High-Temperature Thermal Array for Next Generation Solar Thermal Power Production

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PROJECT OBJECTIVES

Goal: Development of the key technical challenges to enable the fabrication of long (>300 ft) heat pipes to act as a dual purpose receiver/heat transfer system.

- *The High-Temperature Thermal Array maximize the thermodynamic efficiency of solar energy capture and transport to the power converter. This enhanced efficiency results in lower Levelized Cost of Electricity.*

Innovation: The key innovation is the ability of construct an extended heat pipe array no longer constrained by the orientation of the heat pipe system.

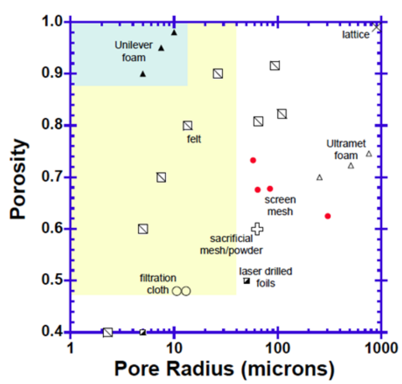
- *Traditional heat pipe systems are limited by the wicking height of the working fluid, the methodology utilized by LANL in this program enable the fabrication of vertical towers with extreme heights.*

APPROACH

- Technical approach is focused on advancing the thermal array from TRL 2 to 4 by overcoming a host of outstanding technical challenges focused on applicability to heat pipes to Concentrated Solar Power production. These include
  - Counter gravity physics
  - Counter gravity operation
  - Vertical start-up
  - Diurnal thermal cycling
- Technical effort also focus on cost metrics through development of new materials and compositions for new wick compositions. Development of high porosity, high permiability and low pore volume wicks directly impacts system capital costs.

KEY RESULTS AND OUTCOMES

- Key efforts have focused on the development of parametric models balancing heat pipe performance and cost parameters.
- Parametric models build the framework that guides the scientific effort and system design efforts for the construction of a large tower design.
- This work has resulted in a intellectual property disclosure this quarter on heat pipe system design.



NEXT MILESTONES

- Technical efforts will focus on
  - Parametric relationships balancing wick and artery properties.
  - Development of preliminary physics model for heat pipe system. Authentic data will be used when available and estimations will be parameterized using conservative estimations.
  - Diffusion bonding techniques for wick and heat pipe wall focusing on the integration of porous wick structure targeting wall morphology with pore volumes in the 10 to 20 μm range.
  - Chemical vapor deposition on sacrificial template wick is evaluated. Decomposition of templates are overcome through sacrificial metallization.