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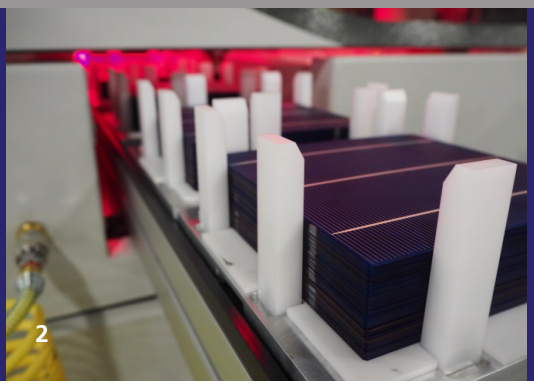
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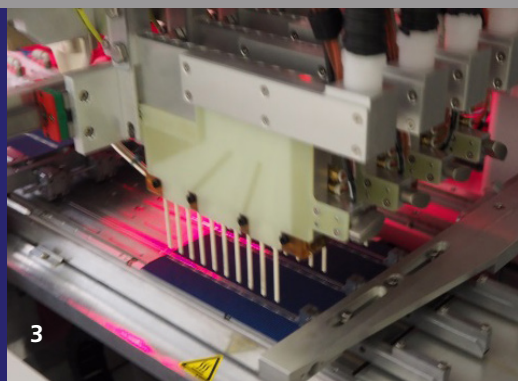
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1 *View into the stringer and its cell handling robot.*
2 *Cell trays at the feed-in conveyer.*
3 *Soldering head unit with cell and tabbed ribbons before interconnection.*

SOLAR CELL STRINGING FOR INDUSTRY AND RESEARCH APPLICATIONS

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Work Area

At Fraunhofer CSP Module Technology Center, we provide a production line for PV modules and prototyping.

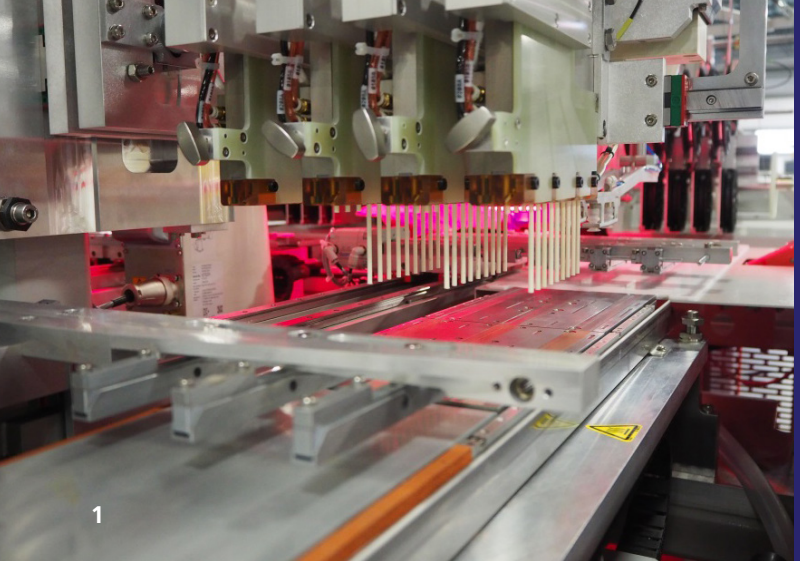
Newest equipment is a state-of-the-art full-automated tabber-stringer for cell string assembly.

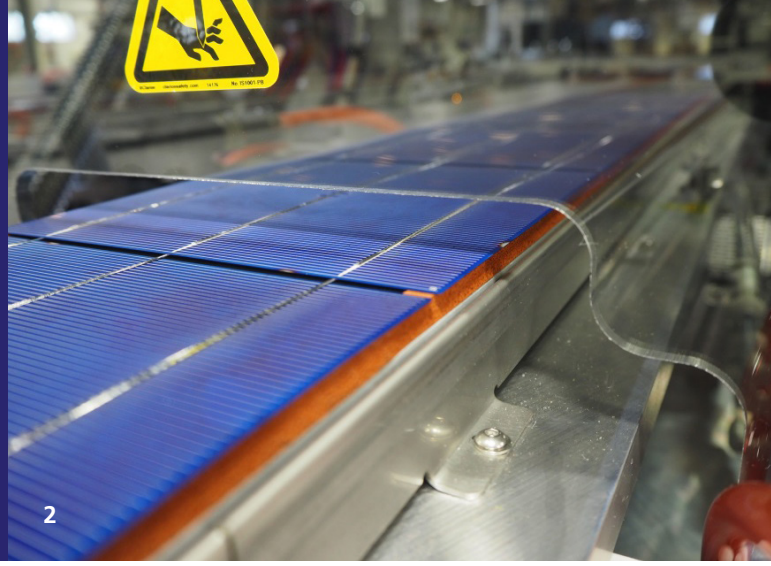
We are offering flexible cell stringing service (2-5 BB, full & half cells) at customers specifications.

With our expertise we support your solder recipe evaluation and new cell and ribbon material implementation.

Topics

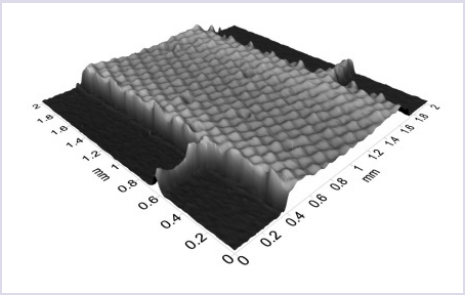
- Cell string assembly as a service at customer specificiations
- Large and small scale production volume, laboratory provision and full-time facilitation
- Evaluation and optimization of solar cell interconnection processes
- Optional offering of destructive and non-destructive testing methods, and estimation of contact quality and reliability
- Optional full module assembly at customer specifications
- Optional atypical cell string assembly for *Sondermodule*



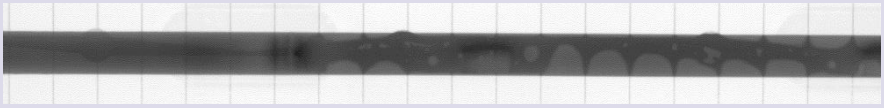


Equipment Features

- Full-automated cell stringer for industrial scale production by Xcell Automation, Inc.
- Connecting Technology: Closed Loop Induction Soldering
- Number of Busbars: 2, 3, 4, 5 BB
- Cell Technology & Types: Mono & Poly (p- & n-types), PERC, Bifacial
- Cell Shapes: Square, Pseudo Square, 45° Corner
- Solar cell sizes: full & half cells, 156 x 156 mm, 156 x 78 mm
- Cell Alignment & Inspection: Optical Inspection for quality, alignment, & accuracy
- Throughput: 1500 cells / hour
- Cell Thickness: 160 - 250 µm
- Cell Spacing (varies with cell size): 2 - 40 mm
- Interconnect Spacing: 30.0 -76.5 mm
- String Length: 78 - 2000 mm
- Cu-Ribbon Dimensions: Width: 0.8 - 2.5 mm, Thickness: 0.10 -0.25 mm
- Breakage Rate: 0.2 % (Down to 160 µm cell thickness)
- Technical Availability: 95 % (VDI 3423)



3 *Optional method to analyze cell material: 3D visualisation of the solar cell bus bar front side metallization.*



4 *Optional in-house methods to characterize solder quality: X-ray imaging of Cu ribbon busbar interface for void formation.*

Referring Publications

- Schindler, S., Mueller, M., Wiese, S.; Investigation of the undercooling of SnCu solder spheres, Electronics System-Integration Technology Conference (ESTC), 2014 , vol., no., pp.1,7, 16-18 Sept. 2014
- Sebastian Schindler, Fraunhofer CSP, Halle, & Michael Volk, SCHMID Group, Freudenstadt; Multi-busbar technology: Increased module power and higher reli-ability at lower cost; Photovoltaics International; March 2014; 23rd Edition
- Schindler, S; Schneider, J.; Pönisch, C.; Nissler, R.; Habermann, D., Soldering Process and Material Characterization of Miniaturized Contact Structures of a Newly Developed Multi Busbar Cell Metallization Concept, 28th European Photovoltaic Solar Energy Conference and Exhibition, pages: 480 - 483, 30 September - 4 October, 2013, Paris, France
- Schindler, S.; Schneider, J.; Klengel, R.; Petzold, M., The impact of material composition and process parameters on the cSi solar cell interconnection, Electronic System-Integration Technology Conference (ESTC), 2012 4th, vol., no., pp.1,6, 17

1 *View into the stringer and its induction soldering head.*

2 *Feed-out conveyer with 3BB cell string.*