

## Registration

### Workshop "Impact of mechanical and thermal loads on the long term stability of PV modules"

on 05<sup>th</sup> November 2013

by Fax: +49 5151 999 400

Degree, last name, first name

Institute/company

Department

Phone

Fax

e-mail

Internet

Street address

Postal code

City

I take part: (please tick the appropriate boxes)

- Workshop on 05<sup>th</sup> November 2013

☐ Yes ☐ No

- Guided tour through ISFH

☐ Yes ☐ No

Date

Stamp/Signature

## Contact

Institute for Solar Energy Research Hamelin (ISFH)  
Am Ohrberg 1, 31860 Emmerthal

[www.isfh.de](http://www.isfh.de)

### Questions concerning organisation:

For general questions, questions concerning registration and hotel booking please contact:

Sabine Kreber, Phone +49 5151 999 100 or e-mail  
[kreber@isfh.de](mailto:kreber@isfh.de)

### Questions concerning the workshop:

For questions concerning the program please contact:

[mikroworkshop@isfh.de](mailto:mikroworkshop@isfh.de)



## Workshop

### Impact of mechanical and thermal loads on the long term stability of PV modules

5<sup>th</sup> November 2013

08:30 - 17:00

Institute for Solar Energy Research Hamelin  
Am Ohrberg 1, 31860 Emmerthal



An-Institut der



## Invitation

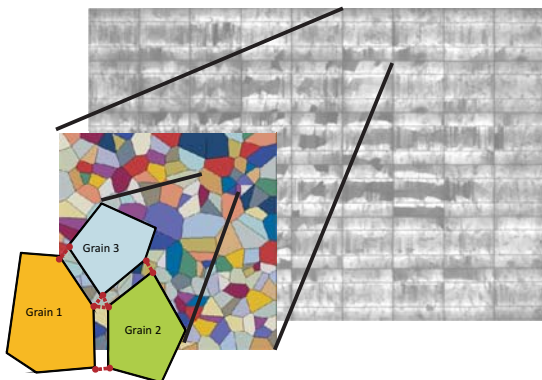
### Workshop „Impact of mechanical and thermal loads on the long term stability of PV modules“ 05<sup>th</sup> November 2013, 08:30 – 17:00

At peak periods, the installed photovoltaic modules already contribute up to 30 % to the generated electrical power in Germany. Increased module efficiencies as well as reduction of costs of the module fabrication have resulted in net parity in electricity production cost of crystalline silicon photovoltaics. New photovoltaic modules have warranties of at least 80 % of the declared power after 20 years of installation. It is well known that thermal and mechanical loads can reduce the power of photovoltaic modules and the impact of such loads has already been investigated. However, in many cases the exact origins of the power degradation are still poorly understood. In order to reduce their impact and to increase the long term stability of the photovoltaic modules, it is important to identify the origins of the before mentioned power degradation.

The “Federal Ministry of Education and Research” is funding a joint project “MIKRO” between the Institute for Solar Energy Research Hamelin (ISFH) and the Institute of Structural Analysis (ISD) at the Gottfried Wilhelm Leibniz Universität Hannover. This project investigates the origins and impact of micro-cracks on the long term stability of photovoltaic modules. Within this project we host a workshop at ISFH entitled “Impact of mechanical and thermal loads on the long term stability of PV modules” where invited speakers from research and equipment manufacturers give an overview of their current work on measurements and models for photovoltaics.

We invite you to join the workshop and are looking forward to a lively exchange of ideas and experiences.

Felix Haase  
(Project coordinator MIKRO)



## Program on 05<sup>th</sup> November 2013

- 08:30 Welcome of participants**
- 08:40 Modelling of cracking in PV modules: Physical aspects and computational methods**  
*Prof. Dr. M. Paggi, Politecnico di Torino, Torino*
- 09:10 Damage features in polycrystalline quasi-brittle Materials: Application to silicon wafers**  
*Dr. J. Reinoso, ISD Universität Hannover, Hannover*
- 09:40 Interpretation of cell fracture in PV modules by superposition of mechanical and thermo-mechanical stresses**  
*M. Sc. M. Eng. S. Dietrich, Fraunhofer CSP, Halle*
- 10:10 Coffee break**
- 10:40 Analysis of laminated glass structures for photovoltaic applications**  
*Prof. Dr.-Ing. H. Altenbach, IFME, Universität Magdeburg, Magdeburg*
- 11:10 Recent developments in cohesive zone methods for the simulation of fracture in quasi-brittle materials**  
*Dr. ir. J.J.C. Remmers, TU-Eindhoven, Eindhoven*
- 11:40 Overall mechanical properties of polysilicon films: homogenization vs Monte Carlo simulations**  
*Prof. Dr. S. Mariani, Politecnico Milano, Milano*
- 12:10 Lunch**
- 13:00 Crack investigation of encapsulated solar cells under thermal and mechanical stresses**  
*Dr. M. Sander, Fraunhofer CSP, Halle*
- 13:30 Mechanisms leading to electrically isolated cell parts and power loss under mechanical loads**  
*Dr. F. Haase, ISFH, Emmerthal*
- 14:00 Poster session and coffee break**
- 14:45 Residual stress measurement in solar cells**  
*Dr. T. Schönbeck, Panalytical, Kassel*
- 15:15 Advanced EL inspection with predictive estimation of module power loss**  
*Dipl.-Ing. R. Schmidt, Pi4, Schwarzenbruck*
- 15:45 Guided tours through ISFH**
- 17:00 End of guided tours**

## General notes

### Registration:

Please only use the overleaf form. The number of participants is limited. (Deadline: 22<sup>nd</sup> October 2013).

### Services:

Proceedings, coffee break and lunch, guided tour through ISFH

### Attendance fee:

The attendance fee is 60 Euro. Please transfer the fee only after receiving the invoice. The invoice serves also as confirmation of participation for you.

### Venue:

Institute for Solar Energy Research Hamelin, large lecture room, Am Ohrberg 1, 31860 Emmerthal, Phone +49 5151 999 100

### Transport connections:

- **Train** Approach by train to Hamelin station. From there take the bus line 40 or 520 to station Ohrbergpark or by taxi (about 10 min) to ISFH in Ohr.
- **Plane** By train „S5“ from the airport Hannover to Hamelin (about 60 min). From there take the bus line 40 or 520 to station Ohrbergpark or by taxi (about 10 min) to ISFH in Ohr.

### Accommodations:

- Hotel Stadt Hameln, Münsterwall 2, 31787 Hameln  
Phone +49 5151 9 01 0, Fax +49 5151 9 01 3 33  
[www.hotel-stadthameln.de/](http://www.hotel-stadthameln.de/)
- Hotel Christinenhof, Alte Marktstrasse 18, 31785 Hameln  
Phone +49 5151 9 50 80, Fax +49 5151 4 36 11  
[www.christinenhof.de/](http://www.christinenhof.de/)
- Hotel Zur Post, Am Posthof 6, 31785 Hameln  
Phone +49 5151 7630, Fax +49 5151 7641  
[www.hotel-zur-post-hameln.de/](http://www.hotel-zur-post-hameln.de/)
- Hotel Birkenhof, Hugenottenstraße 1-1a, 31785 Hameln  
Phone +49 5151 9 56 26 0, Fax +49 5151 9 56 26 23  
[www.hotel-birkenhof-hameln.de/](http://www.hotel-birkenhof-hameln.de/)
- **Further accommodations** see Hamelin Marketing und Tourismus GmbH, Tourist-Information, Deisterallee 1, 31785 Hameln  
Phone +49 5151 95 78 23, Fax +49 5151 95 78 40  
[www.hameln.de/tourismus/hmt/kontakt.htm](http://www.hameln.de/tourismus/hmt/kontakt.htm)

### Cancellation:

Till seven days before the workshop you can cancel the registration free of charge. If you cancel later, the full fee has to be paid. Of course you can announce an alternate participant. Please inform us about such a change in time before the workshop.