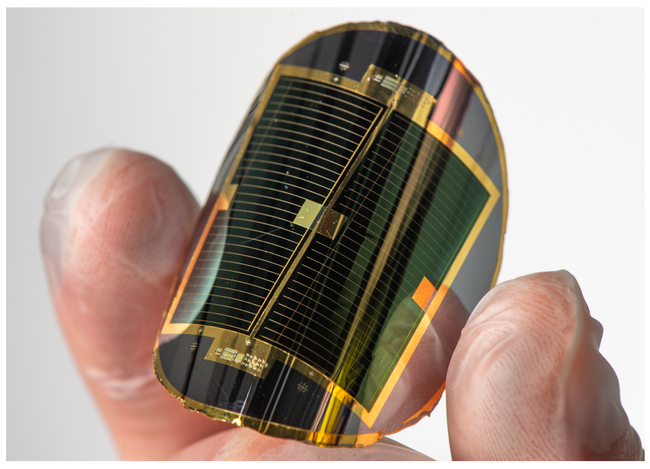
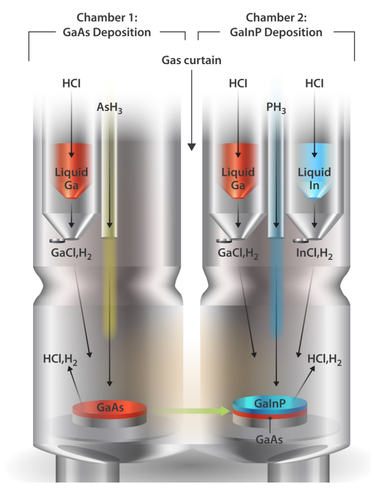
Reducing Cost and Speeding Manufacture of Top-Performing Solar Cells

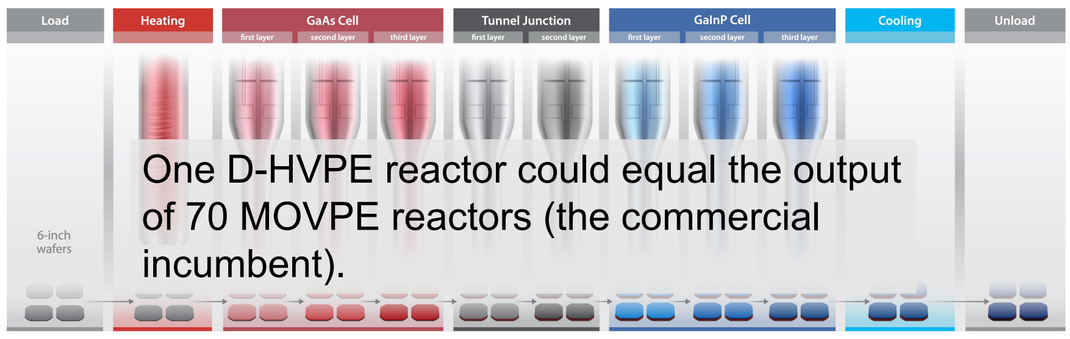
D-HVPE Growth



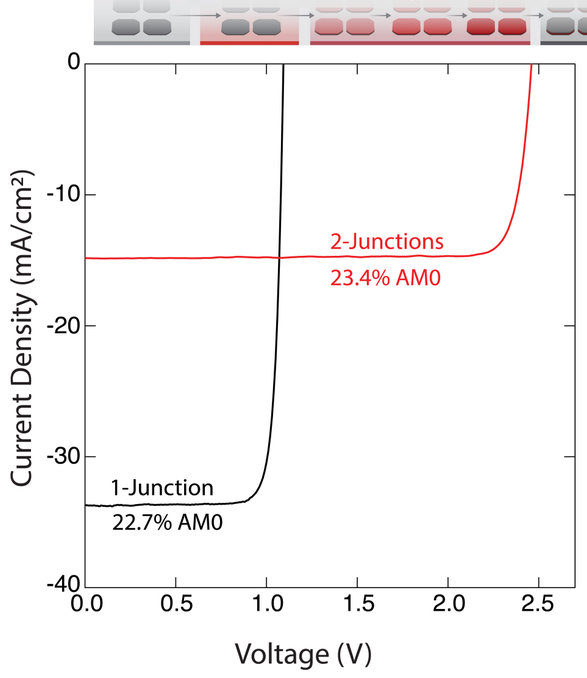


These lightweight, flexible solar cells (left) were grown using NREL's dynamic hydride vapor phase epitaxy (D-HVPE) process. Example of growth reactor (right).

- NREL is developing a new way of growing III-V solar cells that reduces their cost and increases manufacturing volumes by 10x or more. D-HVPE offers:
  - High deposition rates,
  - In-line tool design (like an assembly line),
  - Low-cost input materials.

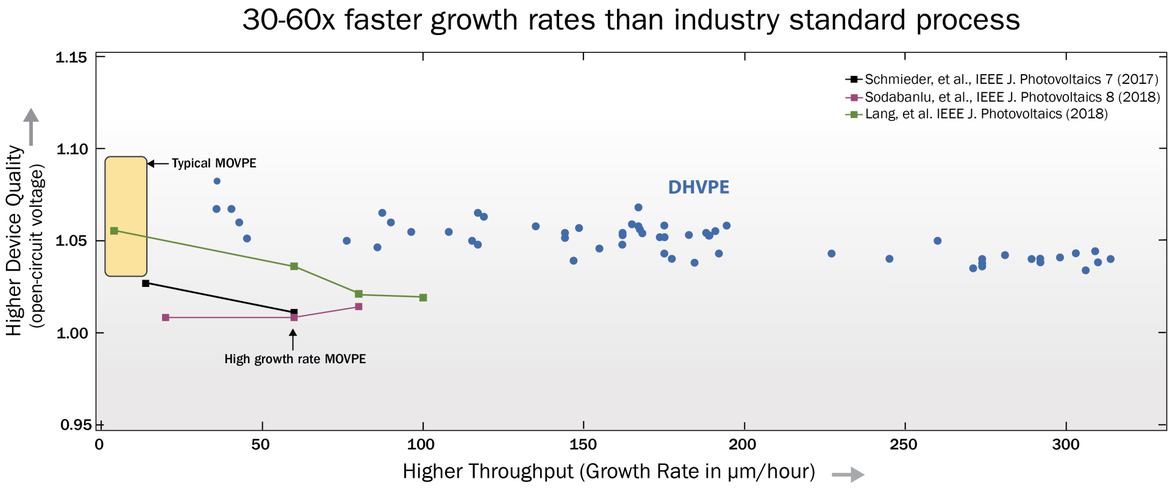


One D-HVPE reactor could equal the output of 70 MOVPE reactors (the commercial incumbent).



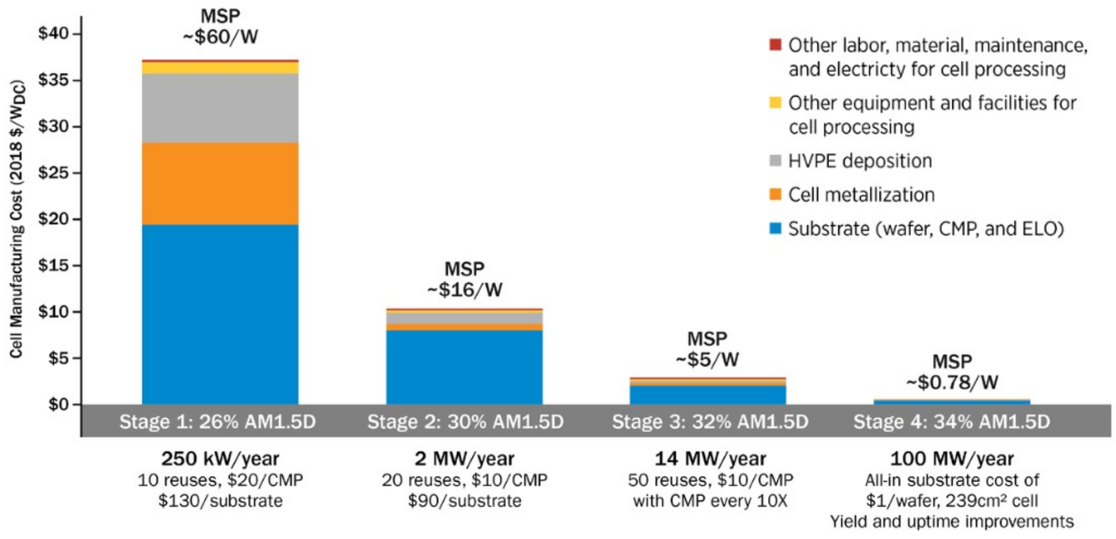
- Performance on par with devices grown by MOVPE

30-60x faster growth rates than industry standard process

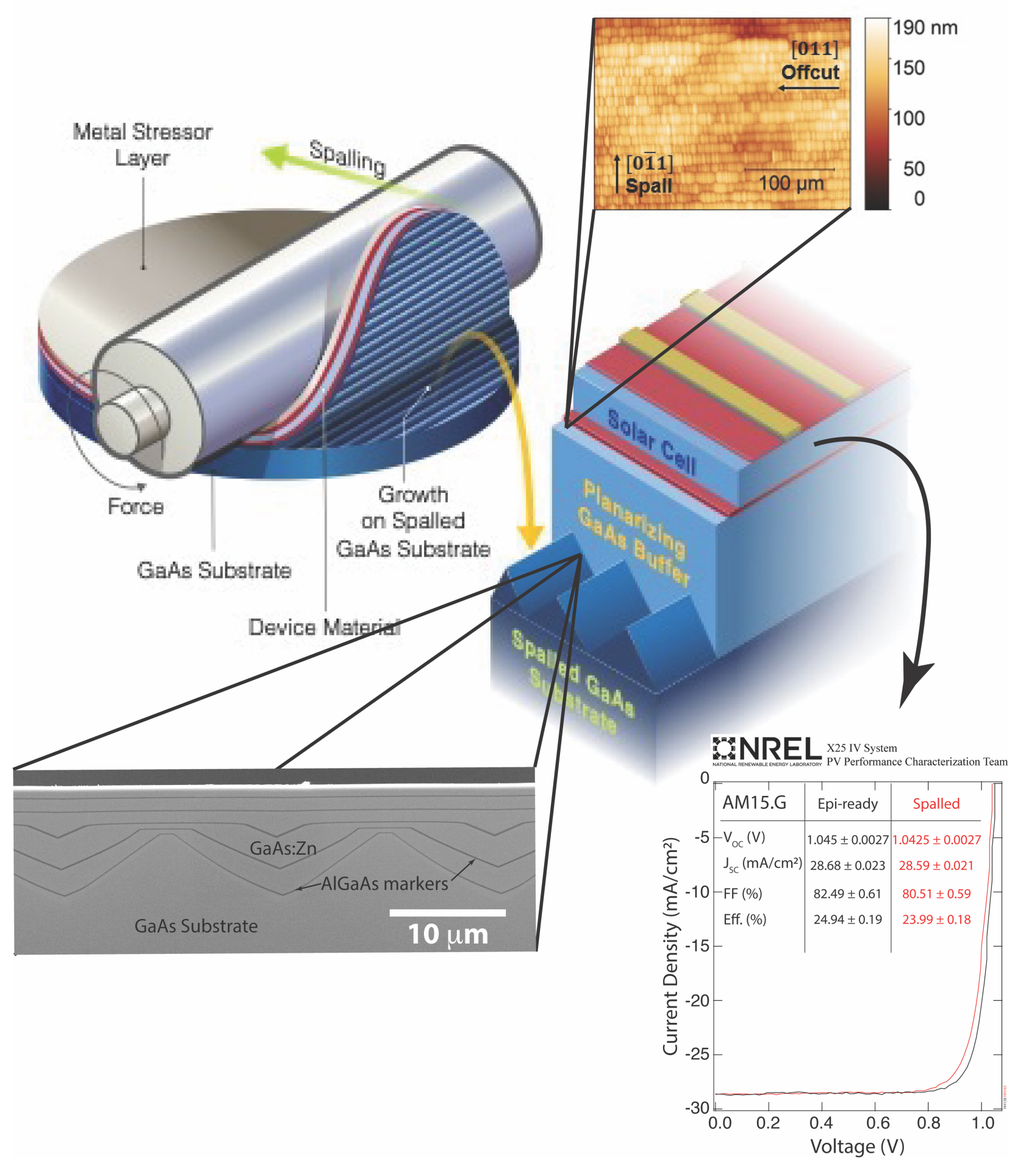


Substrate reuse

- NREL's parallel collaborative research on substrate reuse will also contribute to much lower costs for III-V solar cells.



NREL technoeconomic modeling suggests that the D-HVPE process and substrate reuse could together drive down costs of III-V solar cells by more than 75x at full commercial scale.



- Able to produce cell on reused spalled wafers after planarization with HVPE with equivalent performance to epi-ready substrates.

- Boyer et al. Prog Photovolt Res Appl. 2023;31:230–236.
- Schulte et al. Joule 2023 Under review
- Bringing down the cost of III-V Epitaxy, Compound Semiconductors, 2022 (https://compoundsemiconductor.net/article/115632/Bringing_down_the_cost_of_III-V_epitaxy)
- Braun et al. Joule 2023, In progress.

Flexible, Low-Mass, High-Specific-Power Solar Cells at One-Tenth the Cost to Enable New Missions

