

Advancements in Equipment and Process for PV metallization

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MIW

Chambery, 23rd October 2024

Applied Materials - External Use



AGENDA

Applied Materials Baccini[®] Metallization Tools

New Equipment: Tempo Presto[™] for Half Cut

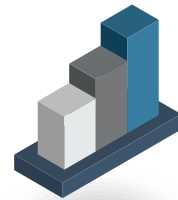
New Process: Low-Ag Pastes and Parallel Dispensing



FOUNDED IN 1967

World's #1

semiconductor and display equipment company



\$26.52 billion
revenue



\$3.1 billion
R&D spending



~19,600
patents



~34,000
employees
in **24** countries

*Data as of fiscal year end, October 29, 2023

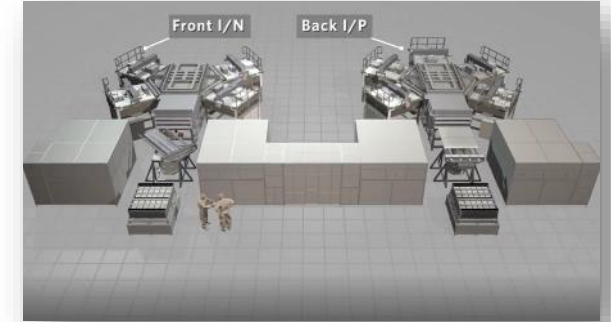
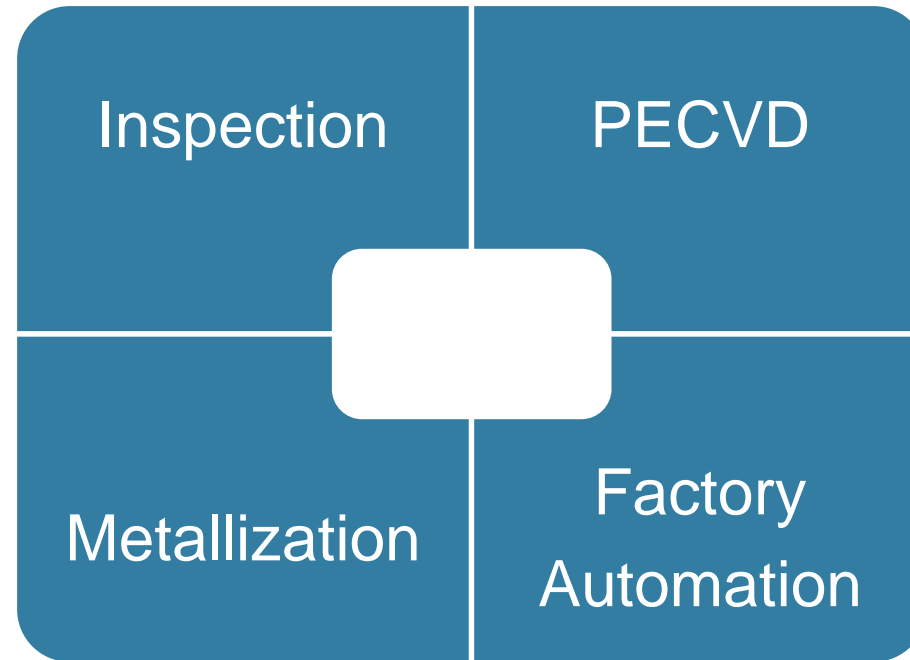
Applied Materials Solar Manufacturing Portfolio



*Vericell™ full wafer inspection
> 600 tools worldwide*



Baccini® metallization solutions

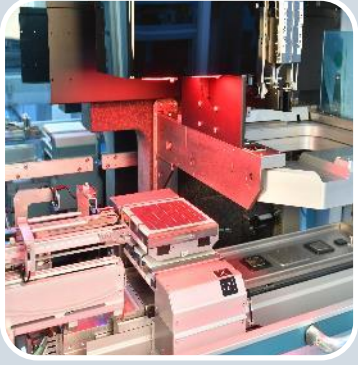


*Display proven technology
Gen 8.7 600MW Inline cluster*



*SmartFactory solutions
Increase quality and productivity*

Applied Materials Baccini® Metallization Solutions



Tempo Presto™ Platform

- Full, Half Cells
- SHJ, Topcon

Paste Drying

- Cassette
- Belt

Sintering

- Curing >30min
- Fast Firing

Light Soaking

- LED
- >50suns, >12sec

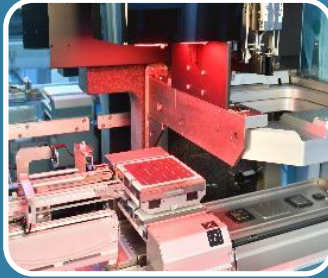
IV Flasher

- LED
- >100M flashes

Sorter

- Full, Half Cells
- SHJ, Topcon

Applied Materials Baccini® Latest Platform: Tempo Presto™ HC



Versatile

Cell size: 182, 210 and 230mm FC - 182, 210mm HC
TPT: >5,500 uph FC, >11,000 uph HC
Ultra thin wafers < 90 μm



Accessible

Full Back-End of line length < 60m
Ergonomy for operator
Low changeover time: <8h

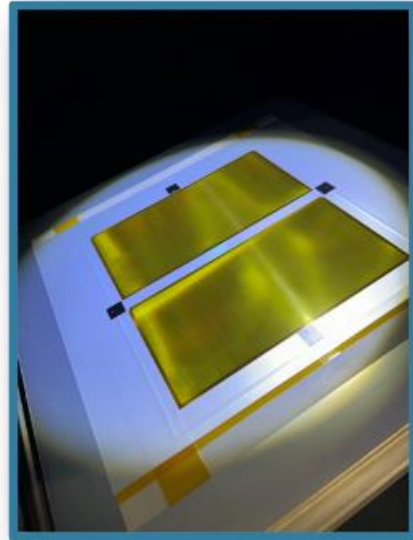


Smart

Esatto AOI for Post-Print Quality Inspection
Profilometer for 100% in-line control
OEE tool embedded in the SPV™

Applied Materials Baccini[®] Latest Platform: Tempo Presto[™] HC

HC Printing Head



Printer Characteristics

- Single printing head per process step
- Printing direction along the fingers
- Simultaneous printing of half cells
- Ready for ultra thin wafers

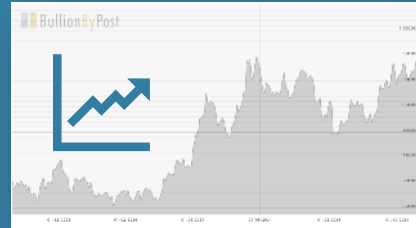
Alignment precision FC: $\pm 6\mu\text{m}$

Alignment precision HC: $\pm 15\mu\text{m}$

Low-Ag Pastes for SHJ

Ag price 1,000 €/kg
(+45% in 2024)

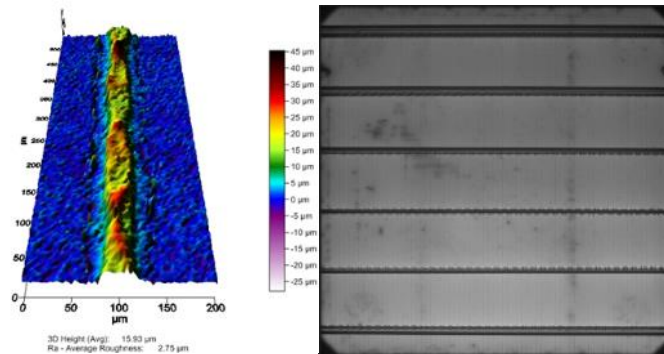
14% of Ag used in PV



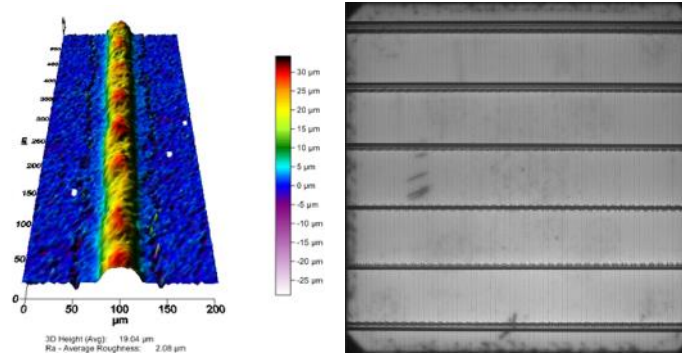
Internal testing of Low-Ag formulation, 35 um finger opening

Paste type	Ag content [%]	Resistivity [$\mu\Omega\cdot\text{cm}$]	Deposit/cell [mg]	Ag / cell [mg]	Ag / W [mg/W]
Ag	94	< 5	242	228	42
Ag-Cu	42	5.8	238	100	18

EL, 3d images of the best cells processed

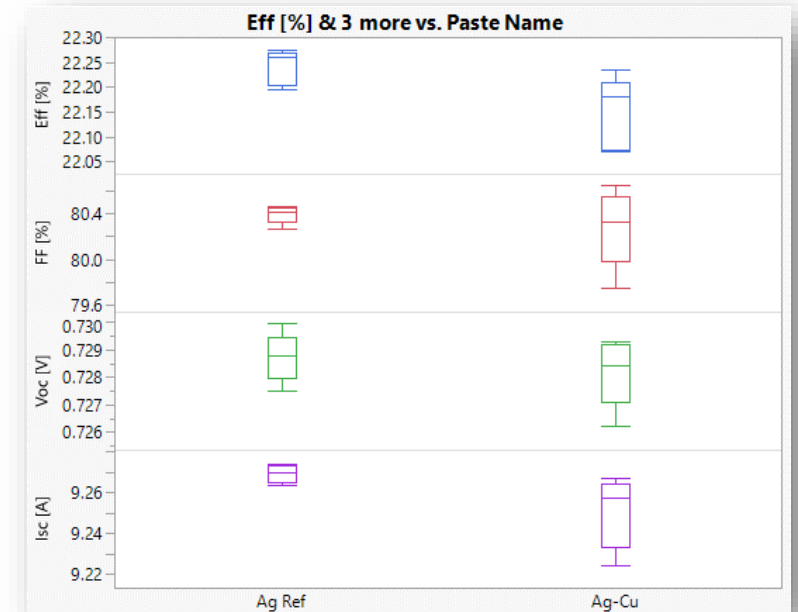


Ag



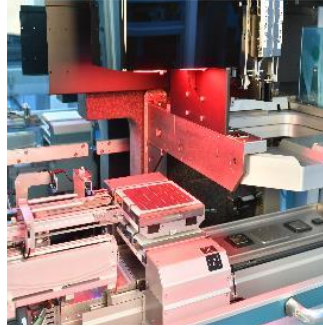
Ag-Cu

5 x best cells, M2 precursors



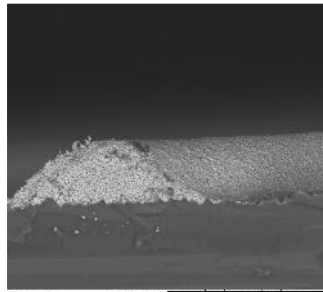
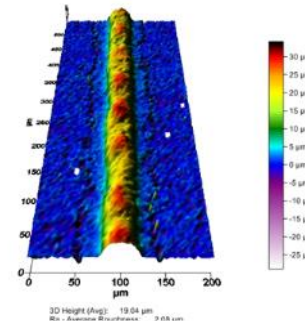
Paste Name	Eff [%]	FF [%]	Voc [V]	Isc [A]
Ag Ref	22.24	80.39	0.729	9.27
Ag-Cu	22.15	80.28	0.728	9.25

Applied Materials Innovations for PV Metallization



New Equipment
Tempo Presto™ HC

New Pastes
Low Ag, <18 mg/W



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New Process
Parallel Dispensing



APPLIED
MATERIALS®

make possible