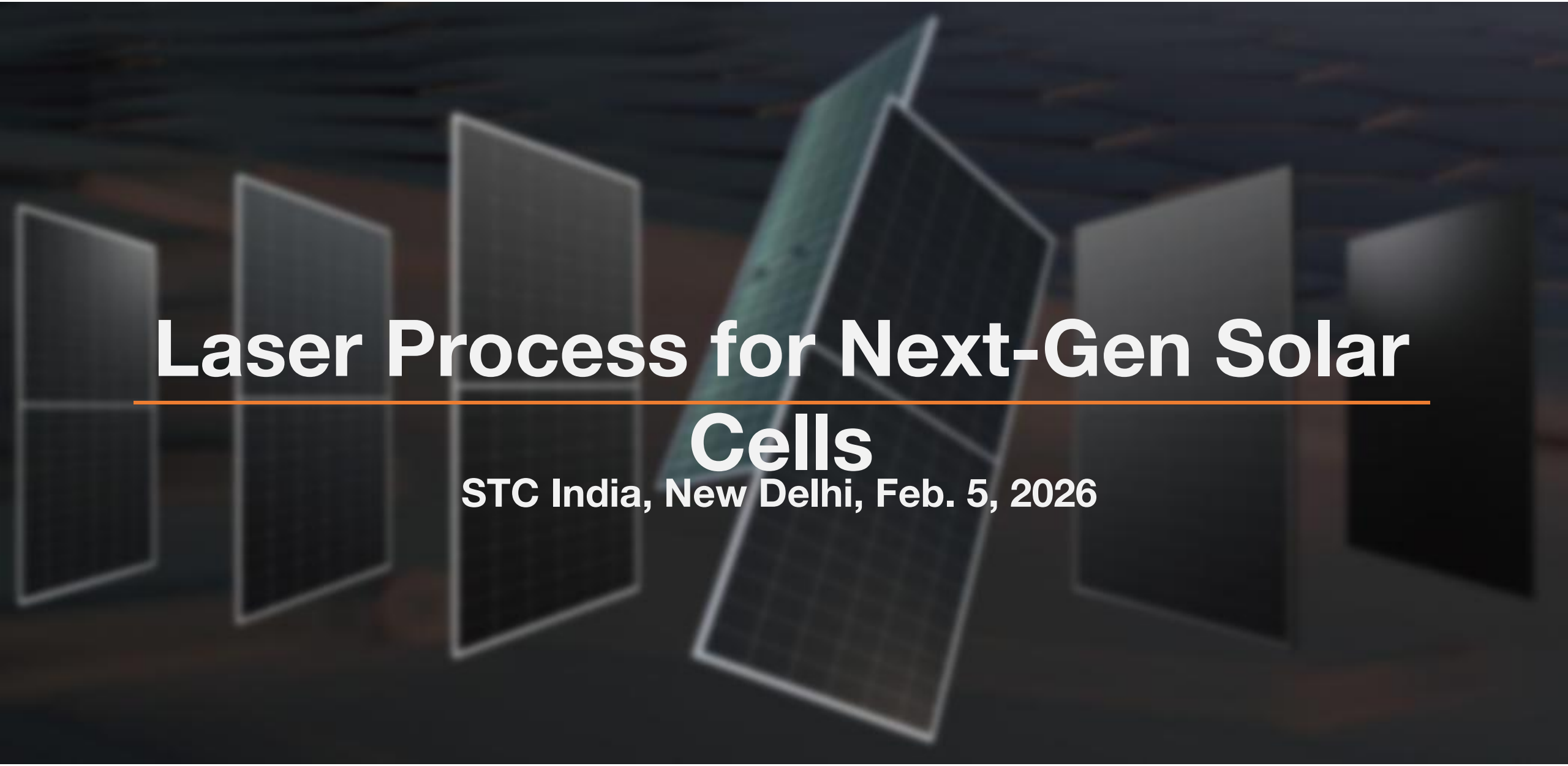
TAIYANGNEWS
ALL ABOUT SOLAR POWER

NMTRONICS
Partners in Technology

DR Laser
帝尔激光



Laser Process for Next-Gen Solar Cells

STC India, New Delhi, Feb. 5, 2026

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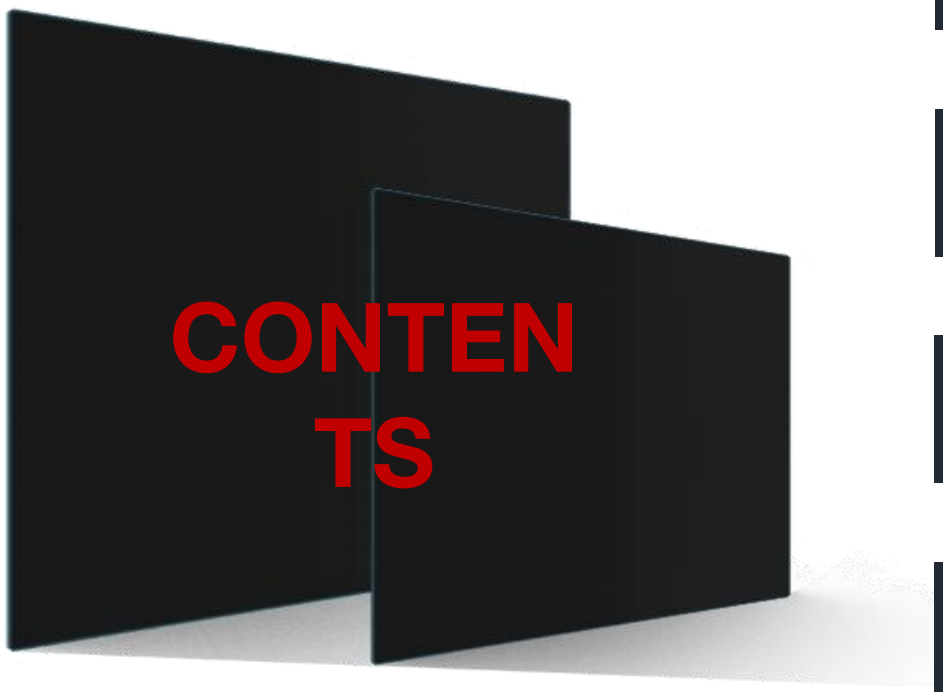
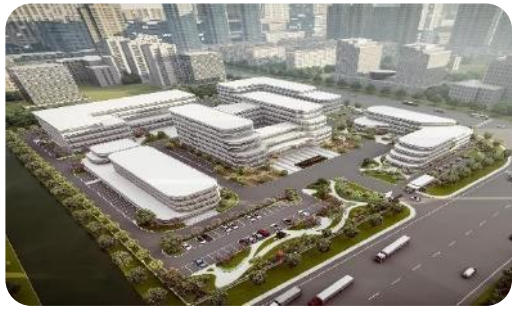


The Company

DR Laser Technology Corp., Ltd

DR Laser (300776. SZ) is a high-tech enterprise committed to developing advanced technologies for laser applications, focusing on the photovoltaic, next-gen. display, and semiconductor industries. It provides customized solutions integrating design, R&D, and manufacturing for high precision laser processing equipment. Founded in 2008, it is based in Wuhan, the geographic center of China, and it currently has a manufacturing base in Wuxi and global R&D centers in Tel Aviv, Israel, and Singapore.

Wuhan Headquarter
Settled in April 2022



Wuxi R&D and Manufacturing Base
Operated in January 2022

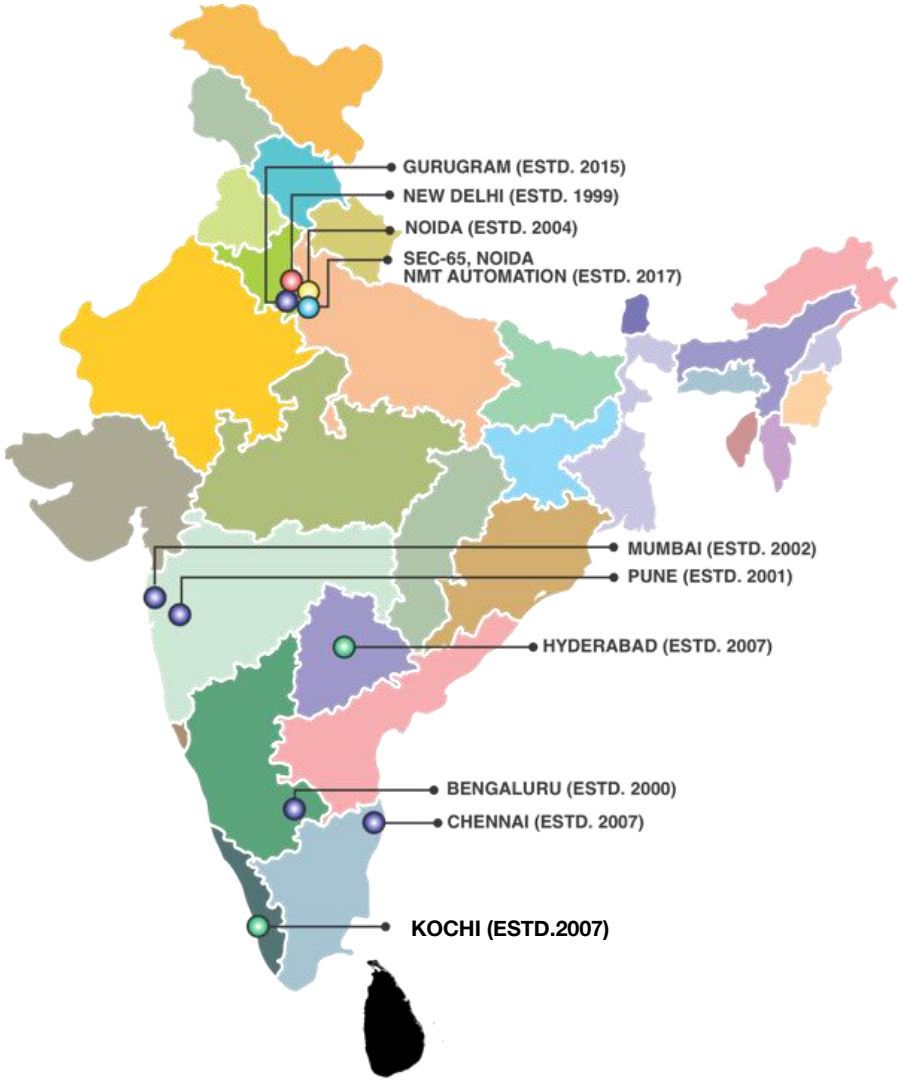
Israel R&D Center
Established in April 2020

Singapore R&D Centre
Established in January 2022

NMTronics India Pvt Ltd

- NMTronics is 26 years old Premier Sales & Service company working on Advanced Technologies [SMT, AUTOMATION, & SOLAR]
- Working in Solar industry since 2010 with Industry leading Solar Cell and Module Manufacturing companies
- Strong Service network in India with offices at Noida (HQ), Gurugram, Chennai, Bangalore, Mumbai, Pune, & service representatives in Hyderabad, Kolkata, Jaipur, Ahmedabad, Kochi & Bangladesh
- Joint Human resource of over 400+ trained engineers providing 24x7 support to valued customers
- Engineering Establishment of over 20,000 sq ft in Special Economic Zone [SEZ] for catering to major electronics manufacturers & PV customers
- Manufacturing of Custom automation & standard conveyor system in Noida

NMTronics Operations



Global Market Supported by DR Laser

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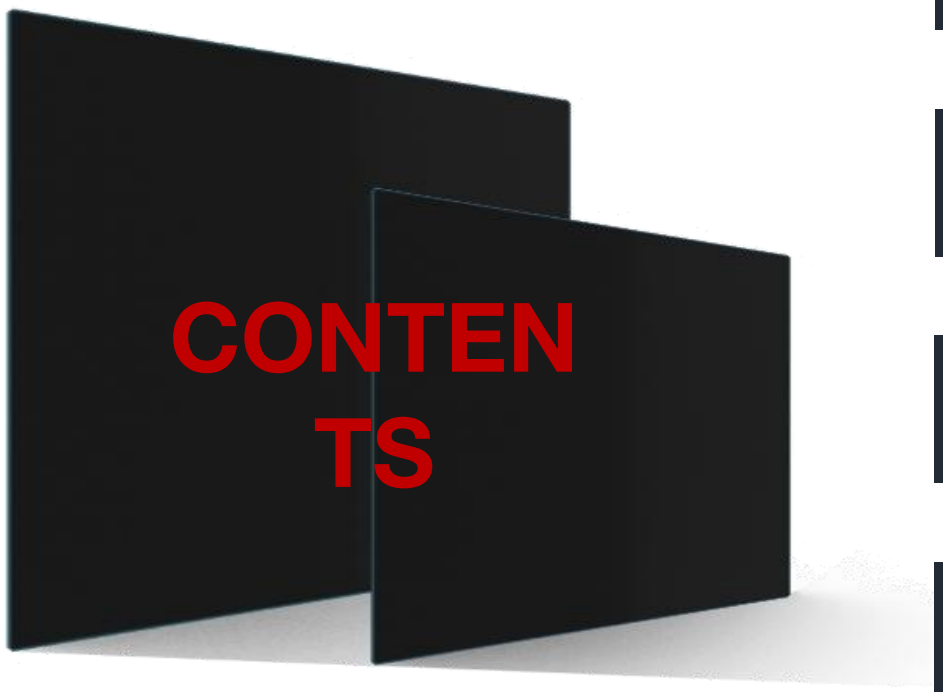
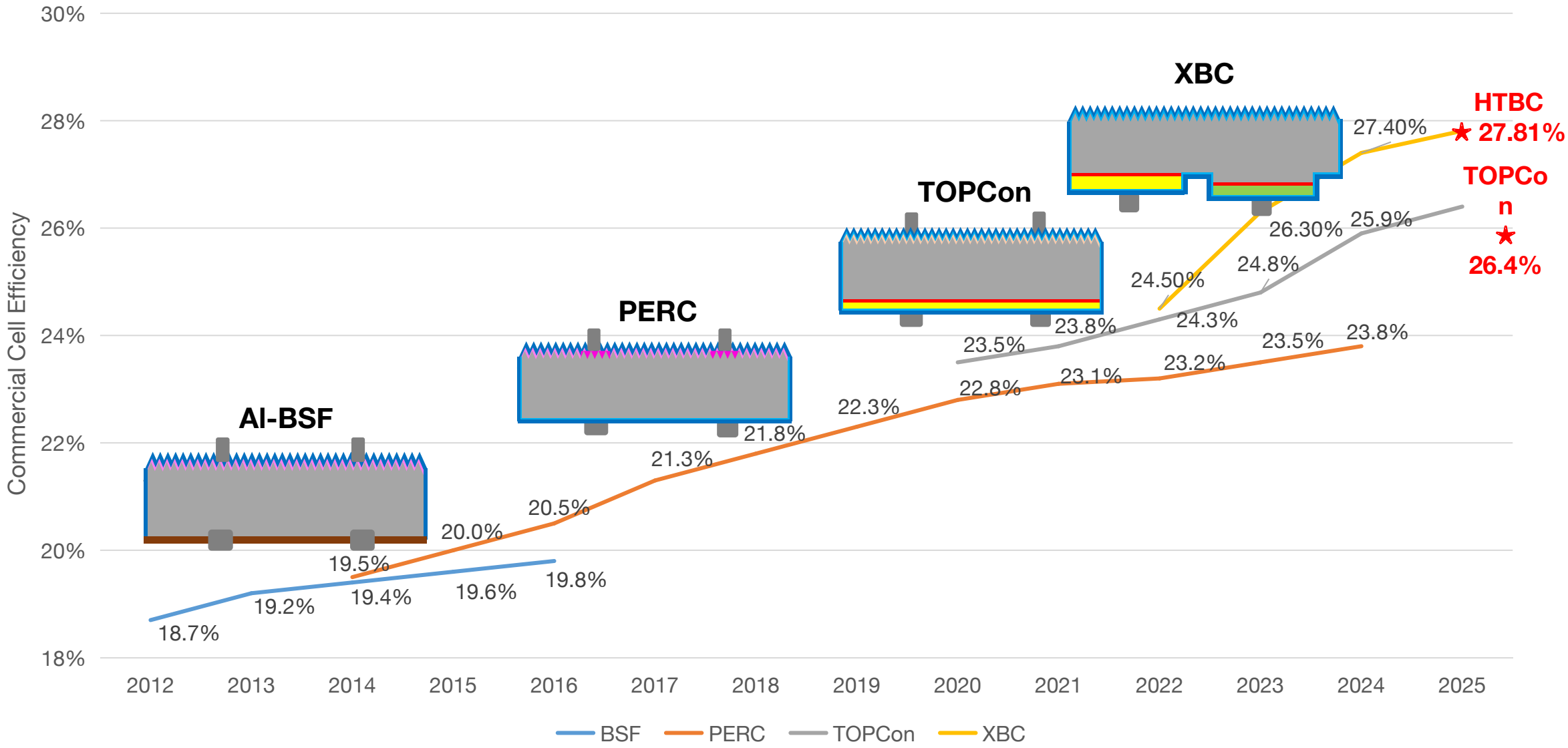


Inside World Records of c-Si Solar Cells



Product Portfolio

Laser Doping for PERC LDSE
TCI for TOPCon Edge Passivation

Laser Ablation for PERC LCO

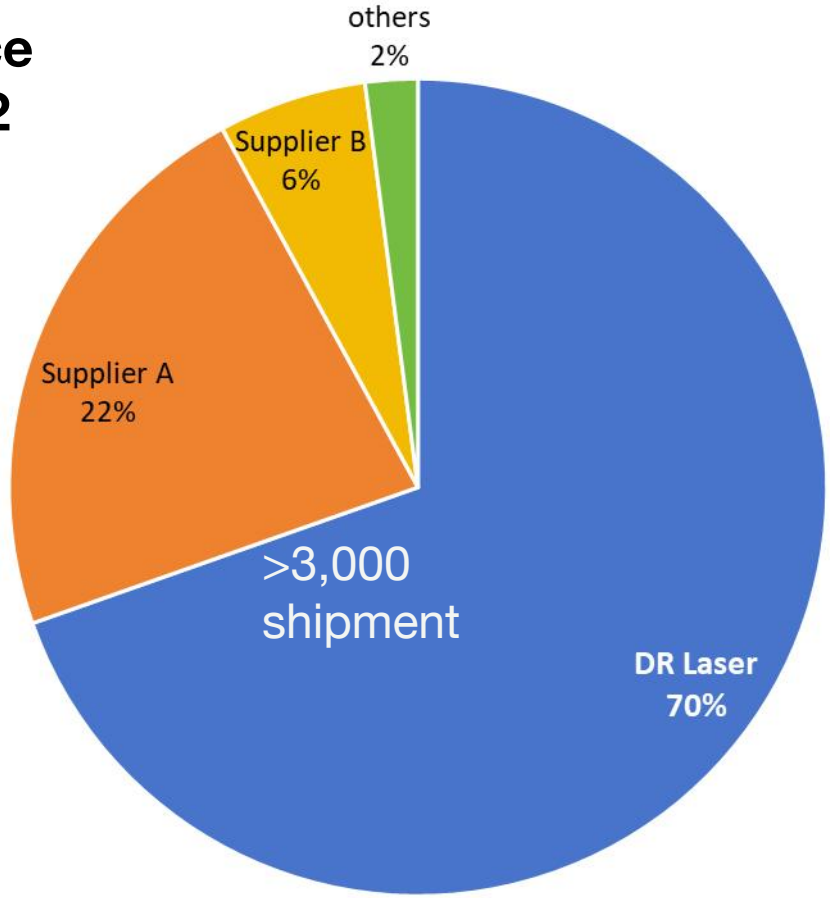
LIF for TOPCon

TCSE for TOPCon LDSE
TCP for TOPCon Poly-Si Fingers
Laser Processing for XBC

State-of-the-art Metallization Line (PTP/Linear SP) for TOPCon and HJT

Market Share of TOPCon Series Equipment

Since 2022



Market Share

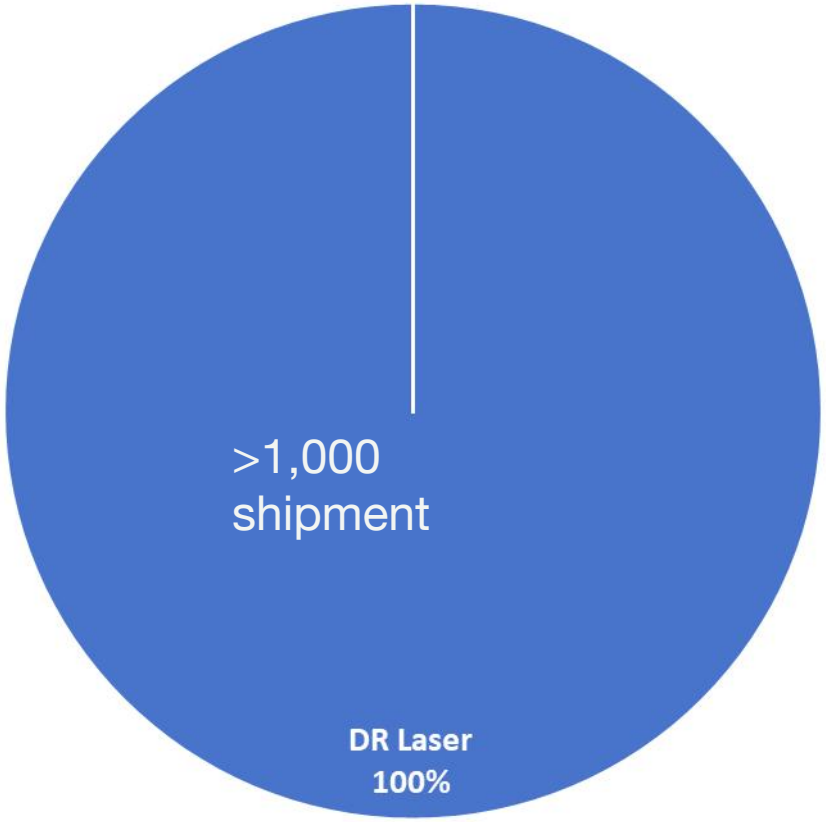
TOP 15

- TW Solar
- Jinko
- JA Solar
- JTPV
- Trina Solar
- Canadian Solar
- Solar Space
- Astronergy
- DASolar
- Yingfa
- Longi
- Aiko Solar
- GCL
- Sunsync
- TOP Solar

Customer Portfolio

Market Share of XBC Series Equipment

Since 2021



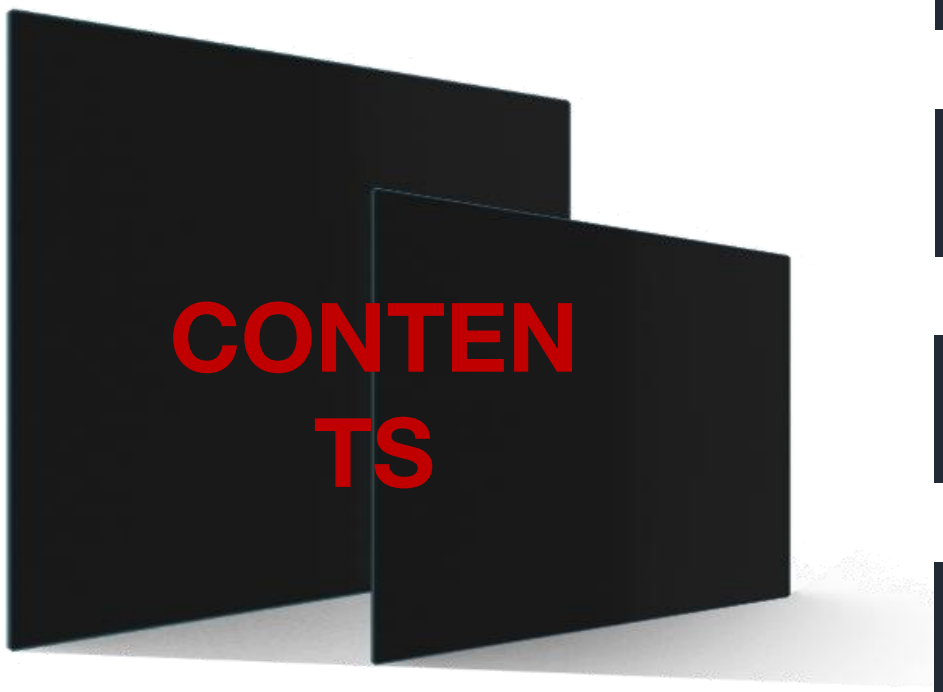
Market Share

TOP 2

- Longi
- Aiko Solar

Cooperating with more than 10 customers

Customer Portfolio



Laser Processing Equipment for TOPCon

Evolution of TOPCon Cell Technology

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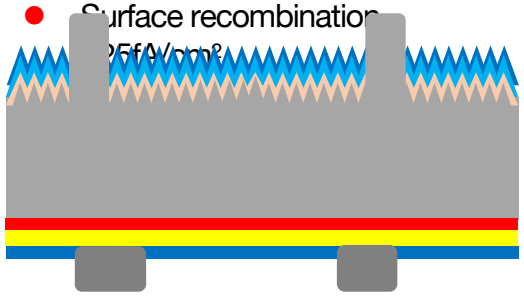
2022~2023

Gen. 1

24.0~24.5%

- Tunneling contact on the rear
- Surface recombination ~25fA/cm²



2023~2024

Gen. 2

24.6~25.0%

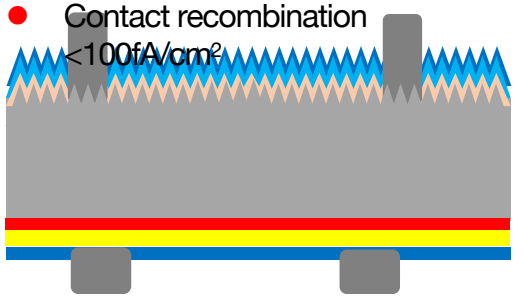
- Laser doped selective emitter
- Surface recombination <15fA/cm²

2024~

Gen. 3

25.1~25.5%

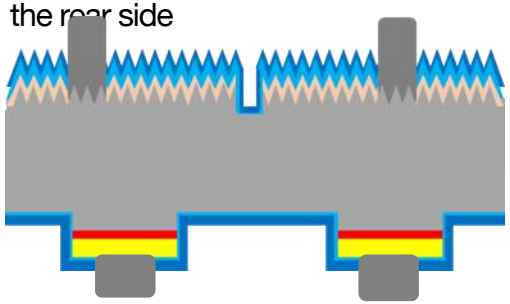
- Laser induced firing
- Contact recombination <100fA/cm²

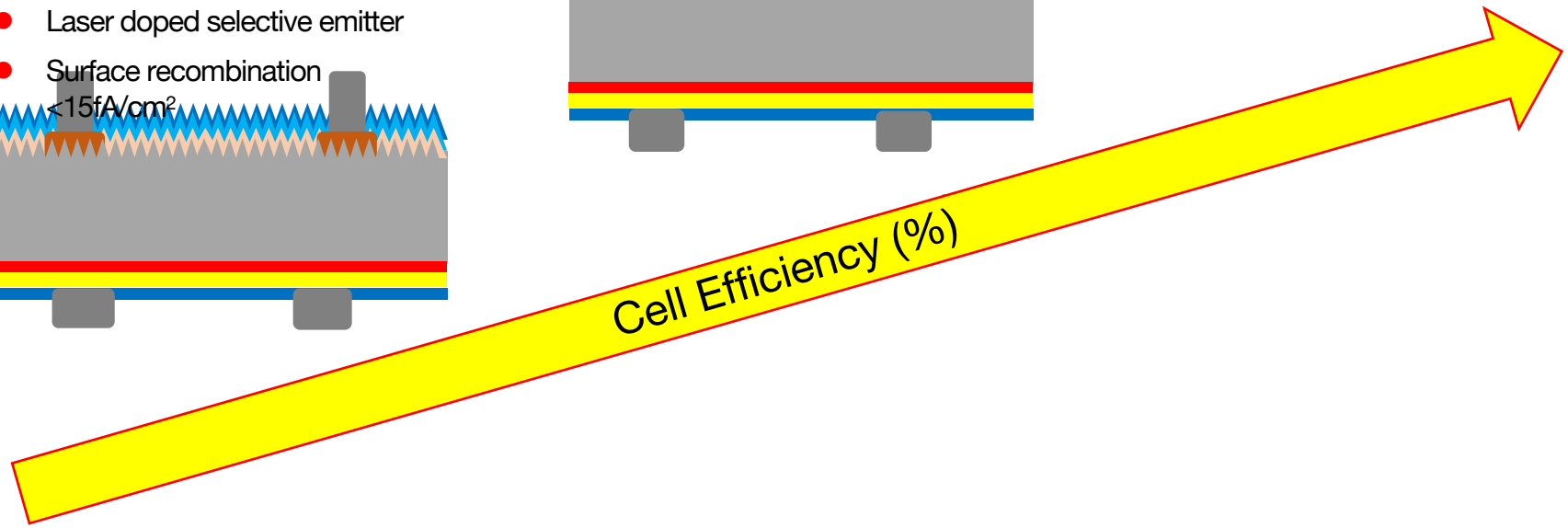


2025~

Gen. 4 >25.5%

- Laser induced firing
- Laser-ablated edge passivation on the front side
- Laser-based selective tunneling contact on the rear side



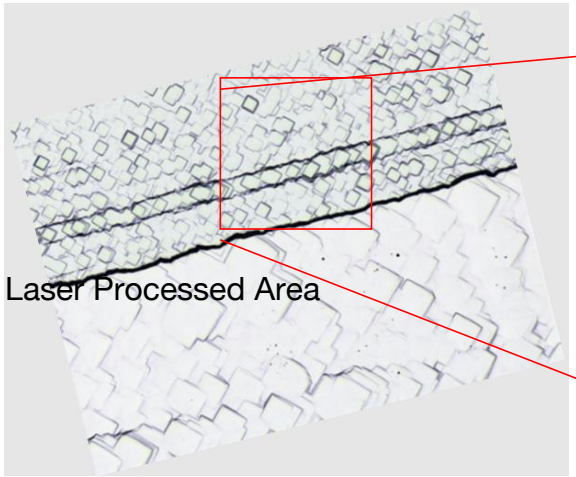


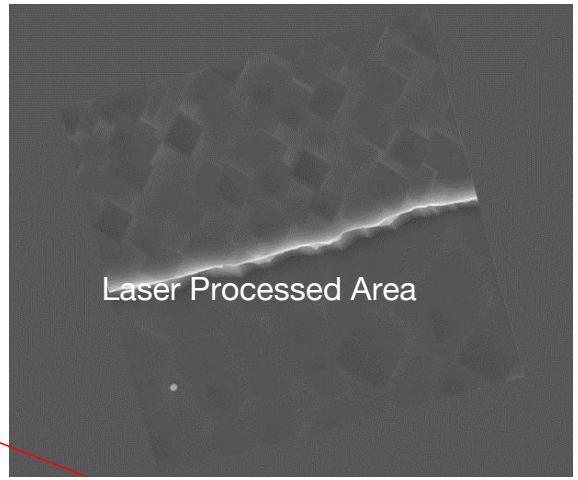
Gen. 4 – TCP for TOPCon Poly-Si Fingers

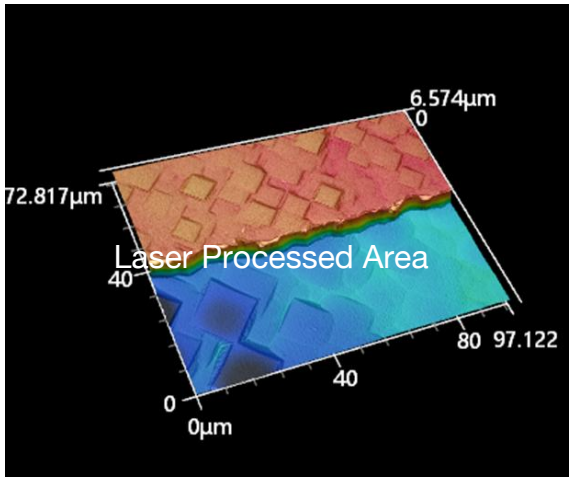
- Dual-lane design with four individual laser sources. No mutual interruption neither in operation or maintenance
- 0.1 ~ 0.15% efficiency gain proven in mass production
- 3~5% bifaciality enhancement proven in mass production
- Throughput up to 9,600UPH (CT<0.75sec) on M10 wafers valid for the varied design of the factories, and the varied wafer sizes including half-cut and rectangle
- Vibration simulation and optimization design from resonance, long-term stability guaranteed

Something Should Know about Poly-Si Fingers

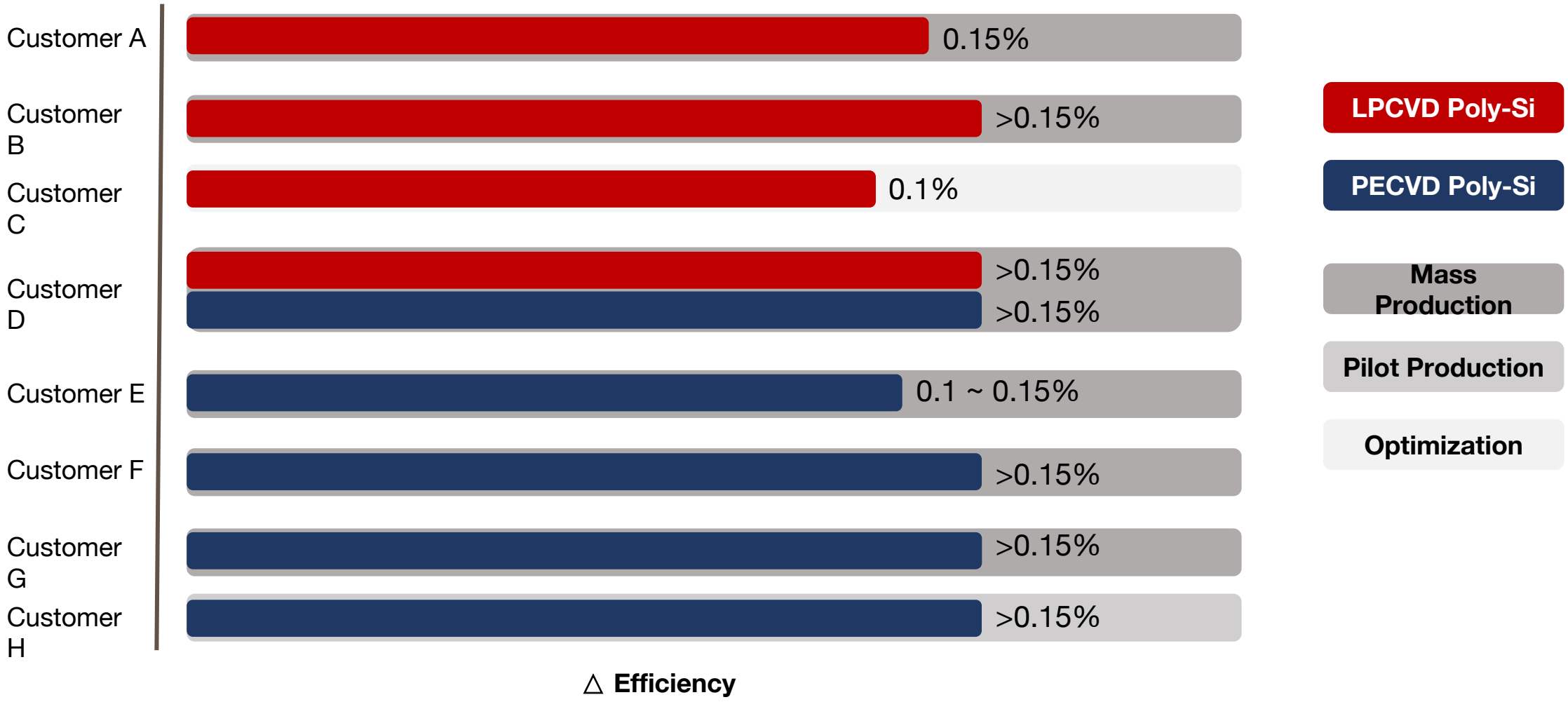
	LPCVD Process	PECVD Process
Poly-Si thickness	120~160 nm	100~130 nm
Doping process	ex-situ doping (POCl3 diffusion)	in-situ doping (annealing)
Capping layer thickness	tens of nm of PSG by diffusion time	tens of nm of SiOx by annealing time
Laser modification process	Low energy density required	High energy density required
Wet etching depth	2 ~ 4 μm	5 ~ 7 μm
Major enhancement	I_{SC}	V_{OC}



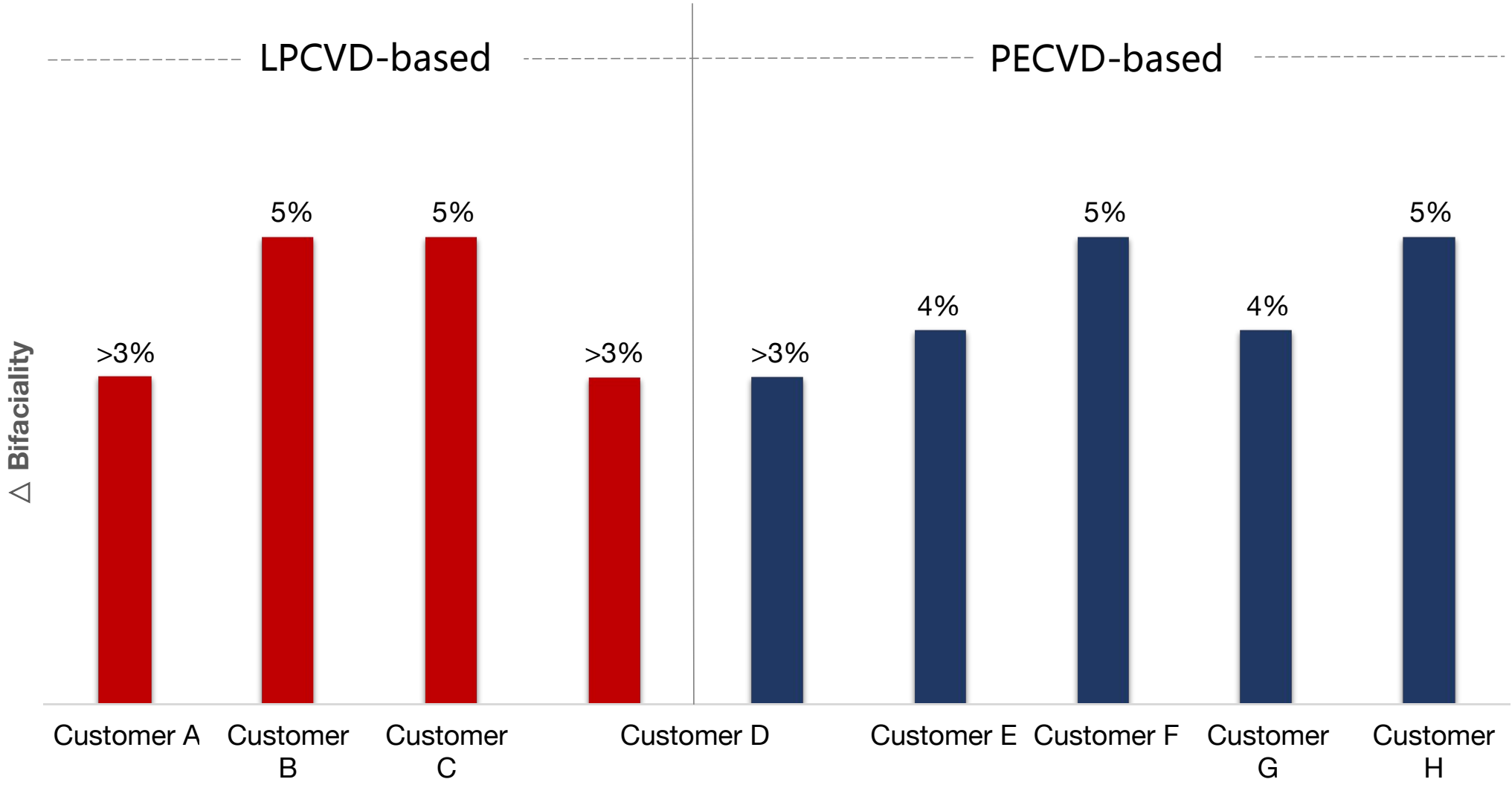




Process Performance of Poly-Si Fingers on Cells



Process Performance of Poly-Si Fingers on Cells

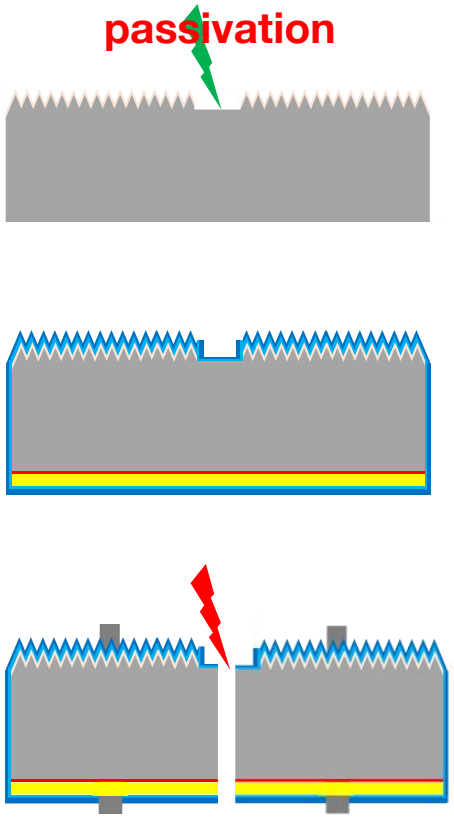


Gen. 4 – TCI for TOPCon Edge Passivation

- Realizing the edge isolation of p-n junction from the transportation of the carriers to the edge of solar cell causing the recombination by cutting-induced defects
- Most cost-effective approach to realize edge passivation by laser isolation of p/n junction
- Dual-lane design with four individual laser sources. No mutual interruption neither in operation or maintenance
- 300 ~ 500μm line width , compatible with half-cut and multi-cut designs
- Power output of 2382mmX1134mm module can be enhanced by 2 ~ 3W, half-cut cell efficiency can be also enhanced by 0.1 ~0.15%
- Throughput up to 9,000UPH (CT<0.75sec) on M10 wafers valid for the varied design of the factories, and the varied wafer sizes including rectangle

Process Sequence of the Varied Edge Passivation Approaches

Most cost-effective approach to realize edge passivation

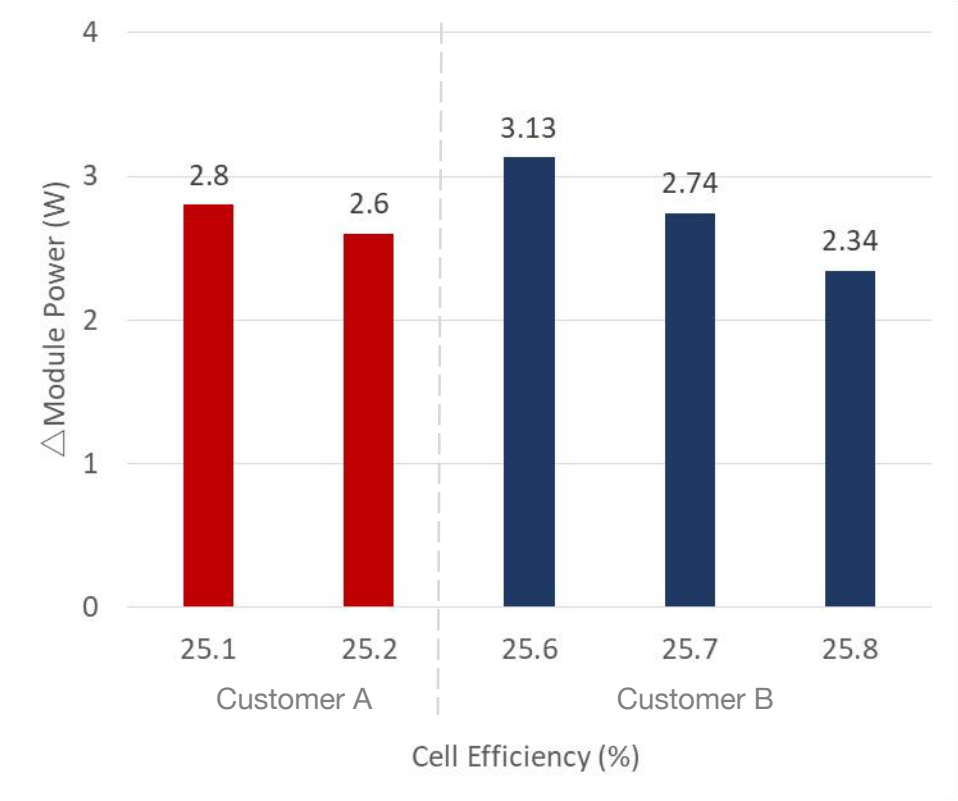


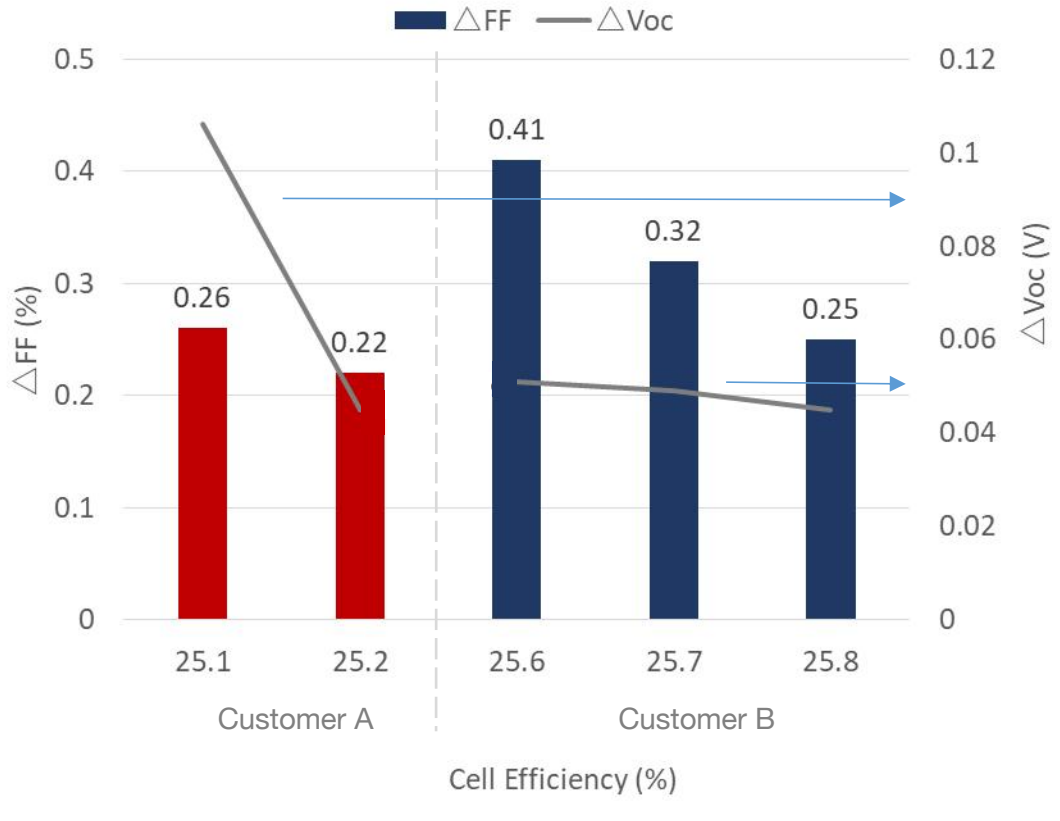
Half- or Quard-cutting	Half- or Quard-cutting	Half-cutting	Quard-cutting	Quard-cutting
Texturing	Texturing	Texturing	Texturing	Texturing
Boron Diffusion	Boron Diffusion	Boron Diffusion	Boron Diffusion	Boron Diffusion
TCI Laser Ablation	TCI Laser Ablation		TCI Laser Ablation	
Rear Polishing	Rear Polishing	Rear Polishing	Rear Polishing	Rear Polishing
Al_2O_3 Deposition	Al_2O_3 Deposition	Al_2O_3 Deposition	Al_2O_3 Deposition	Al_2O_3 Deposition
SiN_X Deposition	SiN_X Deposition	SiN_X Deposition	SiN_X Deposition	SiN_X Deposition
Metallization	Metallization	Metallization	Metallization	Metallization
	Testing (full cell)	Testing (full cell)	Testing (full cell)	Testing (full cell)
	Laser Cutting	Laser Cutting	Laser Cutting	Laser Cutting
		EPD	EPD	EPD
				EPD
Testing & Sorting	Testing & Sorting	Testing & Sorting	Testing & Sorting	Testing & Sorting
Laser Cutting				

Solar Cell

PV Module

Process Performance of TCI Edge Passivation

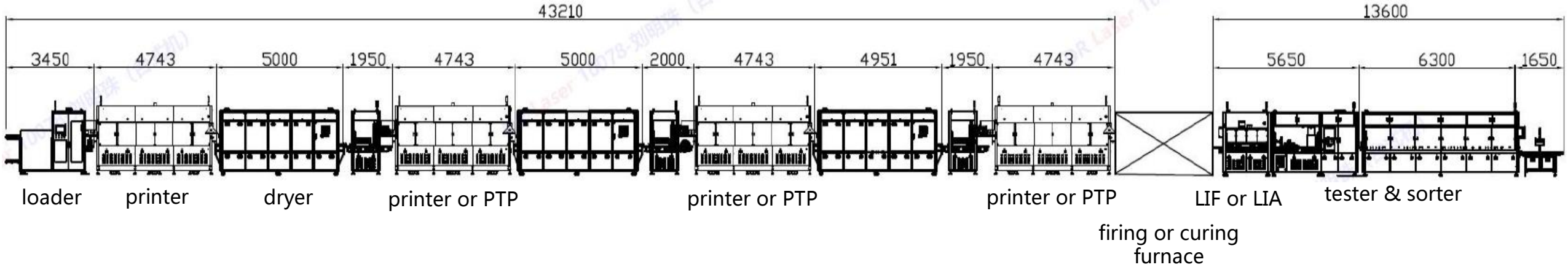




Remark：Customer A，182mm*183.75mm，72 cells，half cutting，2278*1134mm module；
Customer B，182mm*210mm，66 cells，half cutting， 2382*1134mm module

State-of-the-art Metallization Solution

- The State-of-the-art metallization line launched in 2025 including pattern transfer printing (PTP), screen printing, laser induced firing (LIF) or laser induced annealing (LIA), and tester & sorter



Linear Reciprocation Screen Printing

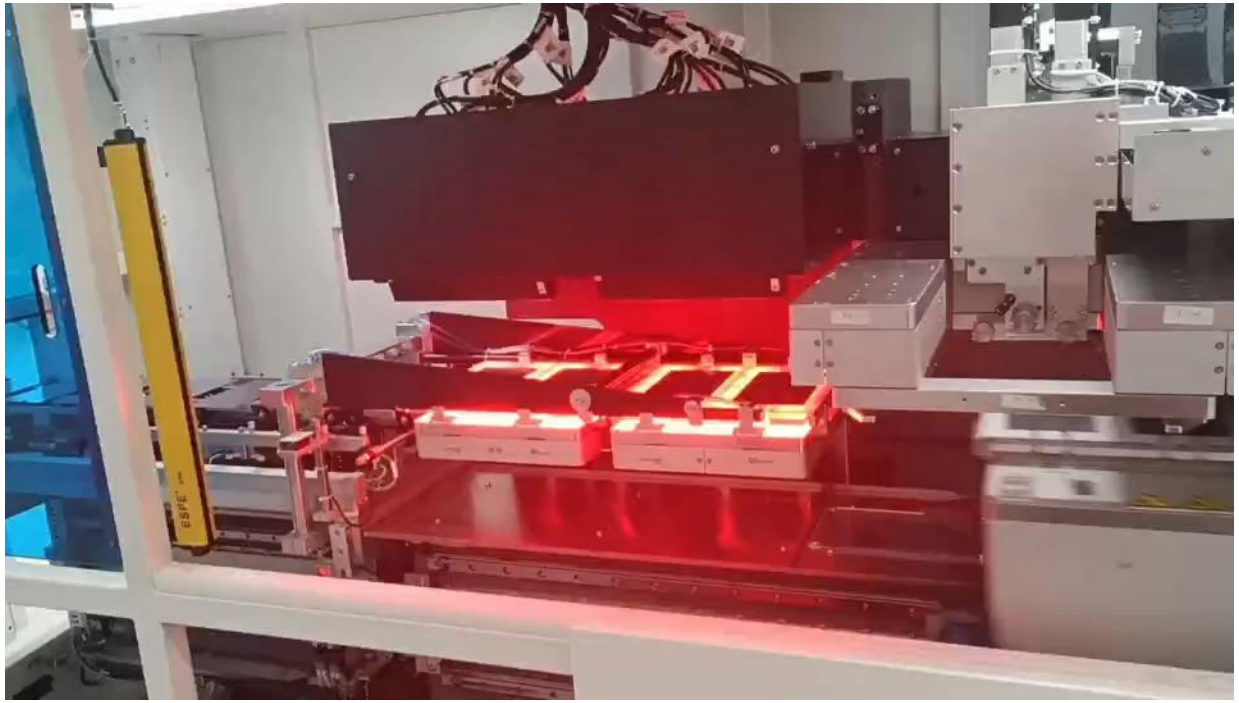
High throughput and high alignment accuracy realized by the design of linear reciprocation

- Throughput

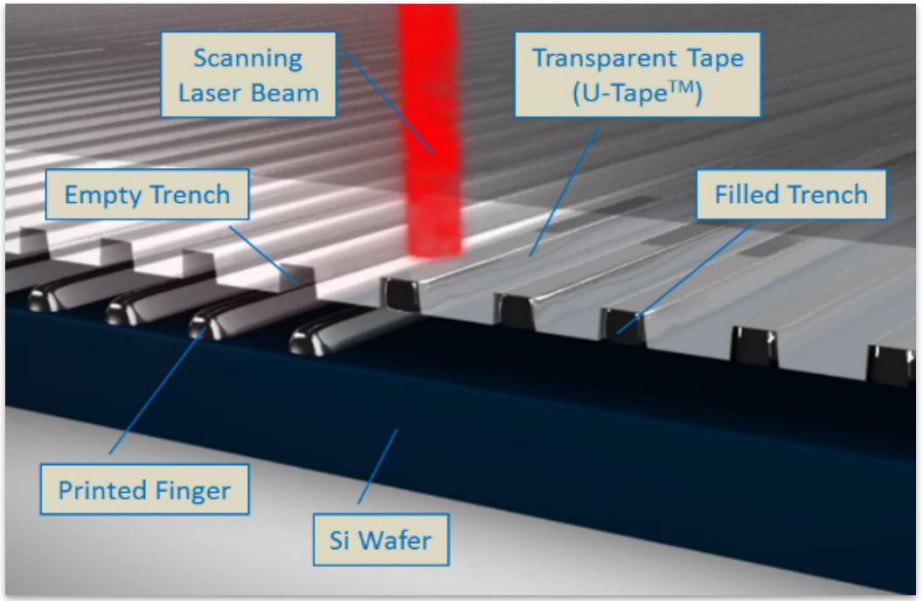
  ≥9500pcs/h (CT≤0.76s) on M10, ≥8000pcs/h (CT≤0.9s) on G12

  ≥16000pcs/h (CT≤0.45s) on half-cut M10, ≥15000pcs/h (CT≤0.48s) on half-cut G12

- Pattern alignment accuracy ±6μm

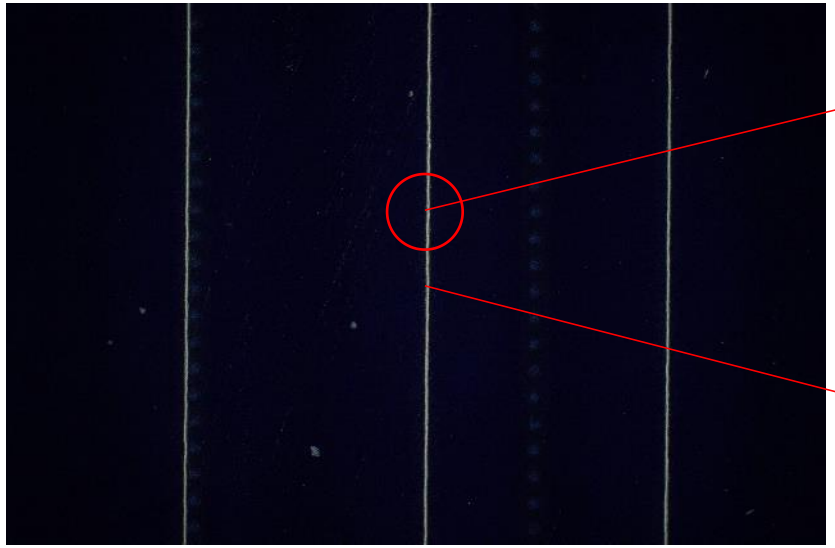


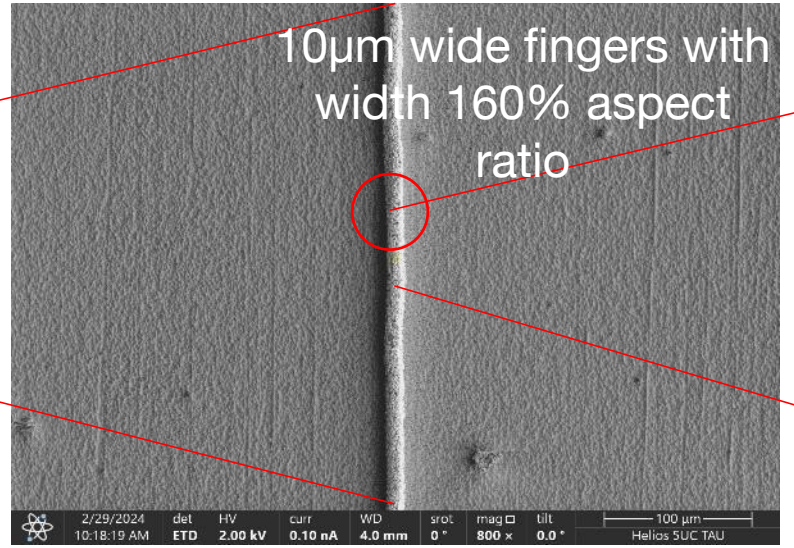
PTP (Pattern Transfer Printing) for Metallization

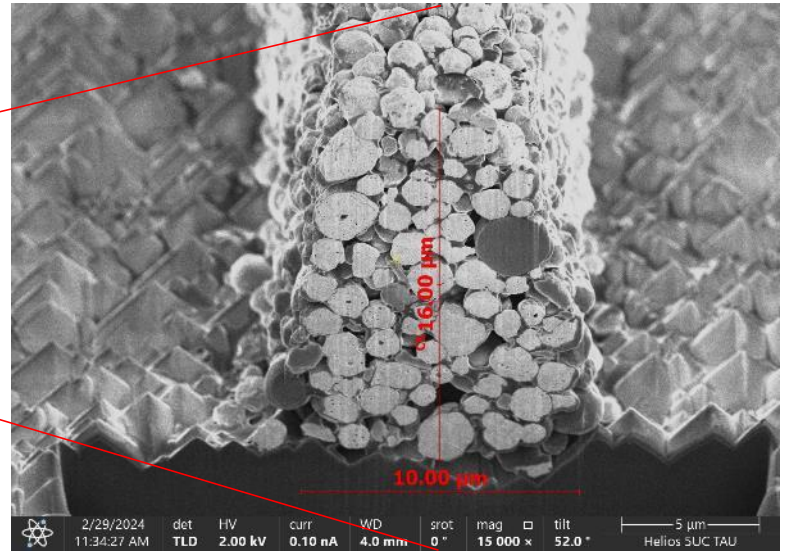


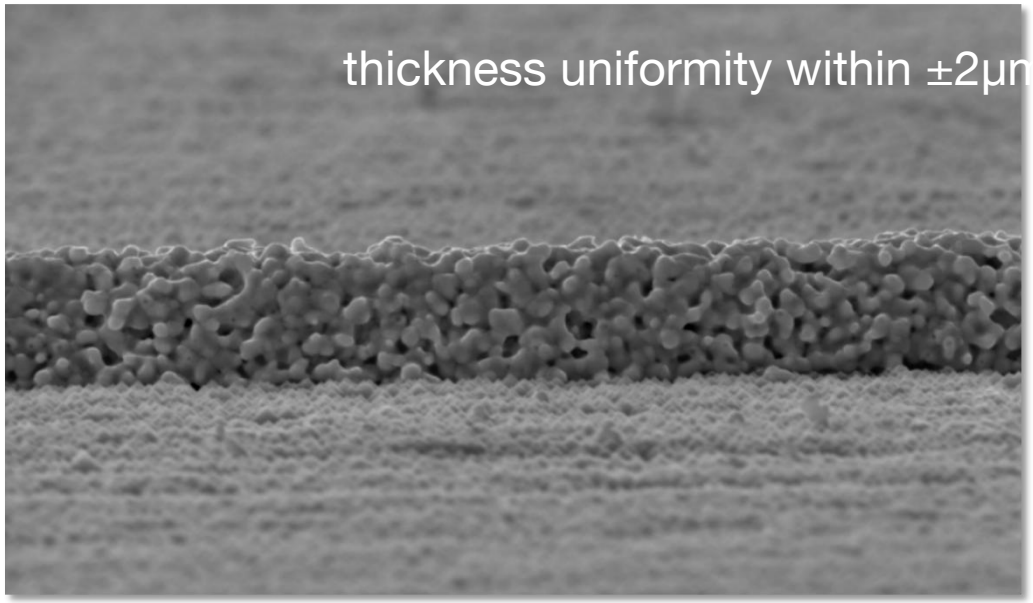
- Printing width ≥10μm, 10 to >100% aspect ratio adjustable
- Fine fingers increasing light absorption area enhance cell efficiency, thin rear fingers reduce paste consumption
- Thickness uniformity of fingers within ±2μm
- Non-contact printing process, friendly to ultra thin

PTP for TOPCon Metallization



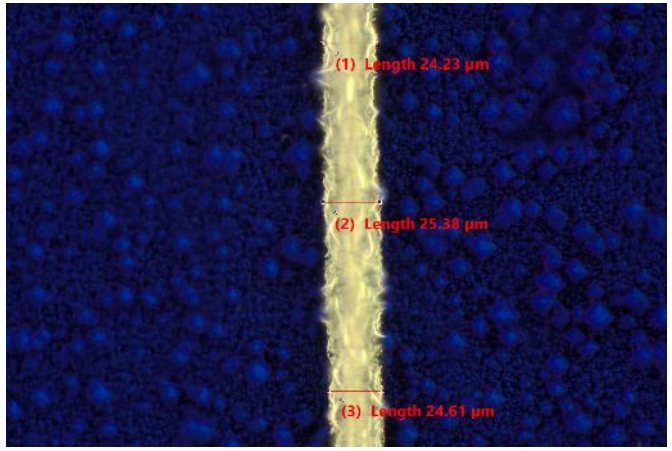


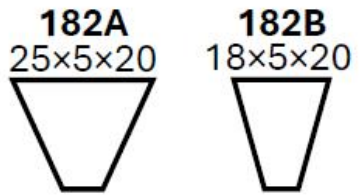


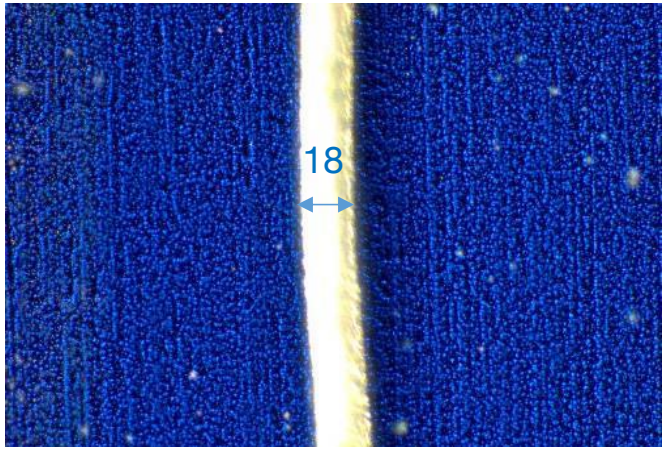


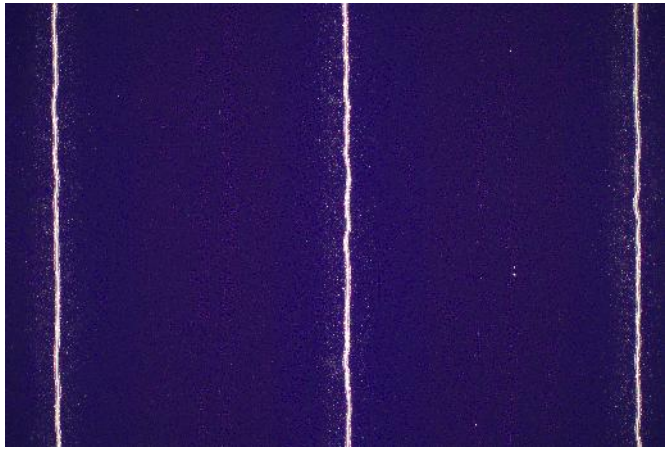
PTP for Advanced Printing Capabilities

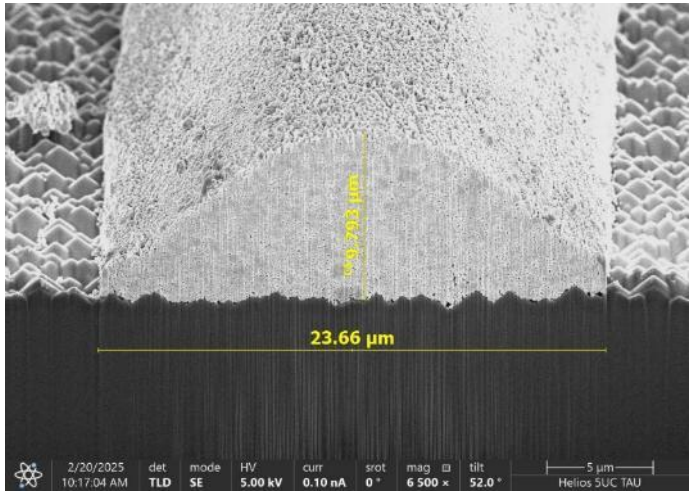
- <20μm fingers printing demonstrated with the cooperation of the leading brands of **Cu** pastes

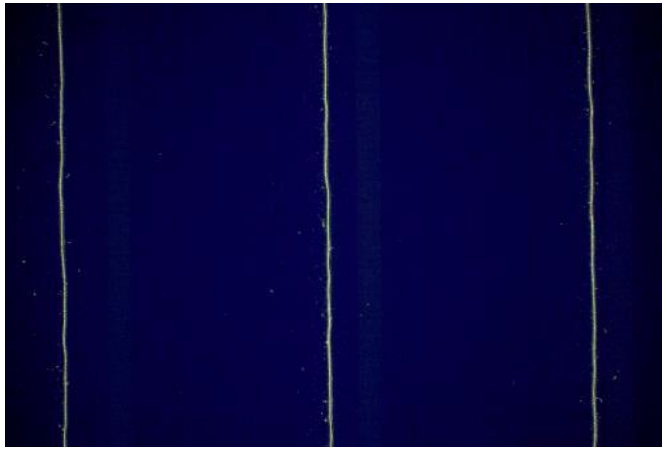






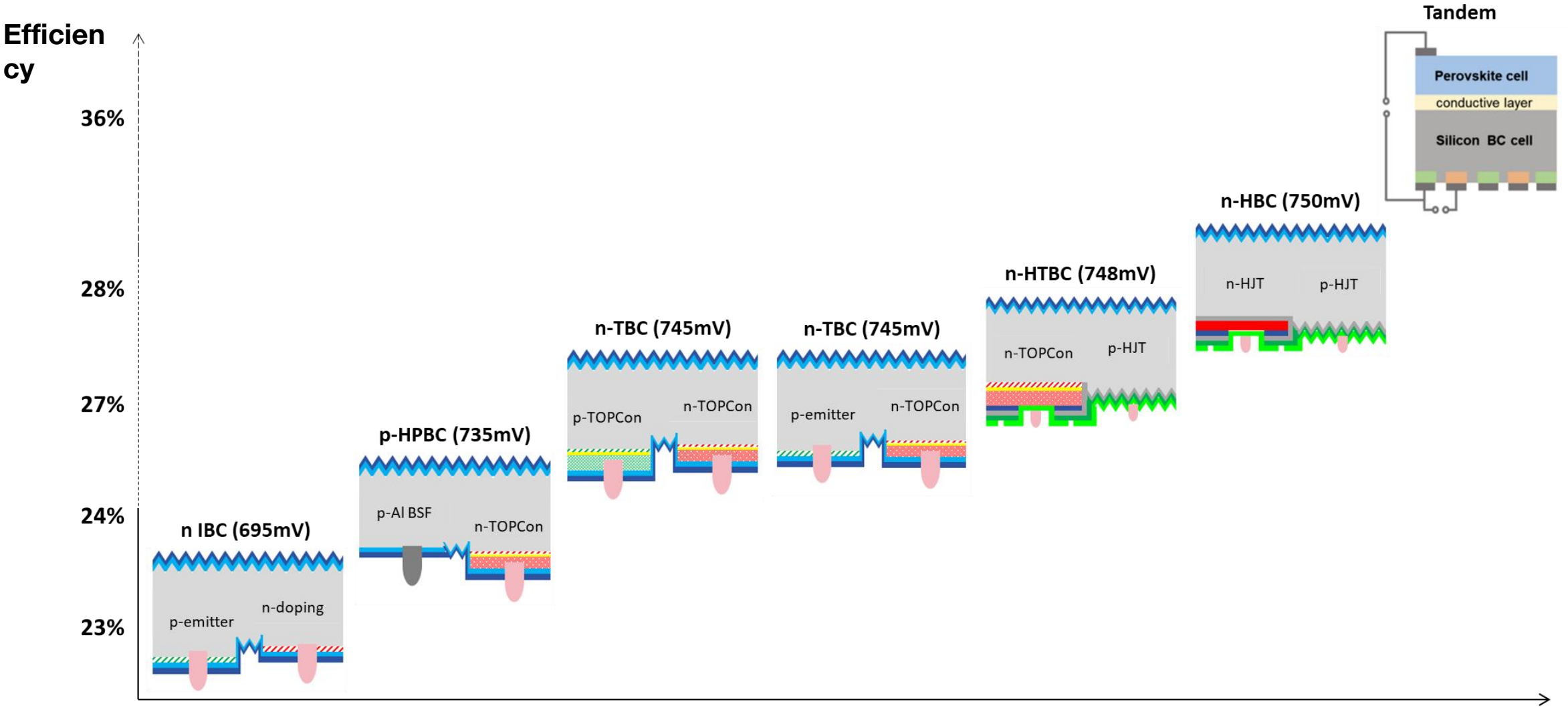






Laser Processing Equipment for XBC

Back-Contact Technology Roadmap

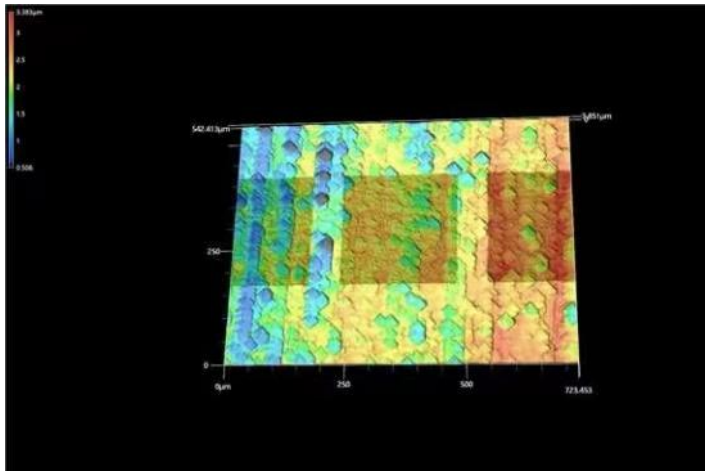


- BC is the ultimate architecture of high-eff. c-Si solar cell by its higher V_{OC} and lower shading loss

Cutting-Edge Laser Patterning for XBC Cells

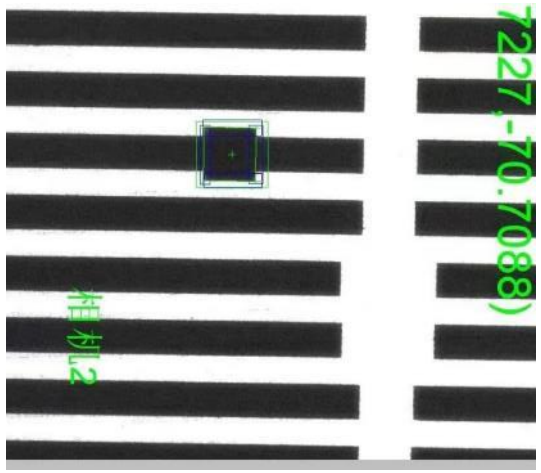
Large-spot ablation

- Uniform energy distribution over large spot size than ever
- Stable energy management of flat-top spot



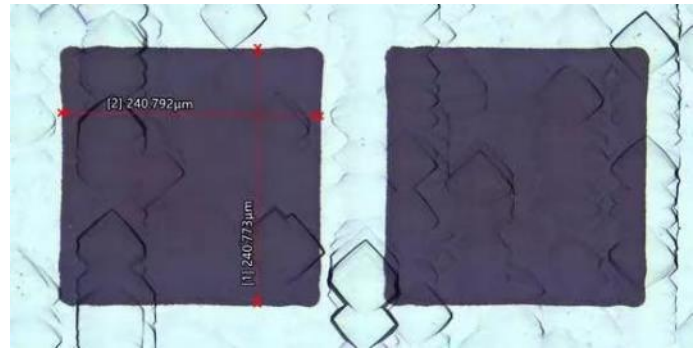
Fine-tuning patternization

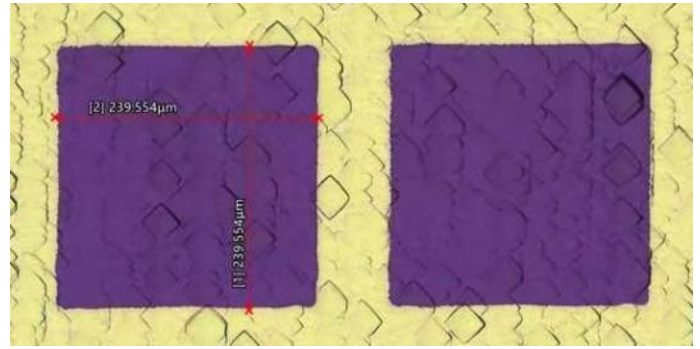
- Time-serial scanning control for well isolation of p- and n-type area
- AI algorithm introduced into visualization recognition for high alignment accuracy



Flexible optimization of laser ablation

- Multiple models of laser sources suitable for the varied film
- Proven ablation processes for the varied XBC structure





Cutting-Edge Laser Soldering Line for XBC Modules

DR Laser LIB

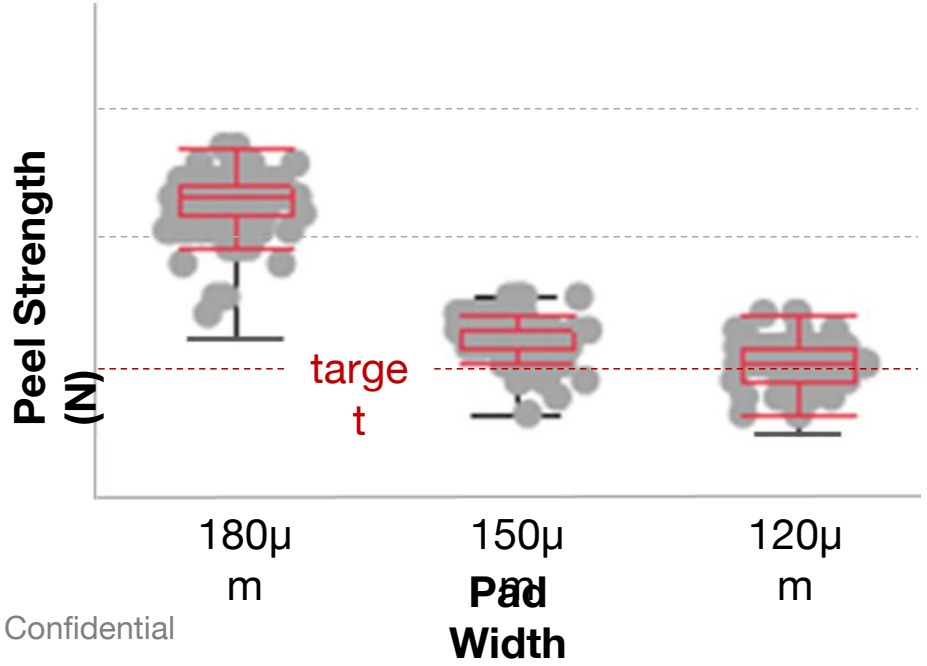
Cell Loading → Insulation Glue Printing + Curing → Solder Paste Printing + Curing (optional) → Cell Arrangement → Ribbon Arrangement → Glass → Laser Soldering → Glass → EL Testing → Lamination → Framing → Fixing Tape Attaching → Stitch Soldering → String Arrangement → Ribbon Soldering

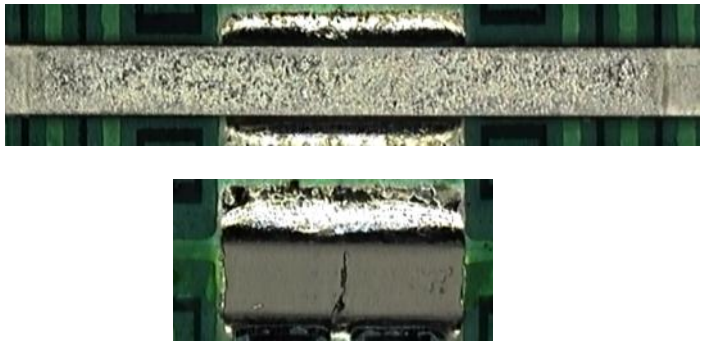
Conventional IR

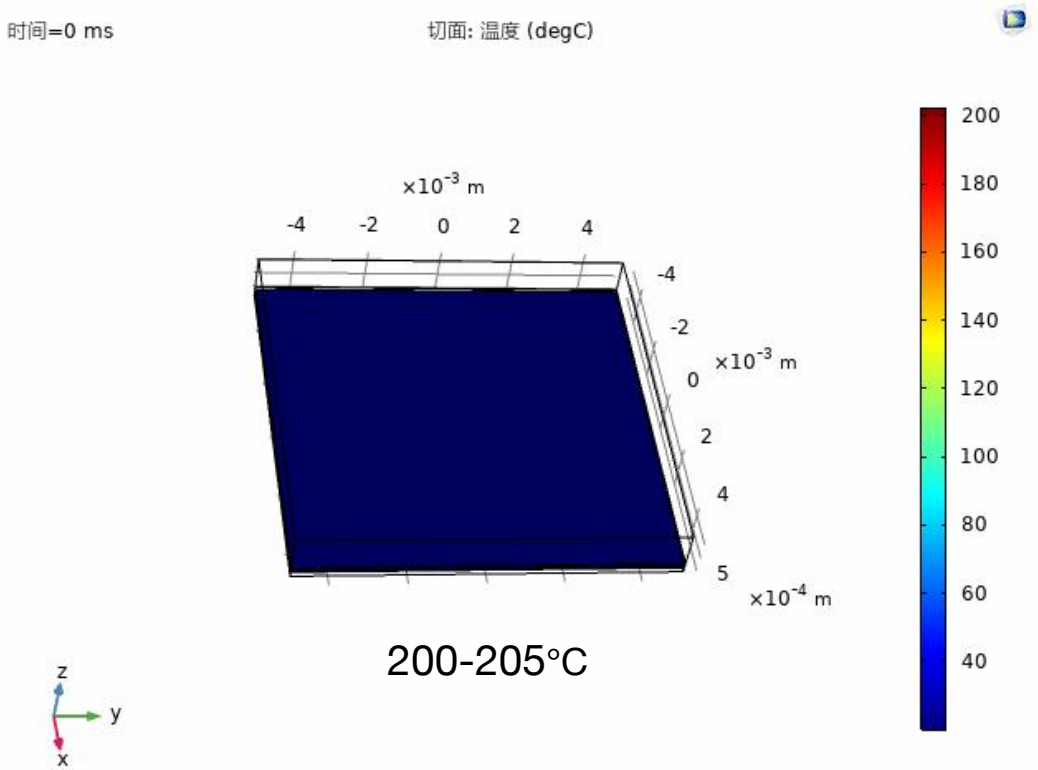
Cell Loading → Insulation Glue Printing + Curing → Solder Paste Printing + Curing → Cell Arrangement → Ribbon Arrangement

Cutting-Edge Laser Soldering Line for XBC Module

- Low-temperature & local-heating process with high alignment accuracy
- No solder paste needed, complete soldering without pseudo soldering
- 0BB design compatible
- Ultra-thin wafer friendly due to ultra-low thermal stress
- Small footprint due to lean process sequence







200-205°C

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DR Laser
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Q & A