Low-Cost PV Substrate Maturation (23NA-I-017)

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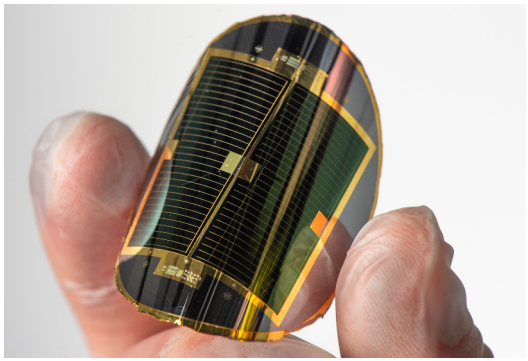
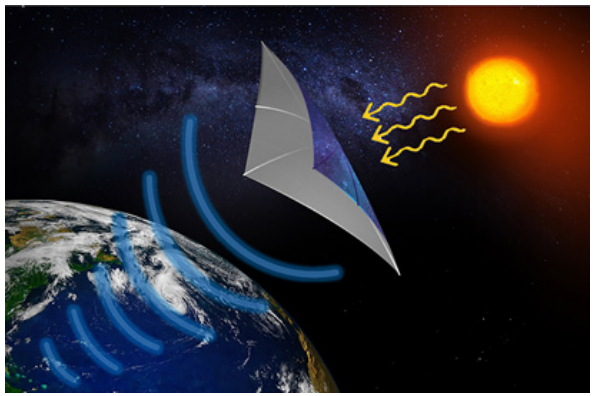


Flexible, lightweight solar cell with substrate removed



Reusable substrates enable low-mass PV for large-scale space installations at one-tenth the cost

The What

High-efficiency (>30%), low-cost, low-mass photovoltaic (PV) devices are a key enabler for current and future capabilities

Technology Improvements:

- Substrates represent >90% of the PV mass and ~30% of the cost, but are not needed in the final product
- This work identified and helped mature promising substrate technologies
- Success criteria involved ability to exfoliate a device quickly and easily without damaging the device and the ability to potentially achieve high-throughput and low cost at scale

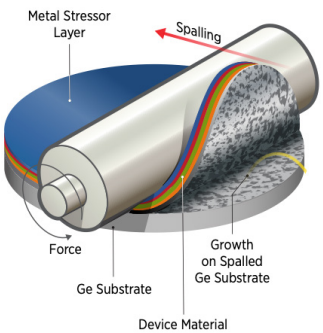
The Why

Reduction of PV cost from ~$150/W to <$30/W, with pathway to <$1/W. Reduction enables widespread use of PV for DOD missions. >$180M in savings for each 1.5 MW Solar Power Satellite, 2.9MKg/yr CO2 savings for each FOB.

Decreases dependence on foreign supplies of semiconductor substrates.

Controlled Ge spalling

Partner: Colorado School of Mines
(PI: Dr. Corinne Packard)

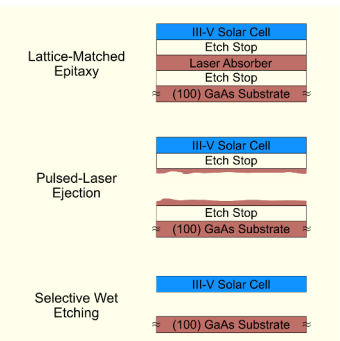


Pros
Low-cost processing
High throughput
Parity devices
No surface repreparation
Compatible with standard 3J space cells

Cons
Small regions of surface morphology
Needs equipment design/understanding

Laser ablation liftoff

Partner: Stanford University
(PI: Dr. Bruce Clemens)

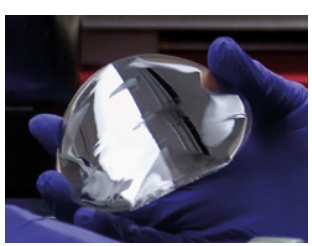


Pros
Low-cost processing
High throughput

Cons
No device demo
Insoluble etch products?
Needs liftoff area scaling

Acoustic GaAs spalling

Developer: Crystal Sonic



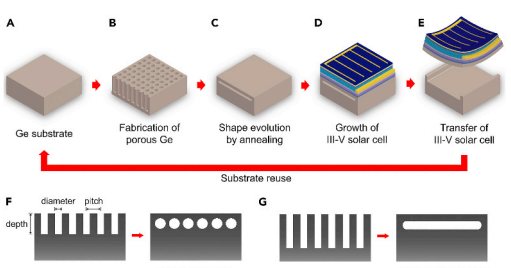
https://compoundsemiconductor.net/article/117366/A_sound_approach_to_cutting_costs

Pros
Low-cost processing
High throughput
Parity devices

Cons
Large regions of surface morphology
Needs equipment design/understanding

Porous Ge

Developer: Université de Sherbrooke



Pros
Low-cost processing

Cons
Needs parity device demonstration

Development of promising substrate reuse technologies continuing
This project will mature the most promising reuse technologies based on the promise for low-cost, high-throughput production and transition to industry.

This work was authored in part by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the Office of the Under Secretary of Defense Acquisition and Sustainment. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.

Department of Defense's (DoD) Energy and Environment Innovation Symposium
Arlington, VA
Nov 28 – Dec 1, 2023
NREL/PO-5900-88066