Next-Generation Solar Collectors for CSP

3M Company

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PROJECT OBJECTIVES

Goal:
Develop a new set of technology elements, including reflective films, reflector panels, framing structural elements and dual axis drives
Design and build a large format heliostat design incorporating these new technology elements
Install and field test the heliostat design at the National Solar Thermal Test Facility (at Sandia National Laboratories)
Analyze the impact of new heliostat design on LCOE

- *These development will lead to the lowest "on target solar flux per dollar"*

Innovation: The use of space frame, continuous tracking, and light-weight reflectors with polymeric reflective film will provide a unique technology set for heliostats with potential for higher performance at lower cost.

- *The use of lightweight reflectors based on polymer based mirrors (vs. glass mirrors) has not been systematically explored in the past*

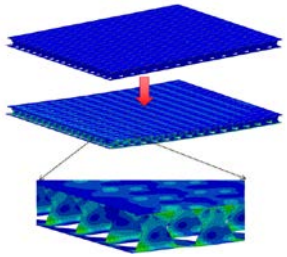
Milestones: No milestones for this quarter

APPROACH

- Lab scale extrusion trials are used to identify compatibility of material sets and prepare samples for subsequent optical and weathering studies for polymeric solar mirror films
- Polymeric mirror films will be metalized for high solar reflectance
- Metalized mirror films will be fabricated into reflectors for heliostats
- A low-cost supporting panel (MTTS) for the mirror film will be developed using lower-cost raw materials and innovative design and process changes
- Space-frame designs, to support the reflective panels, will be designed and evaluated for optimal performance / cost
- Adaptive optics and continuous tracking system will be developed to complete the heliostat design

KEY RESULTS AND OUTCOMES

- Full scale coating trial to apply surface protection to mirror film completed
- Weathering studies initiated on pilot scale samples of acrylic substrates and mirror film substrates.
- PROTOTYPES: 12 prototype MTTS panels were assembled. The structured sheets were aligned and adhesive mixing was optimized before assembly



- VSHOT: a new alignment fixture was designed & built to allow faster and more accurate alignment of the samples for testing
- MODEL: A full set of steel MTTS panels of various metal thickness were modeled for deflection at various wind loads and compared to 5 mm glass. Picture shows deflection modeling of MTTS.

NEXT MILESTONES

- Complete initial metallization trial of mirror films for accelerated weathering studies.
- Complete full scale coating of both surface protection and metallization on same mirror film.
- A first cost / slope error map will be compiled for the steel MTTS panels
- A second set of MTTS panels will be assembled and tested
- MTS panel cost & performance metrics will continue to be refined
- Modeling and ray tracing will be used to understand the effect of support spacing and panel material thickness on the reflected beam deviations. Wind load simulations are also planned.