Numerical and Experimental Evaluation of Ceramic Honeycombs for Thermal Energy Storage (CSPCore-2)

A joint India-U.S. research consortium funded under the *Joint Clean Energy Research & Development Center (JCERDC)*

Scientific Achievement:

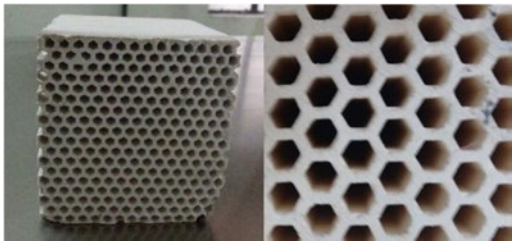
Novel compositions of mullite- and chromite-based ceramic honeycombs were developed for high-temperature thermal storage application. The materials have shown favorable performance for use in high-temperature thermal energy storage.

Significance and Impact:

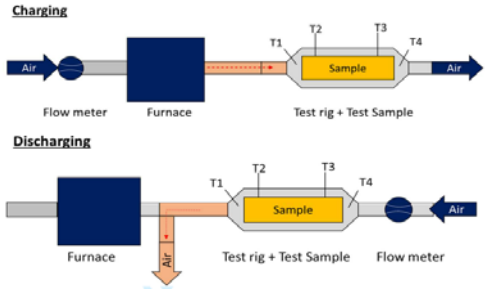
We studied the effect of honeycomb design, material properties, and flow rates on thermal energy storage and heat transfer characteristics. We present an optimized, high-temperature thermal energy storage for new-generation high-temperature power cycles.

Research Details:

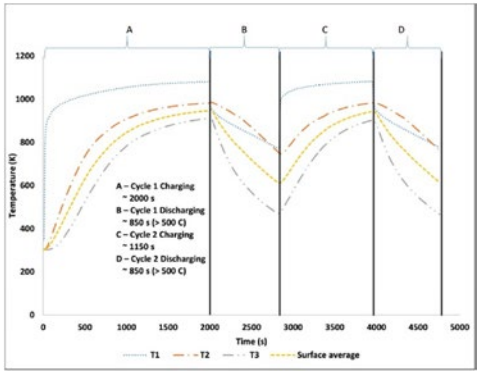
- Experiments and numerical evaluation are presented to evaluate performance in 773 K – 1273 K the temperature range by studying the storage and discharge characteristics in cyclic mode.
- Channel shape of the ceramic honeycomb has no effect if the area of the channels is kept constant, but mass flow rate has significant influence on charging and discharging. Ceramic honeycomb structure with an optimum area of contact for heat transfer for a given flow rate can store thermal energy in a short time.
- The estimated heat storage in mullite-based sample was 549 MJ/m^3 and in chromite sample was 925 MJ/m^3, due to the difference in thermal properties.



Honeycomb sample



Schematic of experimental setup



Cycle performance of chromite ceramic honeycomb

Publication:

- S. Ojasve, S. Khivsara, A. Ramakrishnan, C. Madhusoodana, R. Das, V. Srinivasan, P. Dutta (2017). "Numerical and Experimental Evaluation of Ceramic Honeycombs for Thermal Energy Storage," *Transactions of the Indian Ceramic Society*, DOI 10.1080/0371750X.2017.1281763

Contacts: Ojasve (ojasve.s@gmail.com), Aswathi (aswathi.ad@gmail.com), Sagar Khivsara (sagardk@mecheng.iisc.ernet.in), Madhusoodana (madhu@behelepd.com), Rathindra Nath Das (rndas@bhelepd.com), Vinod S (vindos@gmail.com), Pradip Dutta (pradip@mecheng.iisc.ernet.in)