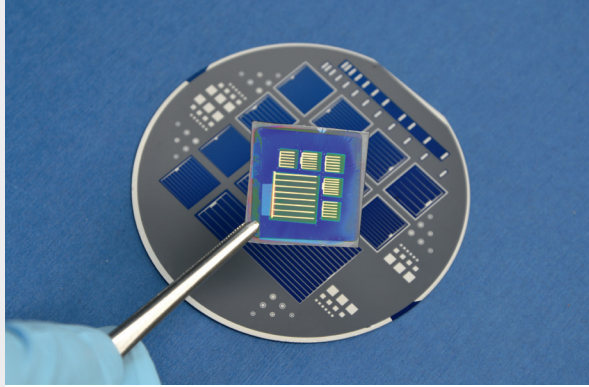


## COLLABORATION WITH INDUSTRY IN AN EARLY STAGE OF DEVELOPMENT



### PEROVSKITE SOLAR CELLS

- New “rising star” in PV research
- Impressive development since 2008
- Efficiencies over 22 % reported
- Tunable material properties
- Processing from solution or vacuum
- Thickness around 500 nm

### PEROVSKITE /SI TANDEM SOLAR CELLS

- Efficiency potential over 30 %
- 4- or 2-terminal configuration
- Scalable to large areas, modules
- Compatible with Si processing

### THIN CRYSTALLINE SILICON ON GLASS

- Wafer-like silicon quality
- Thickness of up to 60 µm
- Scalable to large areas
- Interdigitated Back Contact (IBC) cell and module technology

#### Contact HySPRINT:

Dr. Stefan Gall, Tel. +49 (0)30 8062-41330  
hysprint@helmholtz-berlin.de

# AT A GLANCE

## ENERGY MATERIAL RESEARCH WITH LARGE SCALE INFRASTRUCTURES

HZB is a research centre for energy materials research and contributes to knowledge-based solutions to great societal challenges. Research topics are thin film materials for energy conversion (Photovoltaics), energy storage with solar fuels and energy efficient future information technology.

By integrating excellent research with the operation of dedicated infrastructures – like the synchrotron radiation source BESSYII, dedicated CoreLabs and Joint Labs with universities – HZB is creating a unique research environment.

The HZB is a member of the Helmholtz Association.

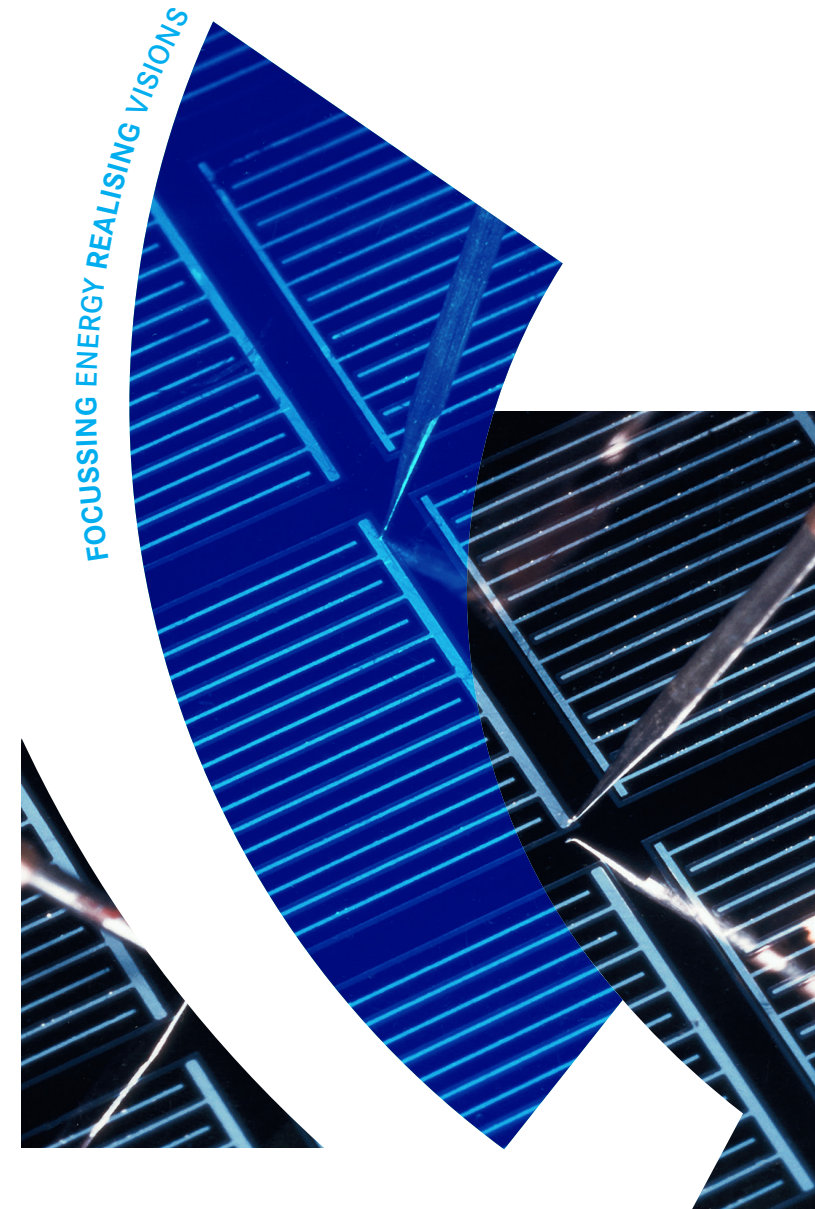


### HZB QUICK FACTS

- Approximately 1,200 staff
- Total budget amounts to approx. 146 million Euros
- About 100 PhD students candidates from neighbouring universities
- HZB is collaborating with about 400 different German and international universities, research institutes, and companies

[www.helmholtz-berlin.de](http://www.helmholtz-berlin.de)  
<http://hz-b.de/ee>

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## RENEWABLE ENERGIES

Photovoltaics and Solar Fuels

Partner for top level technology transfer projects

## RENEWABLE ENERGY RESEARCH

... focuses on thin film technology suitable for photovoltaics and solar fuel production. The goal is to design novel material systems for optimal functionality as well as to develop devices in collaboration with industry. For this we strengthen our activities in synthesis and advanced analytics.

We use the research facilities (CoreLabs):

### PVcomB

Competence Centre  
for Photovoltaics  
Berlin

### HySPRINT

Hybrid Silicon Perovskite  
Research, Integration &  
Novel Technologies

### CCMS

Correlative Microscopy  
and Spectroscopy

### X-Ray

Various X-Ray  
diffraction sources

### EMIL

Energy Materials  
In-situ Laboratory  
Berlin at BESSYII

In EMIL a large variety of deposition instruments are connected to analytics with light from BESSY II via a fully automatised UHV-transfer backbone.

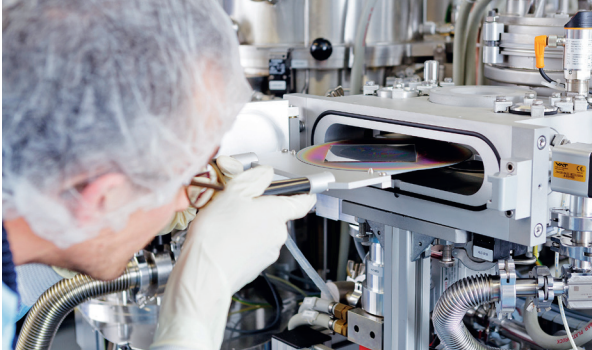


## CONTACT HZB

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und Energie GmbH (HZB)

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Solar Fuels: Prof. Dr. Roel van de Krol  
Tel.: +49 (0)30 8062-43035



The goal of HZB photovoltaic research is to increase the conversion efficiency and operating life of solar cells and to design and develop more cost-effective and sustainable production processes.

## PHOTOVOLTAICS

PV Research at HZB is focused on:

- Thin-film technologies
- Three-dimensional nano- and micro designs for light harvesting
- Solar cell and module prototypes

The research portfolio addresses the full value chain from materials development, device design and prototyping with industrial partners. Sophisticated analytics, simulation and modelling creates an in-depth understanding along this chain.

The materials base comprises:

- Silicon-Heterojunctions and silicon on glass
- Inorganic compound semiconductors
- Organic / inorganic hybrid structures
- Perovskites
- Novel contact materials

## SOLAR FUELS

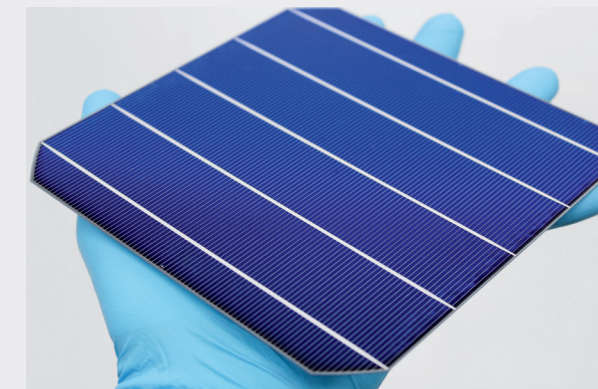
The direct conversion of water and carbon dioxide (CO<sub>2</sub>) into chemical fuels with sunlight represents an exciting new pathway for the combined conversion and storage of solar energy. Solar fuels offer a solution for the intermittent nature of sunlight and are compatible with today's energy infrastructure.

Solar fuels research at HZB focuses on:

- Photo-electrochemical water splitting to produce hydrogen (H<sub>2</sub>)
- Development of novel light absorbers and catalysts
- Integration of light absorbers and catalysts into devices

Solar fuels technologies are still in an early stage of research. Long-term stability, efficiency and cost are among the main challenges to be addressed. The aim is to develop device prototypes that show potential for scale-up.

## TECHNOLOGY TRANSFER FOR PHOTOVOLTAICS



### R&D TOPICS ARE

- High-η Heterojunction technology (HJT) Si solar cells (wafer-based)
- CIGS solar cells & modules
- TF silicon solar cells & modules (a-Si, micromorph, ...)
- High-η tandem cell concepts, using Perovskite top cells
- Functional layers for PV devices
- Module technology and BIPV

### PROCESSES IN PILOT-LINES

- Full 6" (15.6 cm) wafer based HJT Si cell
- Two dedicated pilot-lines for research on 30x30 cm<sup>2</sup> PV modules (CIGS & TF silicon)
- State of the art and advanced analytics of layers, processes and devices and specialised outdoor test facility

### YOUR PARTNER FOR

- Development of cell concepts, manufacturing technologies and functional layers
- Analytical services
- Education and Training and consultancy

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