37877 Re-Designing the CSP Thermal Energy Storage System to Enable Higher-Temperature Performance at Reduced Cost

Pump relocation and alternative internal insulation using cenospheres could reduce Gen2 TES risks and costs

1. Impact

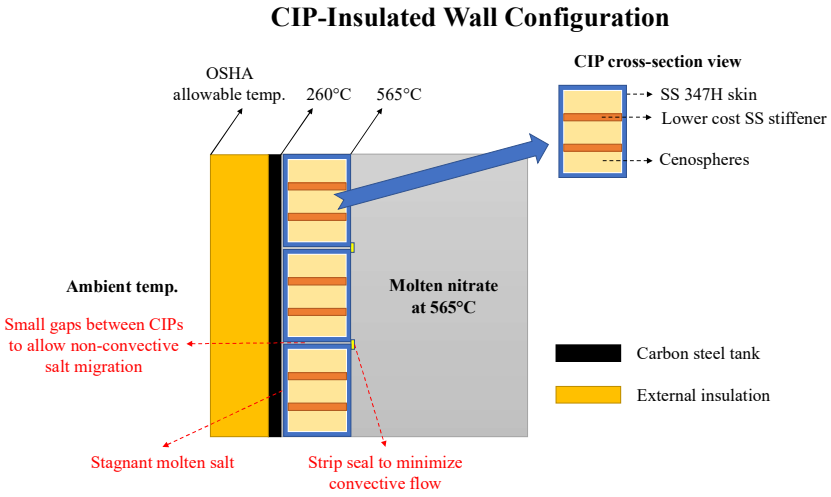
The relocated-pump design and effective internal insulation design could significantly reduce overall TES cost.

2. Project Goal

- Develop conceptual designs for the pump location to eliminate the expensive cantilevered structural-steel pump platforms and to eliminate the very long-shafted and expensive pump designs.
- Develop conceptual hot tank designs utilizing various combinations of internal and external insulation to reduce the temperature of the tank wall enabling the use of less expensive materials.

3. Method(s)

The team perform conceptual design with the project partner on relocated-pump design with detailed thermal and mechanical analysis while analyzing the chemical compatibility of different cenosphere materials in molten nitrate salt as a function of major impurity species.



Conceptual internal insulation design with cenosphere insulation panels

4. Outcome(s)

Pump relocation could potentially reduce the overall Gen2 TES design cost by over $8/kWh-th.

Cenosphere insulation concept could potentially reduce the overall Gen2 TES design cost by over $2.5/kWh-th.

The most chemically resistant cenospheres in molten nitrate is the ones with lower Fe content.

5. Conclusion/Risks

The key benefit of pump relocation is the reduced cost for the steam generation system structure and the reduced tank supply cost due to optimized height-to-diameter ratio of the tanks.

The key benefit of the cenosphere internal insulation concept is the high insulation ability per cost and the fail-"safer" design when salt permeation into the cenosphere containment.

NREL is current constructing a prototype TES tank with the cenosphere insulation concept.

6. Team

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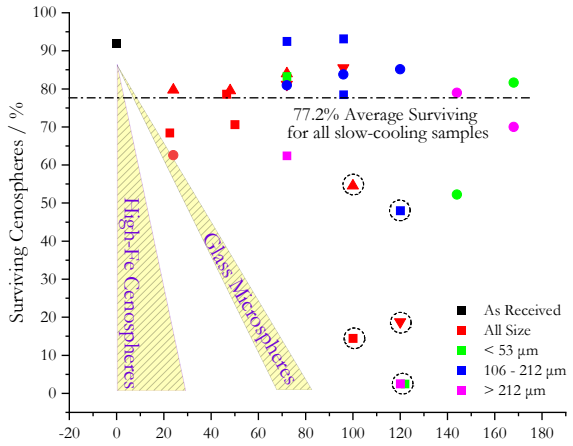

Surviving low-Fe cenosphere percentage in molten nitrate immersion tests