



Oregon State
University

Impactful R&D for Technology Adoption

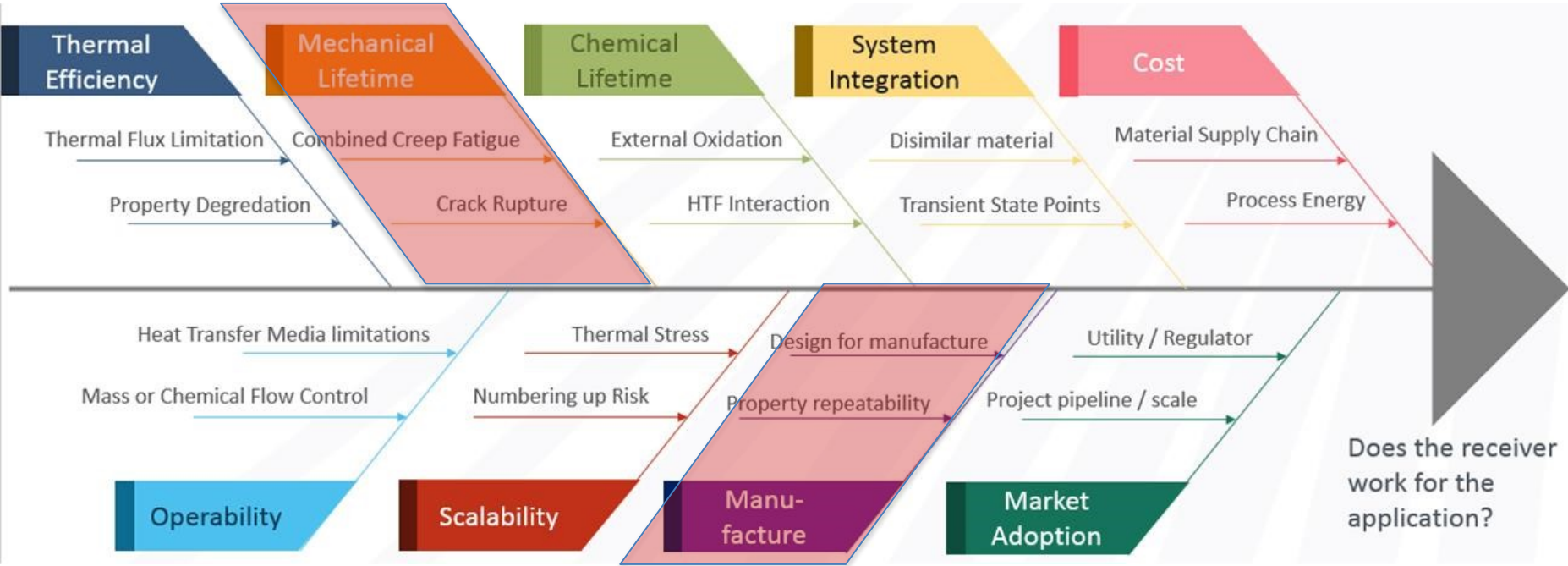
Brian M. Fronk

Solar Technology Office CSP R&D Virtual Workshop Series
October 29th, 2020

COLLEGE OF
ENGINEERING

School of Mechanical, Industrial, and
Manufacturing Engineering

Scaling Innovations

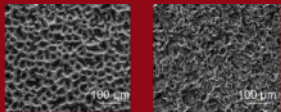


Context

Modular, micro-pin receivers can enable high efficiency and high temperature solar processes, but with significant manufacturing challenges.

Separate Effects Investigation

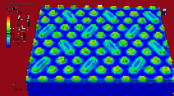
Materials



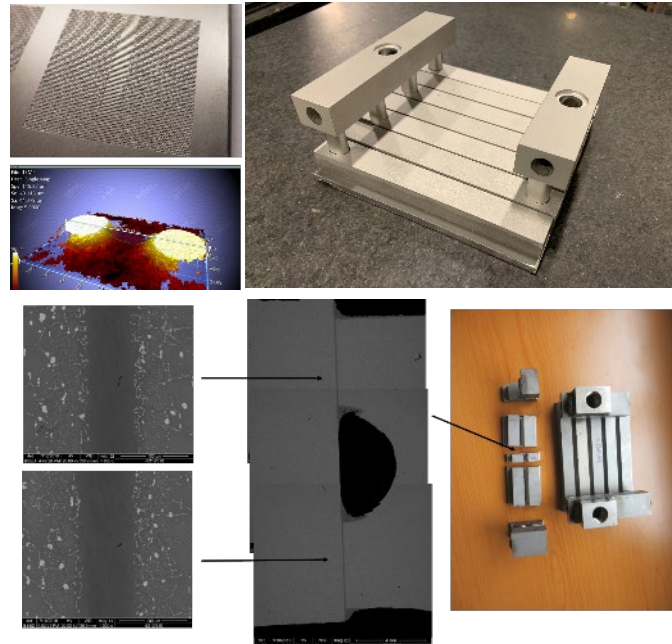
Fabrication Methods



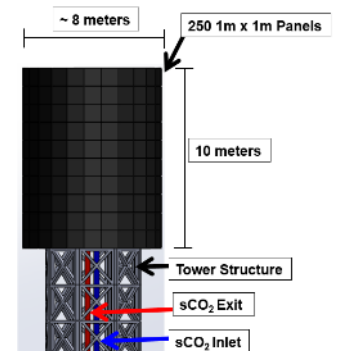
Thermal and Mechanical



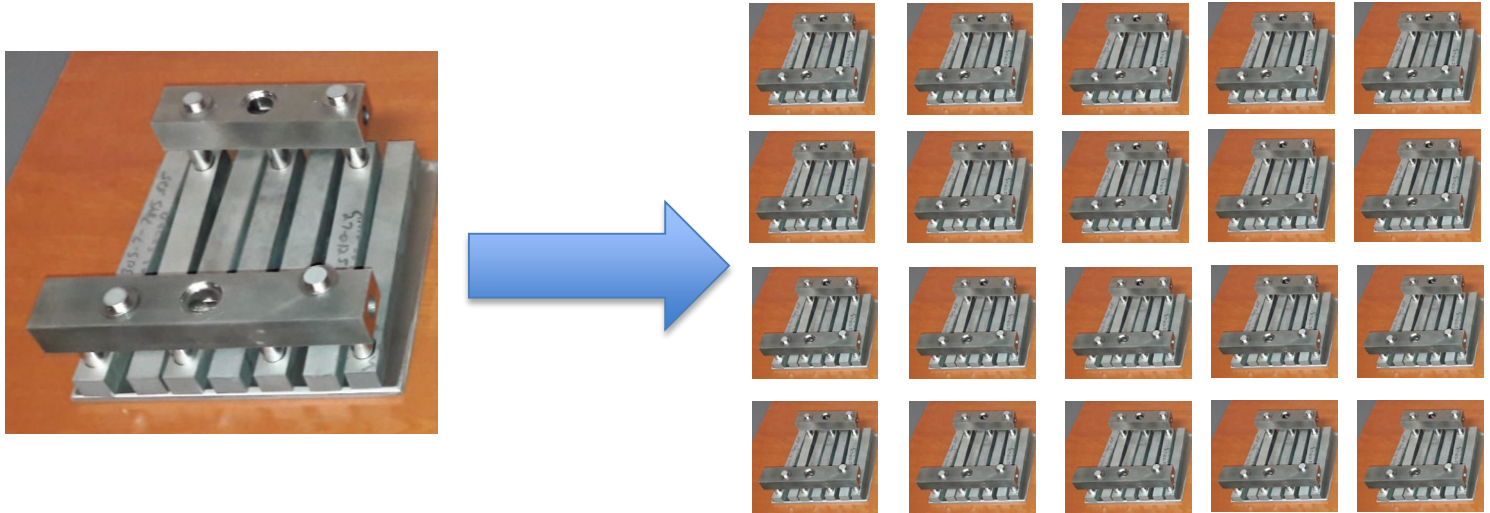
Mitigate Integrated Manufacturing Risks



Prototype Demonstration



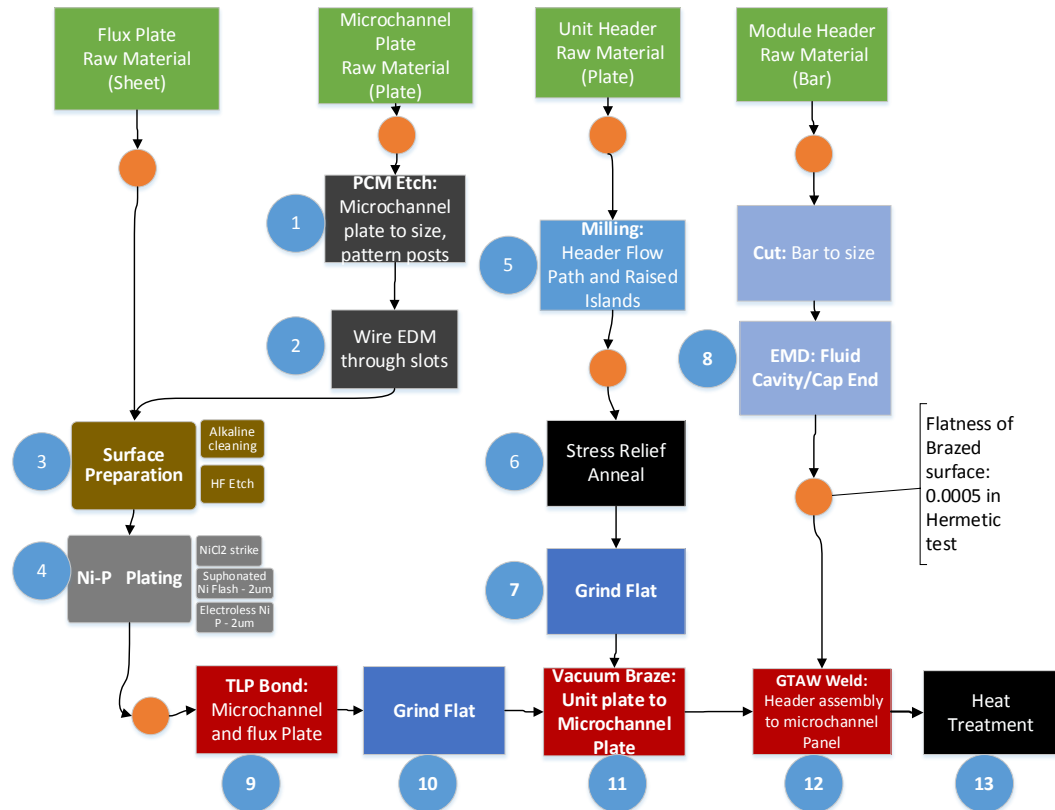
Manufacturing Risks



Potential Missed Risks

- Process limitations on design
- Availability of process capability
- Cost of demonstration/developing process
- Unexpected interactions between processes

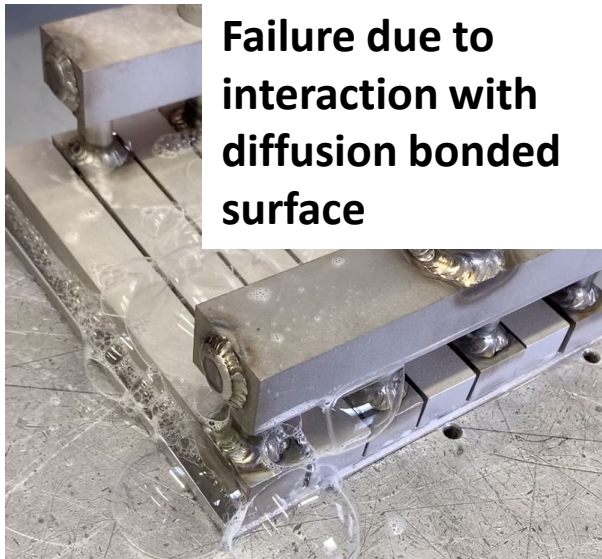
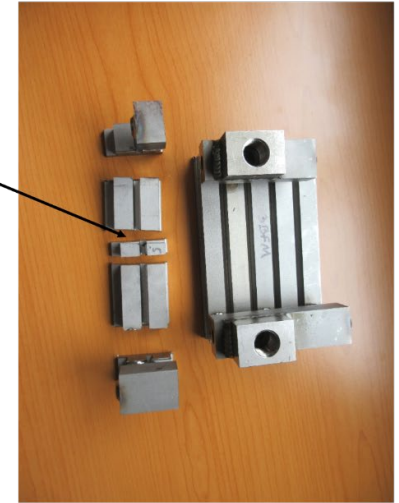
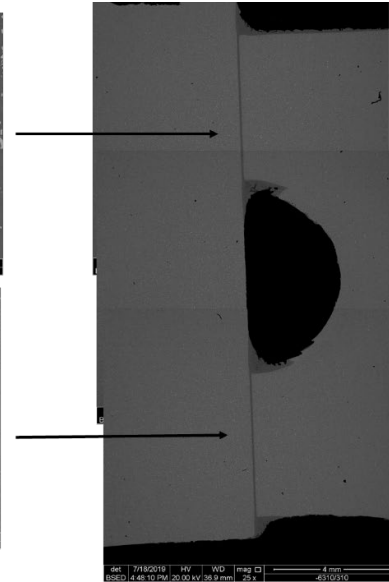
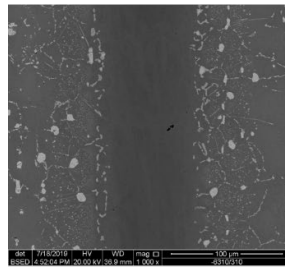
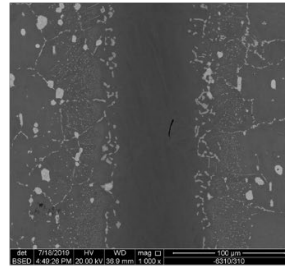
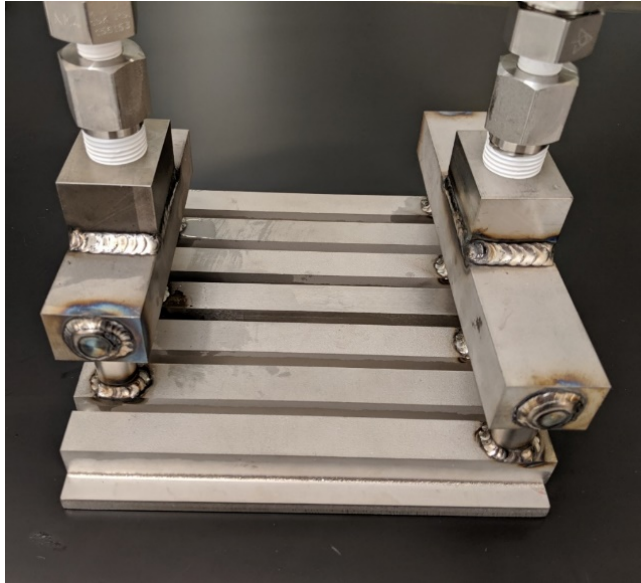
Banking Innovation



Ideal World:

- Develop manufacturing process
- Validate each step in processes
- Build multiple production prototypes

Example Approach - Challenges



Failure due to interaction with diffusion bonded surface

Brazing/Welding

- Headers-to-plate
- Proof test (pass)
- Destructive test(pass)

Manufacturing → 10 MWe

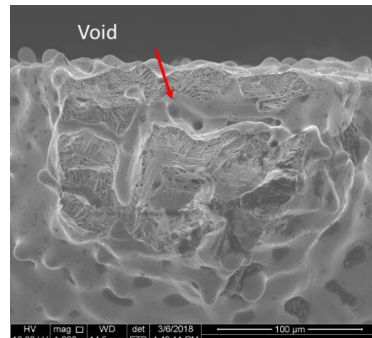
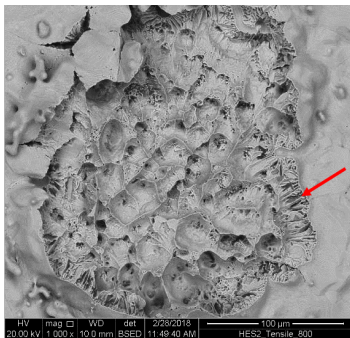
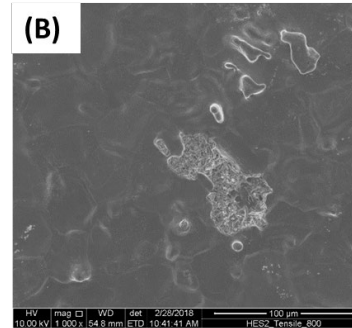
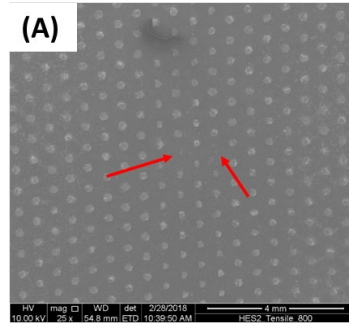
Ideal World:

- Build multiple production prototypes
- Conduct reliability tests (e.g., temperature/pressure cycling)

Potential R&D Challenges:

- Requires “final” design
- Expensive
- Time consuming
- Who is going to do it?
- Small volume in CSP → tool investment

Material/Mechanical Life Risks



Potential Missed Risks

- "Exotic" materials
- Limited experience (machining, forming, joining, etc.)
- Limited base material data at conditions
- Limited/no data on joints
- Extreme operation (difficult to replicate)
- Standards (ASME, UL) haven't caught up

Banking Innovation → Materials/Mechanical

Potential R&D Challenges:

- Fund material data tests (similar to corrosion round robin in NE)
- Dedicated studies on joints and joint properties
- Develop centralized reliability testing capability (e.g., SNL)
- Develop industry informed CSP specific standards for receivers

Closing Thoughts

- Unexpected challenges from proof-of-concept to engineering prototype
- Manufacturing considerations should start day 1
- Coordinated effort on material properties
- Coordinated effort on joining technology and properties
- **Share failures and success**

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Questions?

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