

Webinar powered by

DSM Advanced Solar

24 September 2020

4 pm – 5 pm | CEST, Berlin

3 pm – 4 pm | BST, London

7 am – 8 am | PDT, Los Angeles

10 am – 11 am | EDT, New York



Mark Hutchins

Editor | pv magazine



Back-contact's move to the front



Hugo Schoot

DSM Advanced Solar



Paolo Maccario

Silfab Solar



Radovan Kopecek

ISC Konstanz



ZEBRA IBC technology

low cost IBC in mass production

Dr. Radovan Kopecek et al.

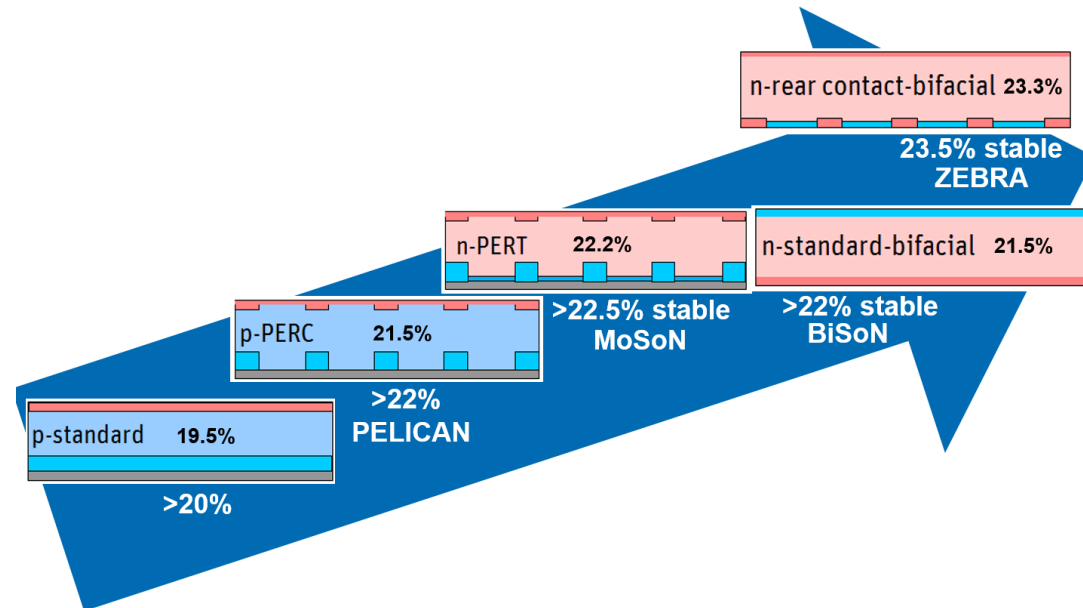
ISC Konstanz technology transfer

ZEBRA technology, mass production

Future of PV which c-Si technology will win?

International Solar Energy Research Center e.V.

- a nonprofit organization
- Founded in 2005
- R&D on c-Si solar cells, modules and systems
- Technology transfer
- About 60 employees
- Turnover about 6-7 Mio€/a



cells



modules

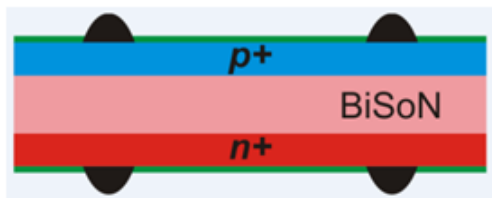


systems

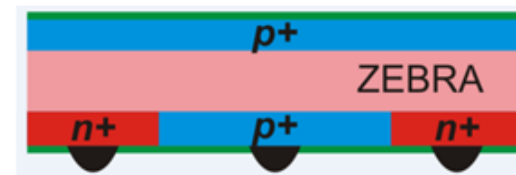
BiSoN (nPERT) and ZEBRA (IBC)



International Solar Energy
Research Center Konstanz

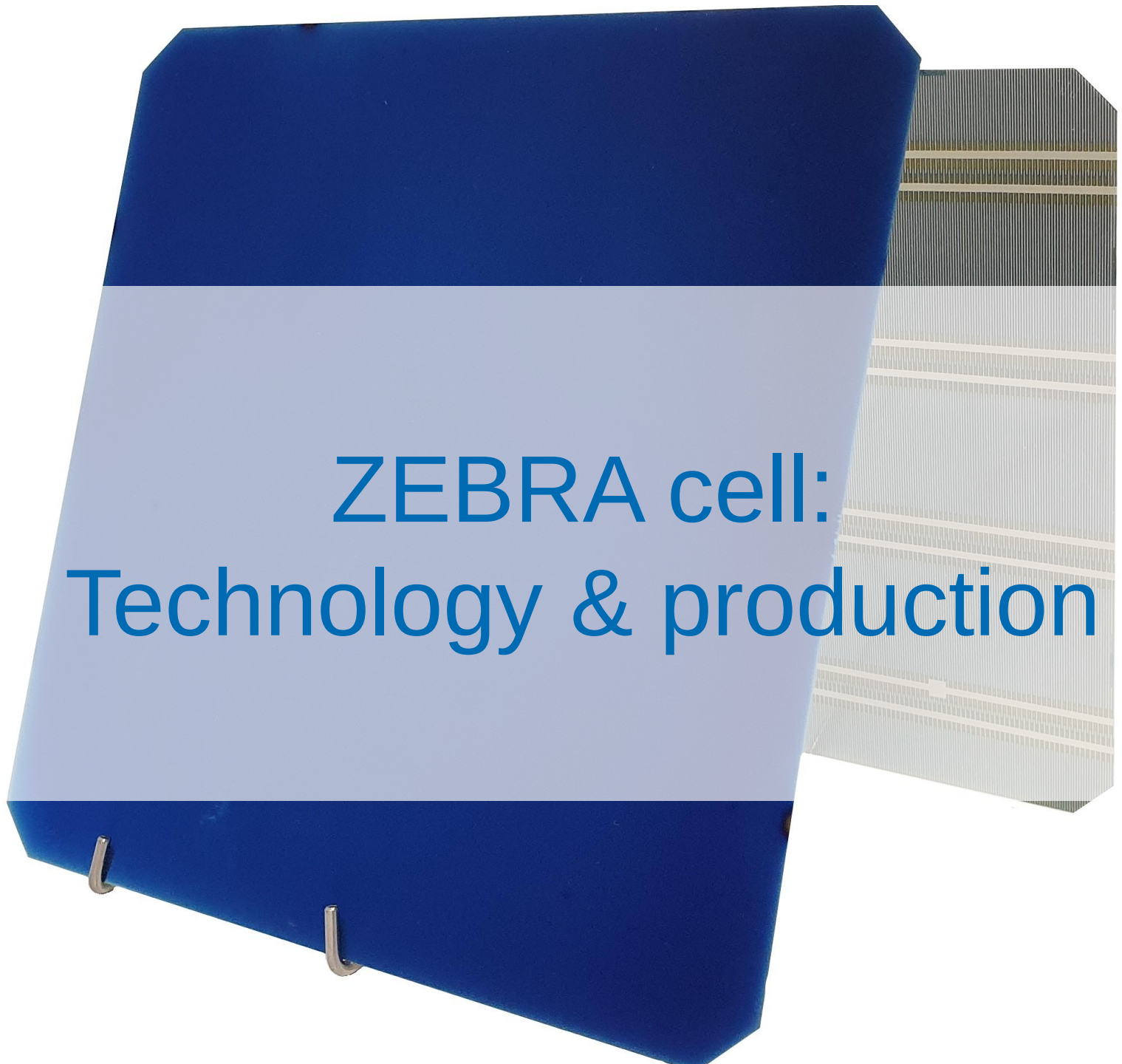


21.5+%



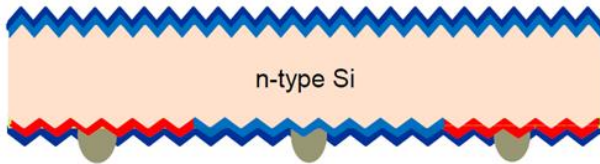
23.5+%



The image shows two components of a ZEBRA cell. On the left is a dark blue, rectangular frame with rounded corners and two metal clips at the bottom. On the right is a rectangular grid of thin, vertical, light-colored lines, possibly a filter or a sensor array, with a few horizontal lines intersecting it. The text "ZEBRA cell: Technology & production" is overlaid in the center in a blue, sans-serif font.

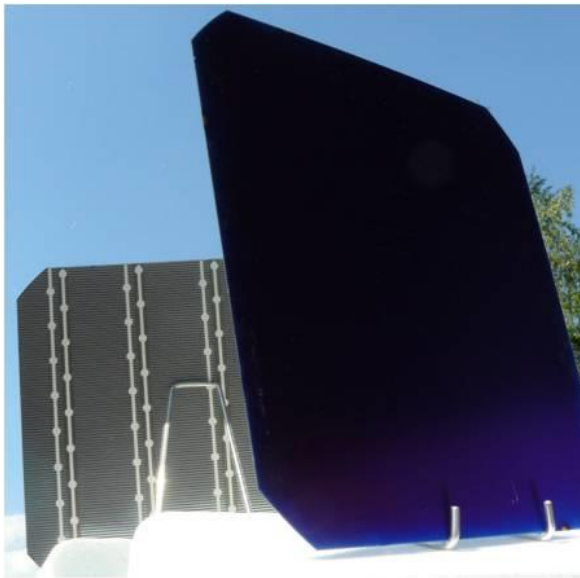
ZEBRA cell: Technology & production

ZEBRA cell: key features



23.5%+, 700mV+

- based on standard **n-type** Cz-Si wafers
- screen printed firing-through contacts
- **no passivating contacts**
- 3D-interconnection of fingers with busbars enables compatibility with **any wafer format**
- BBr_3 and POCl_3 tube furnace diffusion steps
- in-situ surface passivation → **no AlO_x required**
- **bifacial** IBC cell with bifaciality factor of $> 70\%$
- 3D-interconnection of fingers with busbars enables compatibility with **any wafer format and interconnection technology**



*Photograph of the front and back
side (mirrored)*

V.D. Mihailetchi *et. al.*, **Patent pending:** WO2013087458A1
V.D. Mihailetchi *et. al.*, Energy Procedia, 77, 534–539 (2015)

ZEBRA cell: process steps

PERC cell process:

Texturing & cleaning

POCl_3 Diffusion

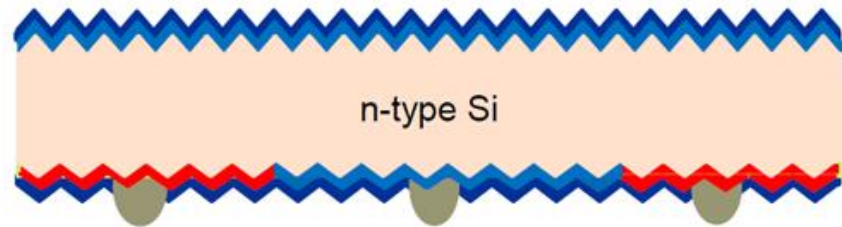
PSG & single side etch

PECVD $\text{SiN}_x/\text{AlO}_x$ rear

PECVD SiN_x front

Laser contact opening

Screen printing



Additional steps required for ZEBRA:

PECVD SiN_x rear (mask)

BBr_3 Diffusion

BSG etch

Saw damage etch

COO ZEBRA < 2 x COO PERC
(COO IBC > 3 x COO PERC)

Ramp-up at SPIC/HHSD

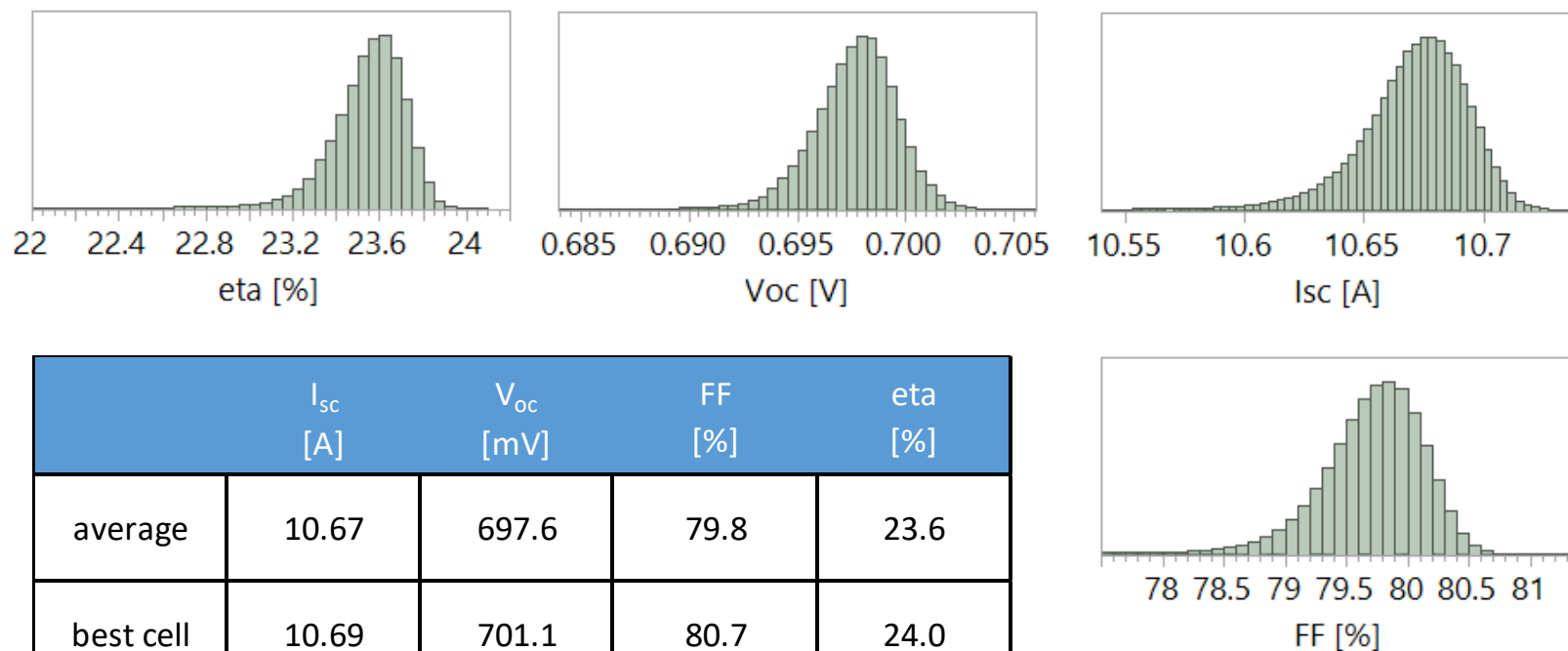


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After completion of the construction of the **200 MW_p/year cell & module factory of SPIC/HHSD in Xining (China)**, a joint team from the company SPIC/HHSD and from ISC performed the transfer of the technology and ramp-up (start in Q4/2019) of the industrial cell & module line.

Industrial cell results: I/V parameters



Details about I/V parameters measured on the sample batch of 286,264 solar cells manufactured on SPIC's industrial cell line: distribution, average values and champion cell result.

ZEBRA modules at FuturaSun



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- reducing the Ag-paste consumption by increasing the number of busbars per polarity to **6+ busbars** → finger cross section can be lower
- ZEBRA modules with **conductive backsheet (CBS)** → part of the shift electrical conductivity from the Ag-based metal grid of the cell to the copper (or Al-) based ECBS
- For parts of the metal-grid, substitute Ag-paste by **Cu-paste** (as already done e.g. for HJT cells) or by Al-paste.

CBS ZEBRA module in 2016



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310+W_p
no LID
no PID

CBS ZEBRA module 2020



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Zebra IBC cell with 24% efficiency moves to large-scale production

Netherlands based manufacturer Energyra this week introduced a new back contact module, which it has developed in partnership with Dutch research institute TNO and Germany's ISC Konstanz. A prototype module was unveiled yesterday in a small presentation at Energyra's factory in Zaandam, Netherlands. The company is targeting large-scale manufacturing by the end of 2020.

SEPTEMBER 4, 2020 **MARK HUTCHINS**



ZEBRA 60 cell module



Will PV become an (bifacial) IBC market?

We believe yes.

Why?

Because it is easier to implement passivating contacts and easy to interconnect. **polyPERC IBC and (poly)ZEBRA IBC to come.**

LET US BRING ZEBRAS
ON EVERY ROOFTOP!!

