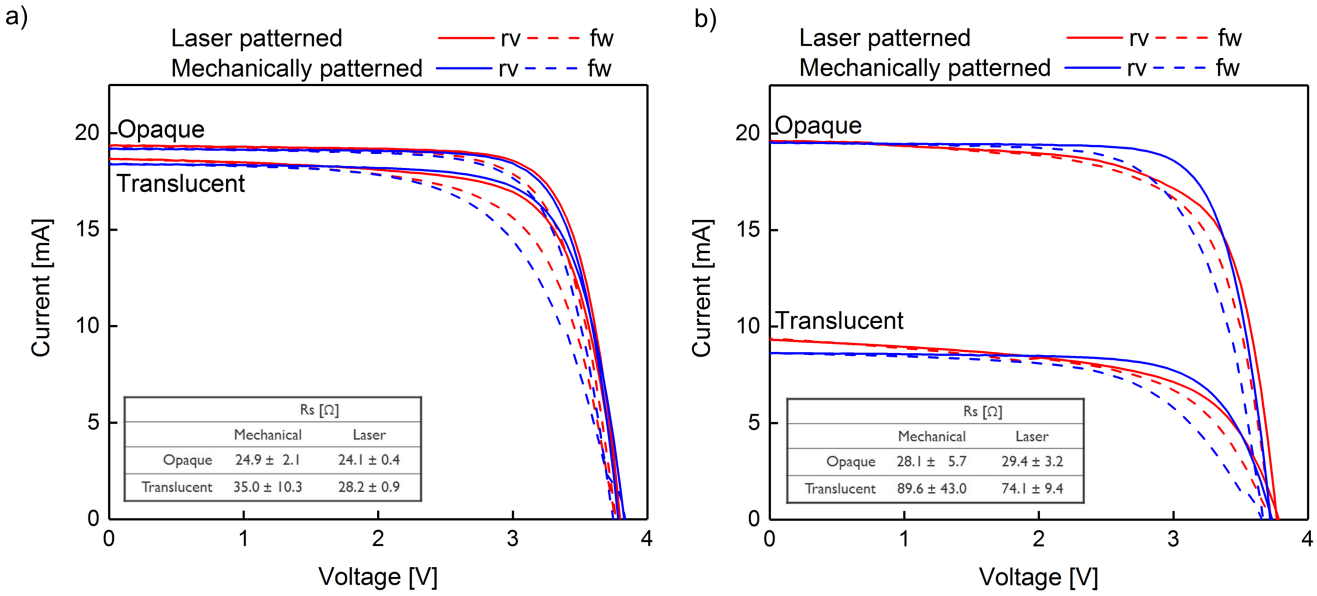

Figure S 1 I-V curves of modules before (opaque) and after (translucent) partial area removal. The modules have been either laser (red) or mechanically (blue) patterned with a targeted transparent area ratio of a) 10 % and b) 50 %. Inset in each graph gives average Rs based on I-V scan for opaque and translucent modules.