

# Durability of Thermally Cycled ELO Solar Cells

## MicroLink Devices, Inc.

### MicroLink Background

- Established in 2000
  - ISO 9001 certified manufacturer
  - Revenue is a mix of commercial and government contracts
  - Profitable, positive cash flow
- Technology leader
  - Core competence is MOCVD growth
  - InGaP HBT structures for wireless communications
  - GaAs and InP-based solar cells
  - Epitaxial liftoff process for solar cell manufacturing

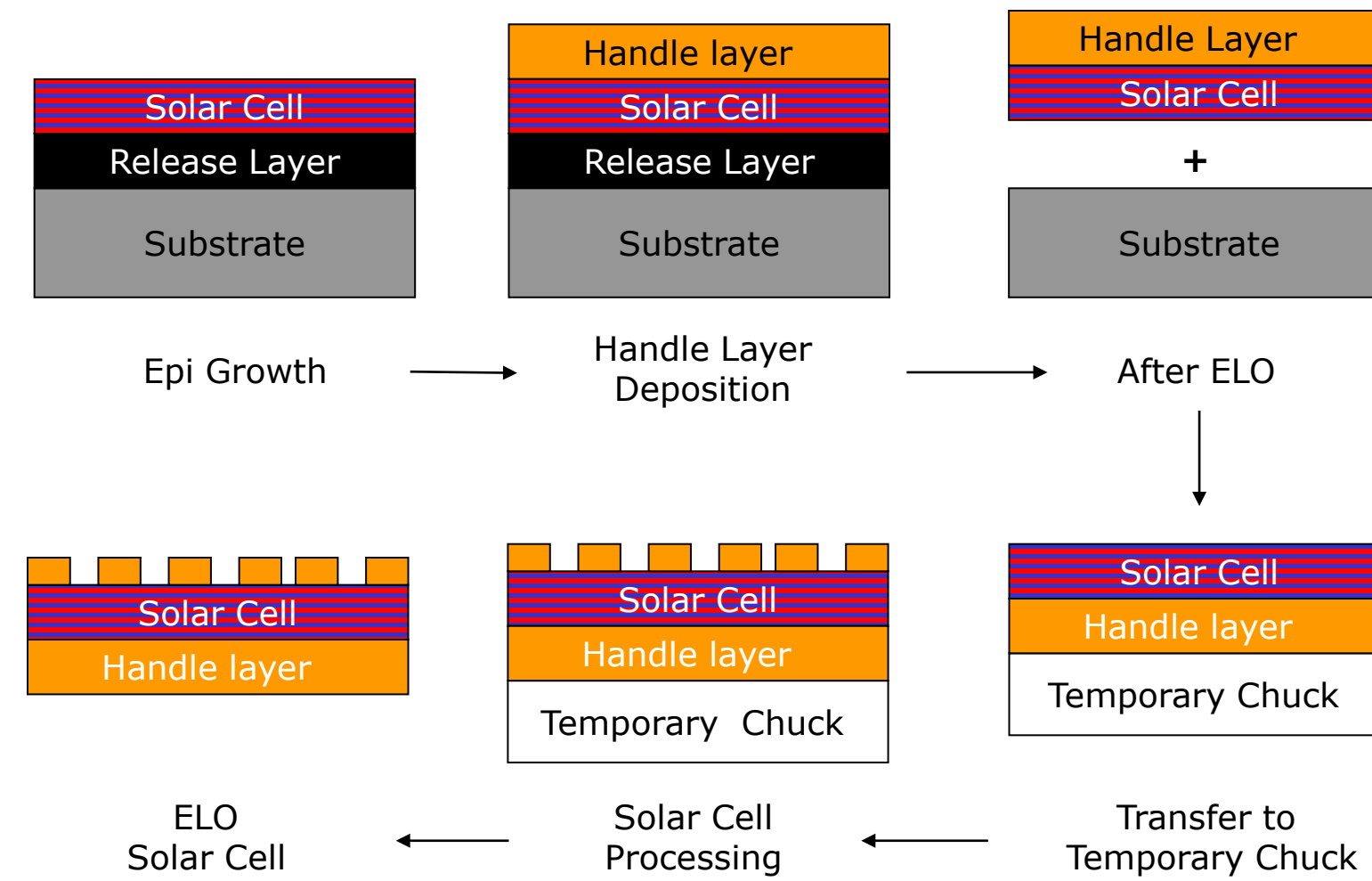


MicroLink Devices MOCVD reactors and solar cell fabrication and processing area.

### What are ELO Solar Cells?

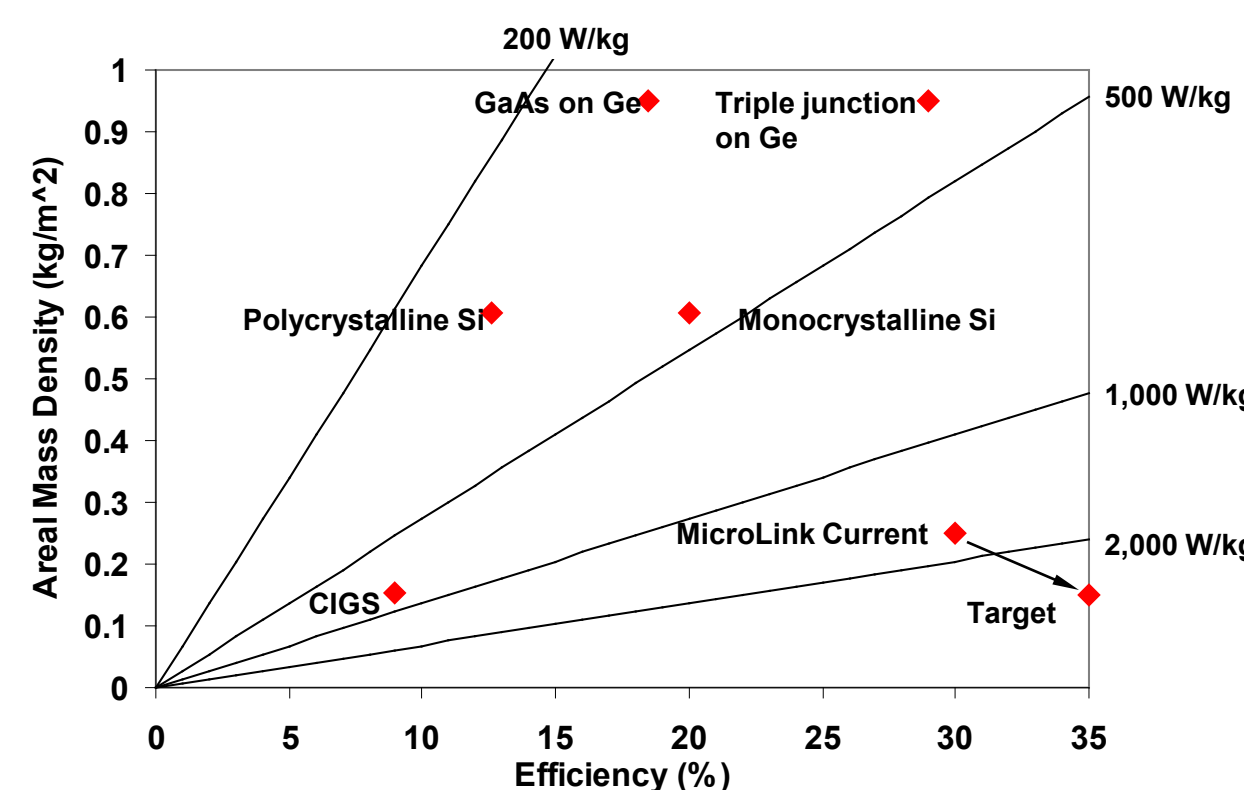
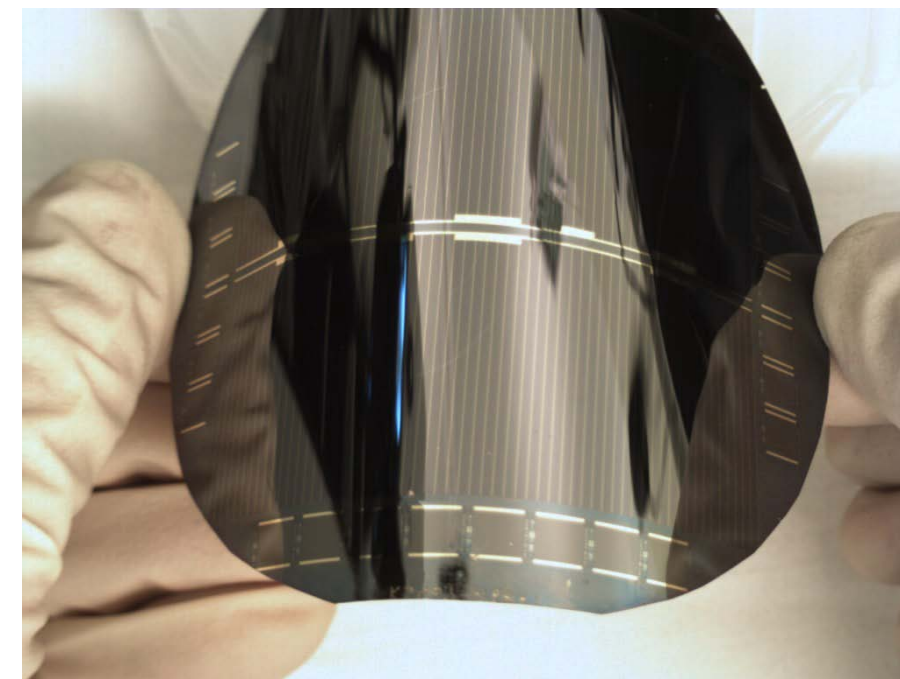
- ELO is epitaxial liftoff
- In ELO, the solar cell is completely removed from the GaAs substrate upon which the solar cell is epitaxially grown
- A release layer is grown between the GaAs substrate and the solar cell.
- Selective etches completely remove the solar cell from the substrate
- Proprietary to MicroLink

### ELO Solar Cell Process Flow



### Advantages

- Lightweight and flexible
- Low thermal impedance – reduces device operating temperature
- Works for GaAs, InP and other III-V materials
- Radiation-resistant InP-based cells are possible
- Substrate can be reused -- 3 x reuse demonstrated



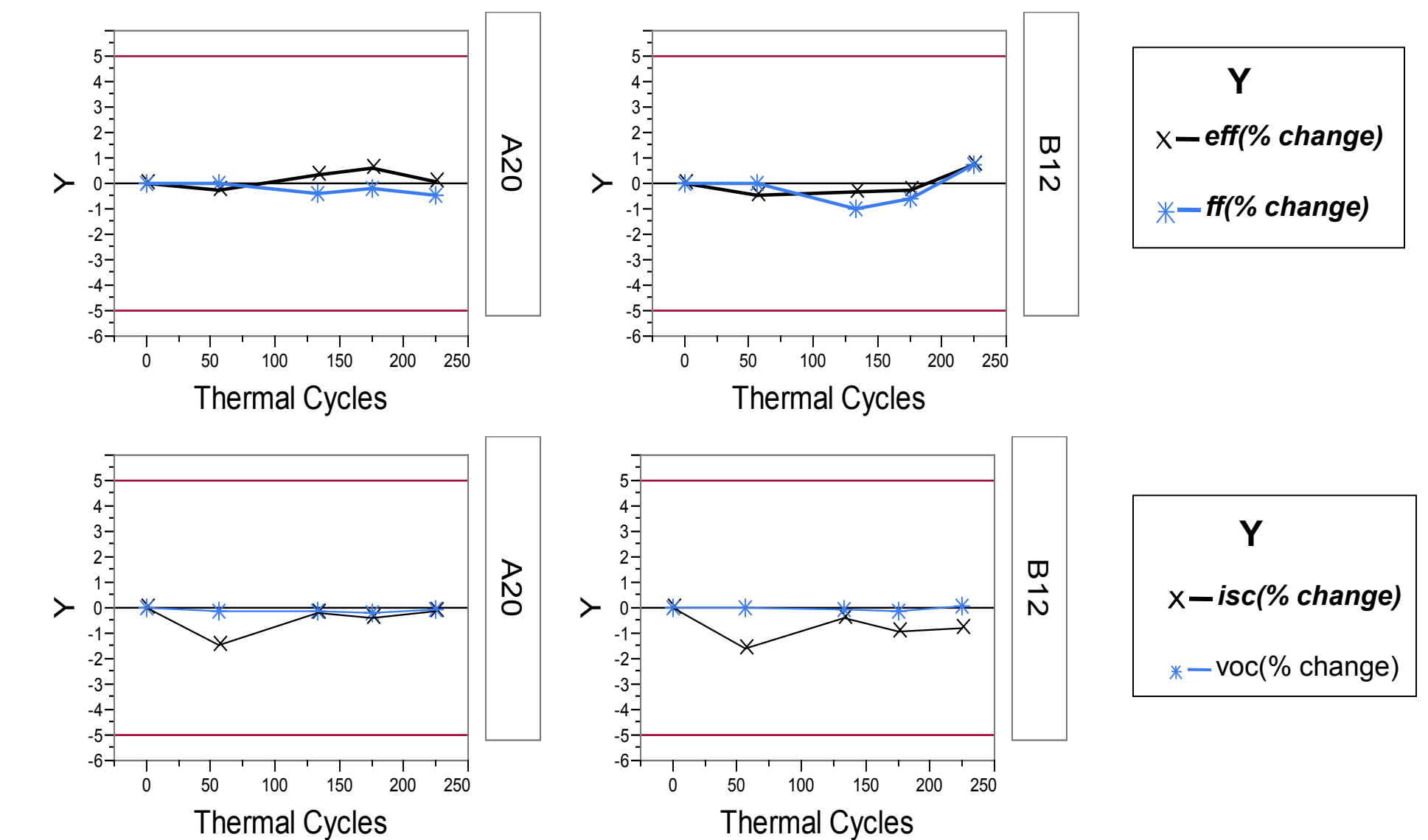
### Durability and Reliability

- Manufacturing ELO solar cells requires new processing and handling procedure that may impact durability and reliability
- Objective:** Differentiate between known solar cell durability issues and those that may be introduced by the ELO process and the extreme flexibility of the ELO solar cells
- Subject unpackaged ELO solar cells to various stresses and compare the durability of the unpackaged cells to those of packaged cells

### Thermal Cycling Durability

#### Unpackaged ELO Solar Cell Advantages

- Cycle  $-40^{\circ}\text{C}$  to  $110^{\circ}\text{C}$
- Measure critical-to-quality output parameters at multiple read points
  - Efficiency
  - Fill Factor
  - Open Circuit Voltage
  - Short Circuit Current



### Conclusion

- The ELO solar cell technology offers multiple advantages related to its low areal mass density and flexibility.
- A battery of environmental tests are scheduled to determine if the ELO technology introduces durability and reliability issues different from those of other solar cell technologies
- After 225 thermal cycles,  $-40^{\circ}\text{C}$  to  $110^{\circ}\text{C}$ , no degradation is observed in key critical-to-quality output parameters.

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