Low-Cost Metal Hydride TES Systems

SRNL

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PROJECT OBJECTIVES

Goal: to evaluate and demonstrate a metal hydride-based TES system for use with a CSP system.

Innovation: metal hydrides have a unique ability to deliver low-cost, high capacity and energy efficient TES systems for CSP applications. New higher capacity and lower cost materials have recently become available. SRNL's combined and integrated modeling and metal hydride material research approach to help solve technical challenges.

1st Year Major Milestones:

- Determine the material properties of for at least 10 MH material pairs.
- Screen at least 10 MH pairs to arrive at 2-3 candidate materials meeting SunShot targets
- Approve the final design and construction of the bench-scale MH cycling system.

APPROACH

- Make use of the hierarchal modeling methodology developed by the SRNL combined with the extensive material knowledge and expertise at both SRNL and CU to screen several promising metal hydride candidate materials and then select the best candidates for more thorough evaluation through experiments and more detailed models.

- During subsequent years, material optimization, bench-scale testing and more detailed component and system models will lead to a proof-of-concept demonstration and a preliminary system design. The culmination of this proposed research will be the design, fabrication and evaluation of a prototype metal hydride TES system aimed at meeting the SunShot cost and performance targets.

KEY RESULTS AND OUTCOMES

Down selected potential Metal Hydride TES Material Pairs

MgH_2 – TiCr	Mg_2FeH_6 – TiMn	CaH_2 – SAH
MgH_2 – TiMn	$NaMgH_3$ – TiFe	NaH – TiFe
Mg_2FeH_6 – TiFe	$NaMgH_3$ – TiMn	NaH – TiMn
Mg_2FeH_6 – TiCr	$NaMgH_3$ – SAH	NaH – SAH

- Material property data on approximately 20 candidate MH materials were obtained and documented.
- Screening tools were developed and applied to down select a database of MH materials to10-12 high potential candidate pairs.
- A tandem bed model was developed and will be used for both screening MH material pairs as well as future system design simulations.
- A design of a bench-scale MH cycling system has been completed along with procurement of major components. Preliminary system fabrication has begun.

NEXT MILESTONES

- Preliminary screening of candidate materials has identified 12 promising material candidate pairs. Additional, more detailed material data will be collected in the next quarter to further down select the possible candidate pairs to arrive at the best 2-3 candidate pairs.
- A technical paper on the screening process and the material data obtained and used for the process is on track to be submitted by the end of this FY.
- Delays due to onsite work authorization apperoval has delayed the procurement of components for the bench-scale MH TES system but the procurement and fabrication should be on track to complete the system by the end of the FY.

Go/No-Go Milestone:

Successful completion of all milestones in Budget Period 1. Engineering materials property data evaluation is complete indicating that the performance of the MH TES system can meet the proposed system technical targets.