

# BCworkshop2023



ISFH



Fraunhofer  
ISE



research  
for a sunny future

**TNO** innovation  
for life

 **TU Delft**

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11th workshop on

**Back contact solar cell  
and module technology**

**#BCworkshop**

**November 29-30, 2023**  
Hamel, Germany

# Hameln – nice historic city and home of the Pied Piper



# Hameln – nice historic city and home of the Pied Piper





- Build in 1827 as a prison
- Today a nice conference hotel at the Weser and in the city center of Hameln
- Coffee break, lunch and dinner in the hotel restaurant
- Business rooms available



- Founded 1987
- 158 employees
- 12 Mio € revenue
- Focus on applied research in PV and solar systems

- ISFH SolarTeC with industrial type c-Si cell processing tools
- Several more labs for perovskite cell and c-Si module R&D
- ISFH CalTeC for calibrated IV tests



# ISFH history of PERC and IBC cell development



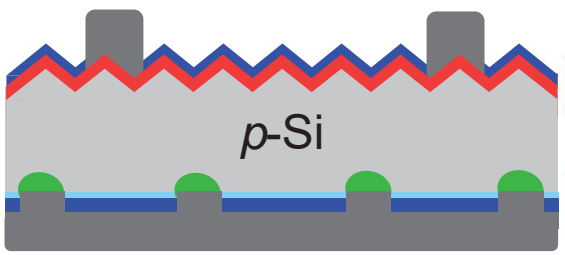
2008

2016

2021

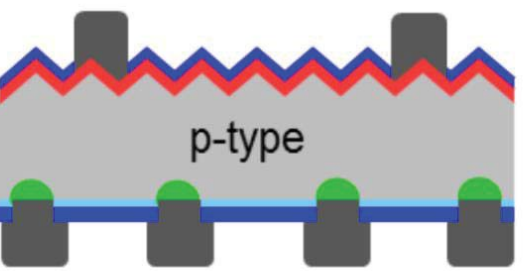


PERC

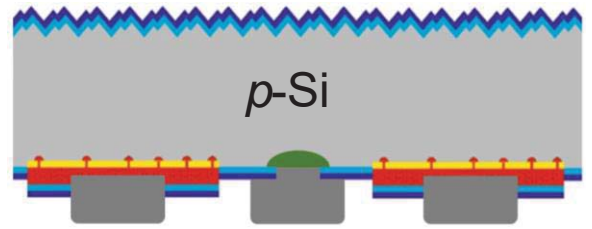


Ag finger  
SiN<sub>x</sub>  
n<sup>+</sup> (P)  
p<sup>+</sup> (Al)  
AlO<sub>x</sub>/SiN<sub>y</sub>  
Aluminum

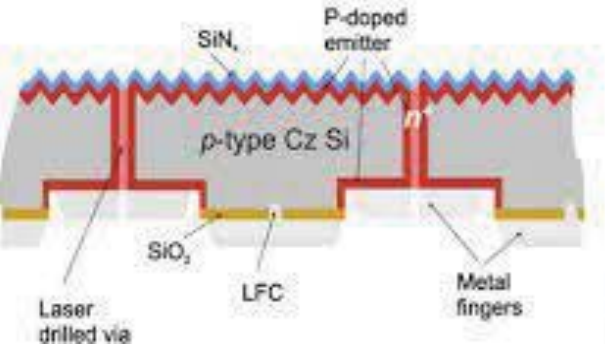
PERC+



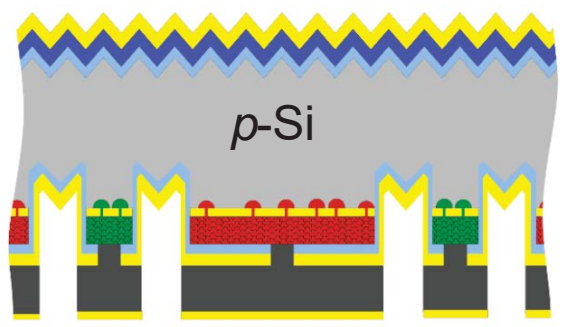
POLO IBC



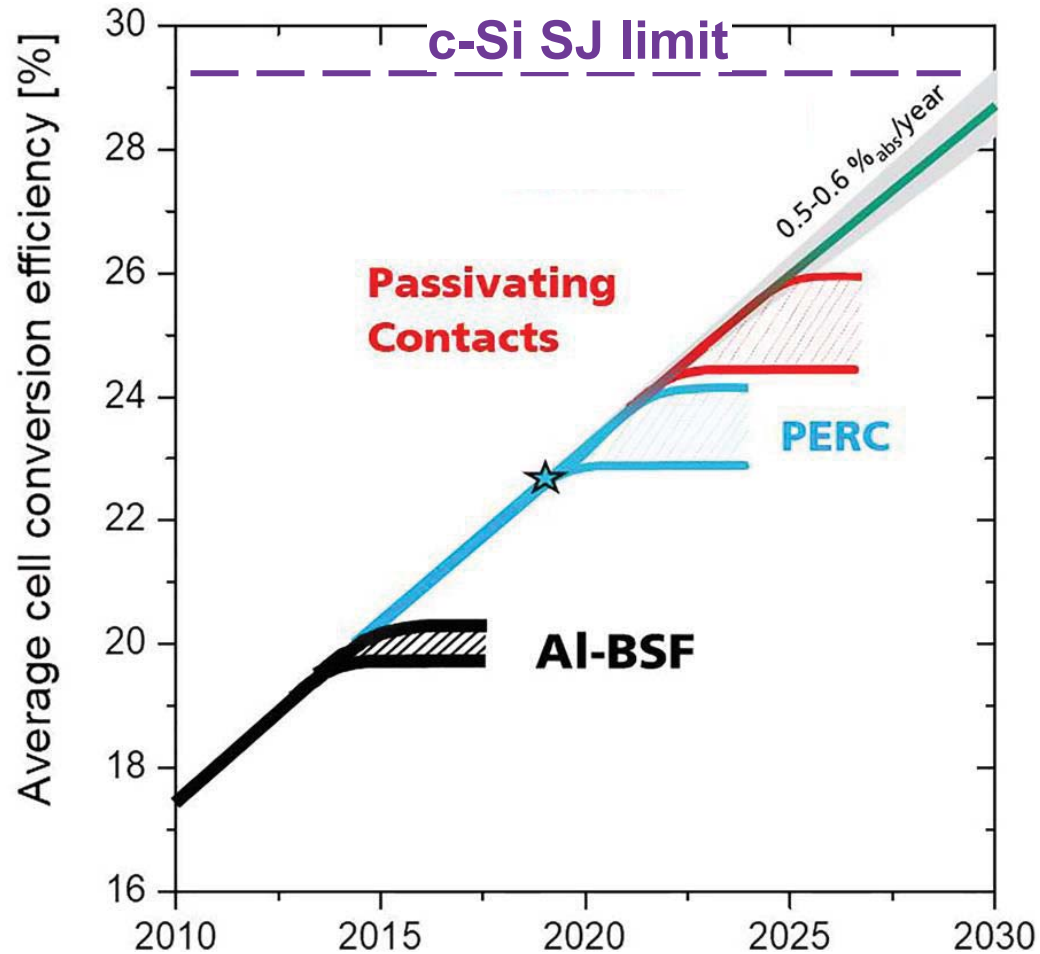
RISE EWT



POLO<sup>2</sup> IBC



# Why IBC now ?



- Is TOPCon efficiency limited to < 26% in production ?
- Will tandem mass production be later than 2025 ?
- If both yes, how to get  $\eta > 26\%$  in the next years ?
- => IBC is the solution !

<sup>1</sup> T. Dullweber and J. Schmidt, IEEE Journal of photovoltaics, Vol. 6, No. 5 (September 2016).

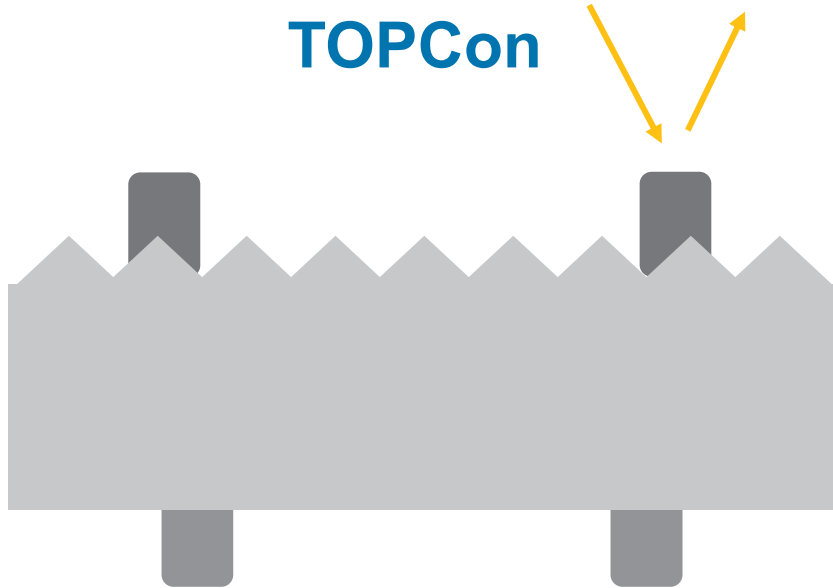
<sup>2</sup> Qcells learning curve 2017 – 2023, latest version: F. Fertig et al. EUPVSEC (2023)

<sup>3</sup> M. Hermle et al., Appl. Phys. Rev. 7, 021305 (April 2020).

# Why IBC now ? No front gid shadowing



TOPCon



## Shadowing loss

- Front Ag fingers: ca. 1.5%
- Front MBB wires: ca. 1.5%

IBC



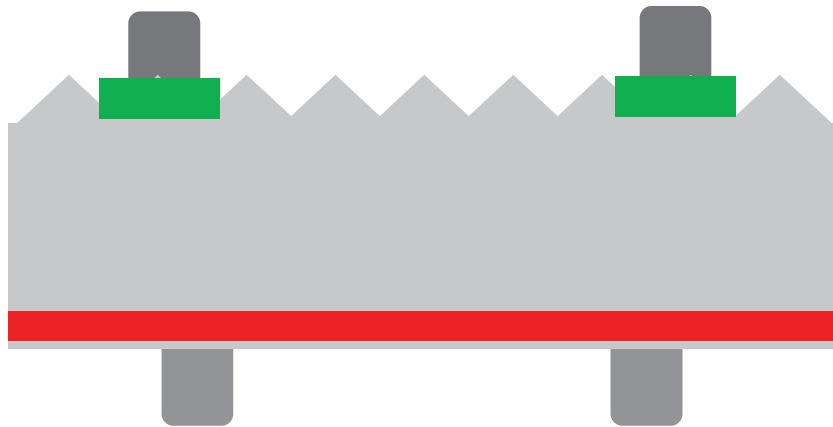
## No shadowing loss

- ca. 0.3%abs. higher cell efficiency
- ca. 0.5% higher module efficiency
- Wider contacts for Al or Cu tolerable



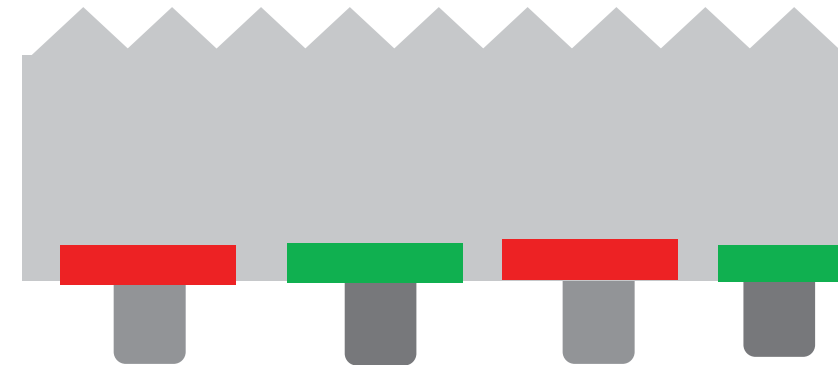
# Why IBC now ? Integration of n+ and p+ poly-Si

## TOPCon



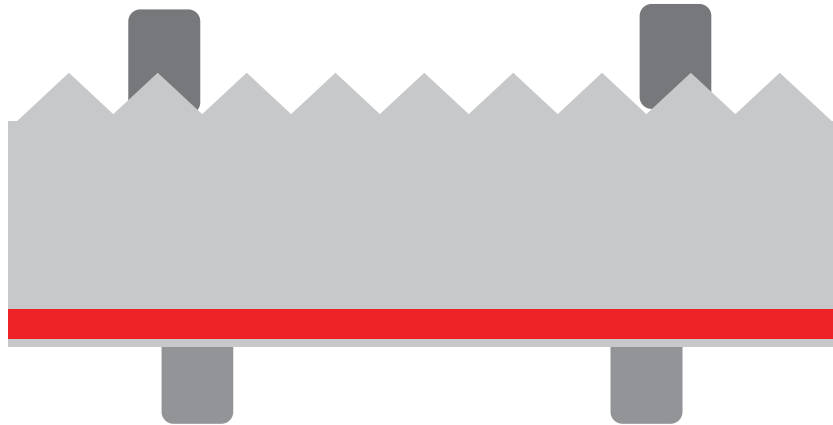
- Ag on Boron emitter limits  $V_{oc} < 740$  mV
- p-poly widths limited to  $< 50$   $\mu\text{m}$
- Ag print alignment challenging

## IBC



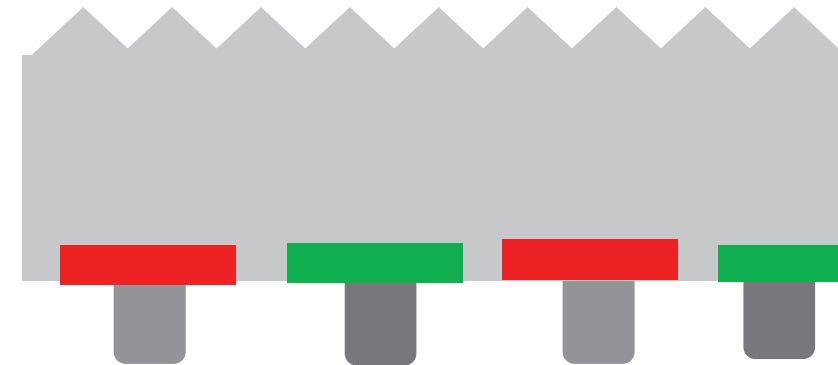
- p-poly widths limited by IBC pitch to  $< 200$   $\mu\text{m}$
- No problem for print alignment

## TOPCon



- No poly structuring required

## IBC



Novel poly-Si structuring technologies available for production

- Laser structuring
- Shadow masks

# Why IBC now ? Highest module efficiencies with IBC



TAIYANGNEWS										
ALL ABOUT SOLAR POWER										
TaiyangNews Top Modules: Highest Efficient Commercial Solar Modules 11-2023										
Rank	Company	Series	Model	Wafer type	Cell Size	Cells No.	Cell Tech	Module Technology	Power (W)	Efficiency (%)
1	AIKO	ABC White hole	AIKO-A620-MAH72Mw	n-type	182	144	ABC	Halfcell, back Contact	620	24.0
2	LONGI	Hi-MO 6	LR5-72HTH-600M	p-type	182	144	HPBC	Halfcell, back Contact	600	23.2
3	HUASUN	Himalaya	HS-210-B132DS	n-type	210	132	HJT	Bifacial, halfcell, MBB	715	23.02
4	Maxeon	Maxeon 6	SPR-MAX6-445-E4-AC	n-type	-	66	IBC	Back Contact	445	23.0
5	SPIC	ANDROMEDA 3.0	SPICN6(LDF)-60/BIH	n-type	166	120	TBC	Backcontact, halfcell, MBB	410	22.8
6	Jinko	Tiger Neo	JKM585N-72HL4-V	n-type	-	144	TOPCon	Halfcell, MBB	585	22.65
7	ASTROENERGY	Astro N5	CHSM72N(DG)/F-BH	n-type	182	144	TOPCon	Bifacial, Halfcell, MBB	585	22.6
8	中東股份 JOLLYWOOD	Niwa Pro	JW-HD108N	n-type	182	108	TOPCon	Bifacial, Halfcell, MBB	440	22.53

- Of top 5 highest-efficient commercial PV modules, 4 use IBC technology
- Ca. 0.5%<sub>abs.</sub> higher module efficiency for IBC compared to TOPCon

## Day 1

09:00	Conference opening
09:20 – 10:40	<b>Session 1:</b> Back contact cells & modules in R&D
11:20 - 13:00	<b>Session 2:</b> Back contact cells in industry
	<b>Lunch</b>
14:30 - 15:50	<b>Session 3:</b> Materials & tools for bc cell technology
16:20 - 17:20	<b>Session 4:</b> Characterisation / Quality / Standards
	<b>Christmas Market</b>
19:00	<b>Dinner</b>

## Day 2

09:00 – 10:40	<b>Session 5:</b> Back contact modules & materials
11:20 – 12:00	<b>Session 6:</b> Panel discussion
	<b>Lunch</b>
13:30 - 14:30	<b>Session 7:</b> Back contact technology users
14:30 - 15:00	Closing session

# Thanks for support of the Organising Committee !



Thorsten  
Dullweber  
ISFH



Radovan  
Kopecek  
ISC



Olindo  
Isabella  
TU Delft



Jonas  
Huyeng  
ISE

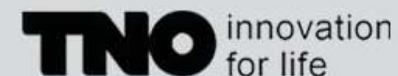


Iris  
Krucker  
PSE

# Thanks for support of our Sponsors !



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