



Module  
development  
and  
performance  
testing

## ■ Module development and performance testing

ISC Konstanz not only develops the latest solar cell technologies but also investigates state-of-the-art module manufacturing processes that help our customers and partners produce high-quality, efficient, and durable solar modules. We focus on simple, cost-effective production and the longest possible product lifetimes to achieve the lowest possible levelized cost of energy (LCOE). Besides our R&D activities, we also take advantage of our extensive suite of in-house characterization tools to offer a wide range of services for indoor and outdoor performance evaluation and reliability testing.



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## ■ Overview Services

### PROCESS + BOM DEDUCTION

#### New interconnection technologies:

- conductive adhesive (ECA) or solder paste
- alternative solder coatings for ribbons
- conductive backsheet
- shingling

#### Prototyping and process determination:

- interconnecting new cell types
- new module materials (front/rear sheet, encapsulation, glass coatings, etc)
- hybrid and tandem module concepts (e.g. perovskite-silicon)

#### Production support and technology transfer:

- line and machine specification
- process integration

### SPECIAL APPLICATIONS

#### Integrated PV:

- VIPV and BIPV concepts

#### Bifacial modules:

- BOM and design optimisation
- yield prediction

#### Desert modules:

- design and prototyping
- BOM selection and reliability testing

### PERFORMANCE AND RELIABILITY TESTING

#### IEC testing indoors on small-scale modules:

- damp-heat testing
- UV exposure
- temperature cycling (open-circuit or under load)
- humidity-freeze cycling
- potential-induced degradation

#### Outdoor characterization:

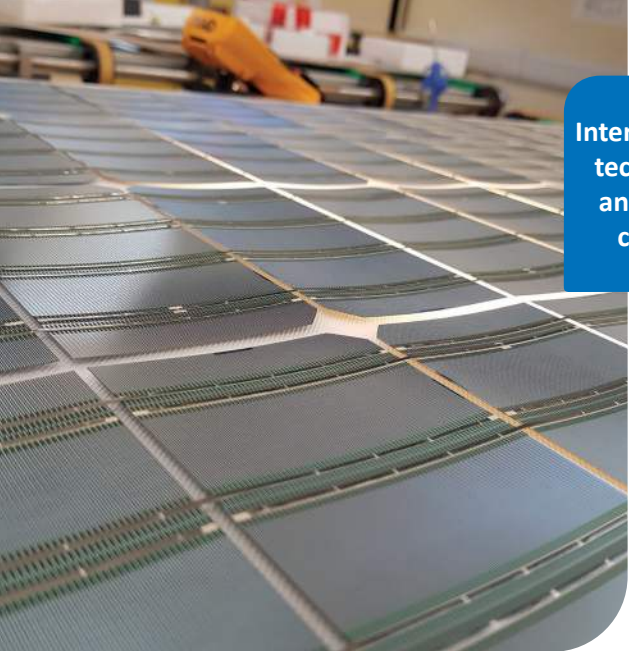
- performance measurement
- data for validation of yield simulations

#### Various indoor characterization tools:

- IV flash testing (all sizes)
- electroluminescence (EL) imaging (all sizes)
- peel testing (e.g. EVA/backsheet, ribbon/solar cell)
- shear testing of shingled joints
- contact resistance (e.g. between ECA and cell metallization)
- DSC profiling
- gel content tests
- hi-pot testing

#### Additionally for small size modules (25 x 25 cm):

- photoluminescence (PL) imaging
- spectral response (QE)
- spectrally resolved reflectance



### Interconnection technologies and module concepts

## Bifacial module technology

By capturing light from both the front and rear at the same time, bifacial modules produce more power, which leads to a drastic reduction in the overall electricity generation costs. All of our in-house developed cell concepts such as ZEBRA and TOUCAN, incorporate optically transparent rear sides and can be embedded in bifacial module architectures. ISC Konstanz develops and tests bifacial module concepts in the laboratory and quantifies their additional yield at several outdoor measurement facilities.

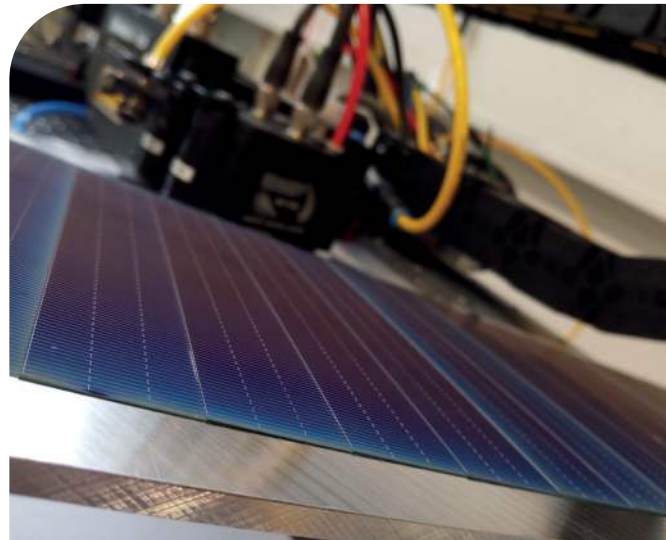


## Flexible and lightweight modules

Lightweight modules and modules with alternative architecture are of great interest in building, vehicle, and product integration. Whether thin glass or polymer-based alternatives are used depends on the operational requirements. Whether the modules are to be integrated as filigree strips or as large and curved surfaces, we are ready to work with you in developing the best and most visually-appealing product, and to help with the integration and physical connection of the PV modules into your application.

## Stringing

At ISC Konstanz, we continue to further the evolution of classic cell interconnection based on solder-coated copper wire using industrial, robotic, or manual stringing. Advanced methods for the production of back-contact solar cell strings are also available. As part of our service we provide these for your in-house evaluation of this next-generation cell technology in your own module concepts. We also conduct research into the use of lead-free electrically conductive adhesives and solder pastes to enable the production of RoHS-compliant products for current and future cell and module concepts.



## Shingling

To maximize efficiency and reliability while reducing manufacturing complexity and cost, ISC Konstanz is developing industry-relevant processes for production of shingled modules. In this design, strings are assembled without additional wires by simply overlapping the cell edges and bonding with a conductive adhesive or alternative material, significantly reducing the inactive module area.

## Conductive backsheet technology

Conductive backsheet technology is a cell interconnection process specially developed for back-contact solar cells and is characterized by low mechanical stress on the cells. Using conductive adhesive or solder paste, this technology enables the monolithic connection of even very thin ZEBRA cells on a structured copper foil. We are happy to help you integrate this technology into your manufacturing process.

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