Capabilities of the Next Generation Photovoltaics Center (NGPV)

Kurt L. Barth: Next Generation PV Center , Colorado State University site, Fort Collins, CO, 80523-1320, (Kurt.barth@engr.colostate.edu)

NGPV: Industry University Collaborative Research Center (I/UCRC)

NSF supported, **industry driven** research center

- Pre-competitive research: shared value
- Stakeholders: Large and small companies, national Labs, state and government agencies, universities
- 76 active centers, 1239 Industry Members
- Successful model developed and optimize over **40 years.**

Dues paying members of NGPV

MicroLink Devices, 5N PLUS, Air Force Research Laboratory, First Solar, Statoil, Younicos (Let the fossils rest in peace.), NPS (Praestantia per scientiam), Ideal Power, EPRI Electric Power Research Institute, UES, NovaCentrix, A.N.D. Inc., MBI, Big Solar, Lucelo Technologies, Sandia National Laboratories, ChimeraTek Design Corporation, Molecular Imprints, NEXT, EMD, IonEdge Corporation

Academic Partners

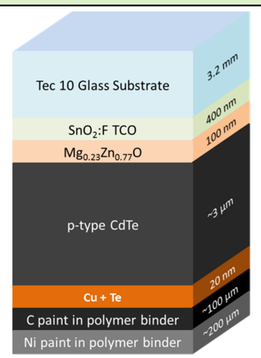
- CSU Founding member of NGPV in 2009, (active research program in PV since 1991)
- NGPV Grown: 4 US and 3 International universities, NREL, Sandia, DOE

Colorado State University, The University of Texas at Austin, Texas A&M University, Texas A&M University Central Texas

General Capabilities / Expertise of NGPV Center

- Thin Film, Emerging and Silicon PV
- Big Data Solar Research
- Module Architecture and Reliability
- BOS and Implementation
- Educational and Societal Impact of PV
- PV Economic Case Analysis
- PV Systems Engineering

18.3% device structure (certified by Newport)

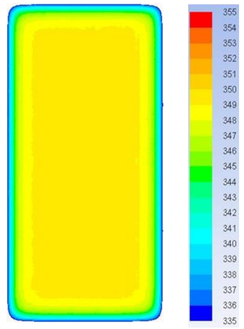


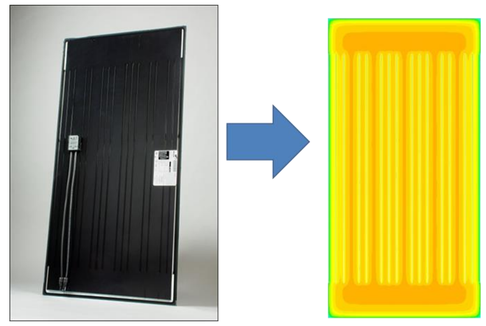
Sample and Device Fabrication

- Automated fabrication of 18%+ CdTe devices
- Multiple II-VI structure films and structures
- Proto line deposition and laser scribing capabilities for 42 x 42 cm substrates

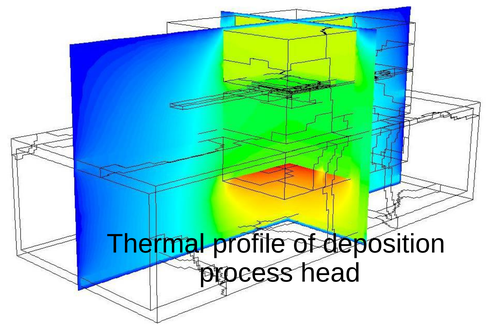
Numerical Simulation

Computational simulation of modules and module **manufacturing processes**





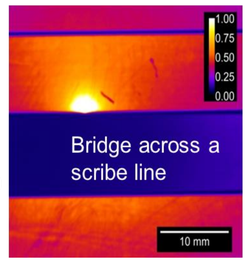
- Current ongoing funded NSF program: high fidelity simulation for solar and high tech industries
- Models incorporate >100 million elements
- Opportunities for a broad mix of physics: thermal, mechanical / stress, flux, gas and moisture transmission

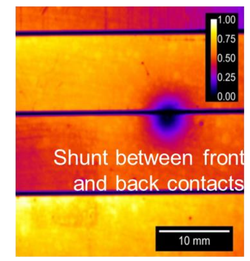


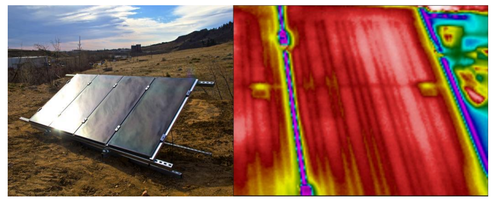
Thermal profile of deposition process head

Advanced Characterization

- IR thermography
- EL (size: scribe to module)
- Device light soaking with controlled temp
- Atomic res. TEM, SEM, XPS, EDS







New Module Architecture: 50 yr. Life Design

- **~1.0-1.5 cents/W reduced materials cost**
- ~15% of cap ex of lamination
- Extreme robustness to moisture, UV
- Process cycle time for each step <30 s
- 20x smaller tool footprint

Polymer with desiccant, adhesion to front glass is optimized to provide retention on breakage. Desiccant protects from moisture ingress from edge or back box