

32nd Workshop on Crystalline Silicon Solar Cells & Modules: Materials and Processes



July 27th – July 30th, 2025

Breckenridge, Colorado

Sponsorship from:

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NATIONAL RENEWABLE ENERGY LABORATORY

32nd Workshop on Crystalline Silicon Solar Cells & Modules: Materials and Processes

Sunday, July 27th

8:00 – 9:00 am Registration & Breakfast

9:00 – 9:30 am **Workshop Welcome and Introduction**
Ron Sinton (Sinton Instruments)

Session 1: Characterization of Solar Cells, Modules, and Arrays

Session Chair: **Steve Johnston** (NREL)

9:30 – 10:00 am **Thorsten Trupke** (UNSW / Lab 360 Solar) – Drone Inspection of PV arrays

10:00 – 10:30 am **Adrienne Blum Karpen** (Sinton Instruments) – Accurate determination of key parameters for high-efficiency silicon solar cells

10:30 – 11:00 am Break

11:00 – 11:30 am **Max Liggett** (University of Central Florida) – Gaining Fundamental Understanding of Critical Failure Modes and Degradation Mechanisms in Fielded Photovoltaic Modules via Multiscale Characterization

11:30 – 12:00 pm **Greg Horner** (Tau Science) – Optically pumped imaging of cells and modules

12:00 – 1:30 pm Lunch

Session 2: The Potential for Perovskite on Silicon Solar Cells

Session Chair: **Tonio Buonassisi** (MIT)

1:30 – 2:00 pm **Stefaan de Wolf** (KAUST) – Progress towards stable and efficient perovskite/silicon tandem photovoltaics (*Remote Presentation*)

2:00 – 2:30 pm **Kai Zhu** (NREL) – Perspective on perovskite PV field (with focus on tandems)

2:30 – 3:00 pm Break

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3:00 – 3:30 pm	Michael Deceglie (NREL) – Room for improvement in perovskite modules, tests, and models
3:30 – 4:00 pm	Florent Sahli (CSEM) – An overview of CSEM and EPFL PVlab research activities on 2T, 3T and 4T perovskite/silicon solar cells
4:00 – 4:30 pm	Break

Session 3: Industrial Challenges in the US

Session Chair: **Greg Wilson** (JERA Americas)

4:30 – 5:00 pm	Markus Beck (former DOE Program Manager) – Opportunities and challenges establishing a domestic c-Si PV manufacturing ecosystem
5:00 – 5:30 pm	Fereshteh (Feri) Farzad (Hanwha Qcells) – Building a Robust and Sustainable Vertical U.S. PV Supply Chain: From Ingot to Module Manufacturing
6:30 – 8:00 pm	Welcome Reception with Dinner

Monday, July 28th

7:00 – 8:00 am	Breakfast
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Session 4: Scaling Silicon PV Production Towards the TW/year

Session Chair: **Ajeet Rohatgi** (Georgia Tech. University)

8:00 – 8:30 am	Yifeng Chen (Trina Solar) – Recent Progress in High Efficiency Silicon Cells and Modules and Sustainable Development of Photovoltaic Industry (<i>Remote Presentation</i>)
8:30 – 9:00 am	Mike Woodhouse (NREL) – Cost of PV around the world
9:00 – 9:30 am	Break
9:30 – 10:00 am	Eric Schneller (Silfab Solar)
10:00 – 10:30 am	Pirmin Preis (ISC - Konstanz) – Challenges and chances of GW solar cell manufacturing ramp up outside of China

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10:30 – 11:00 Group Discussion

Session 5: *Poly-Silicon Production, Cz-Si Crystal Growth, and Scaling Si PV*

Session Chair: **Erich Dornberger** (Wacker)

11:00 – 11:30 pm **Dennis Seibert** (PVA TePla) – Crystal Growth for PV Applications – Current Challenges & Developments

11:30 – 12:00 pm **Ugur Kaya** (RCT Solutions) – Ingot and wafer production outside China (*presented by Markus Beck of RCT Solutions*)

12:00 – 1:30 pm Lunch

Free Afternoon to Enjoy Local Activities

6:30 – 8:30 pm **Poster Session and Reception**
Sponsored by Sinton Instruments

Tuesday, July 29th

7:00 – 8:00 am Breakfast

Session 6: *High-Efficiency Cell Development*

Session Chair: **Rolf Brendel** (ISFH)

8:00 – 8:30 am **Armin Richter** (Fraunhofer-ISE) – Trends in high efficiency silicon solar cell research and development

8:30 – 9:00 am **Ajeet Rohatgi** (Georgia Tech University) – Successful Implementation of LECO to Achieve 21.5% PERC and 24% TOPCon Cells With Screen-Printed Cu Contacts

9:00 – 9:30 am Break

9:30 – 10:00 am **Udo Romer** (ISFH) – Laser ablation for POLO² IBC solar cells

10:00 – 10:30 am **Lachlan Black** (ANU) – Highly effective passivation and contact stacks based on chlorinated metal oxides

10:30 – 11:00 am Break

Session 7: *Research Needs Up/Down the Silicon Value Chain*

Session Chair: **Paul Stradins** (NREL)

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| 11:00 – 12:00 pm | Panel Discussion <ul style="list-style-type: none">• Brenden Frazier (Solx)• Jim Wood (SEG Solar)• Noritaka Usami (Nagoya University)• Ashling Leilaieoun (Amazon) |
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12:00 – 1:30 pm	Lunch
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Session 8: *Materials Research Advances for Si PV and Beyond*

Session Chair: **Sumit Agarwal** (Colorado School of Mines)

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| 1:30 – 2:00 pm | Bart Macco (TU Eindhoven) – (Spatial) ALD of ZnO:Al passivating contacts |
| 2:00 – 2:30 pm | Shohei Fukaya (Nagoya University) – Dopant-Free Si Solar Cells with Double-Sided TiO _x : Insights into Passivation Mechanisms via X-ray Photoelectron Spectroscopy |

Session 9: *Open Questions*

Session Chair: **Ron Sinton** (Sinton Instruments)

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| 2:30 – 3:30 pm | Group Discussion |
| 3:30 – 4:00 pm | Break |

Session 10: *Degradation and Reliability*

Session Chair: **Peter Hacke** (NREL)

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| 4:00 – 4:30 pm | Michael Martinez-Szewczyk (ASU) - Under the Sun: How Chemistry and Structure Shape Long - Term Degradation Pathways in Silicon Modules |
| 4:30 – 5:00 pm | Elizabeth Palmiotti (NREL) - Spontaneous Glass Breakage in Glass-Glass Modules - Glass Physics |

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5:00 – 5:30 pm	Gergely Zimanyi (University of California - Davis) - Molecular dynamic modeling of SHJ and TOPCon cells revealing optimal [H] and degradation/recovery modes
5:30 – 6:30 pm	Break
6:30 – 8:30 pm	Poster Session and Reception Sponsored by NREL

Wednesday, July 30th

7:00 – 8:00 am	Breakfast
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Session 11: *Innovations in PV*

Session Chair: **Armin Richter** (Fraunhofer ISE)

8:00 – 8:30 am	Tonio Buonassisi (MIT) – Accelerating Information Gain during Perovskite Materials Optimization, Device Fabrication, and Stress Testing: Learnings from the ADDEPT Center
8:30 – 9:00 am	Dirk Steyn (NREL) – Nanopinhole contacts as an alternative to TOPCon

Session 12: *Metallization in Cells and Modules*

Session Chair: **Thien Truong** (NREL)

9:00 – 9:30 am	Stefan Lange (Fraunhofer Center for Si PV) – A Microscopic Look at the Working Principle of LECO: From PERC to TOPCon Solar Cells
9:30 – 10:00 am	Li Wang (UNSW) – Ultra-lean Silver Screen Printing
10:00 – 10:30 am	Break
10:30 – 11:00 am	Bryan Mazor (Source Energy Company) – Silicon PV Arrays for space applications
11:00 – 11:30 am	Peter Hacke (NREL) – Cell interconnect/metal reliability project work on cell metallization failure

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Session 13: *Discussion & Wrap-up: Conclusions and Open Questions from the Workshop*

11:30 – 12:00 pm Summary and Q&A
David Young (NREL)

12:00 pm ***Workshop Adjourns***