

Development of a Vacuum Based Heat Battery

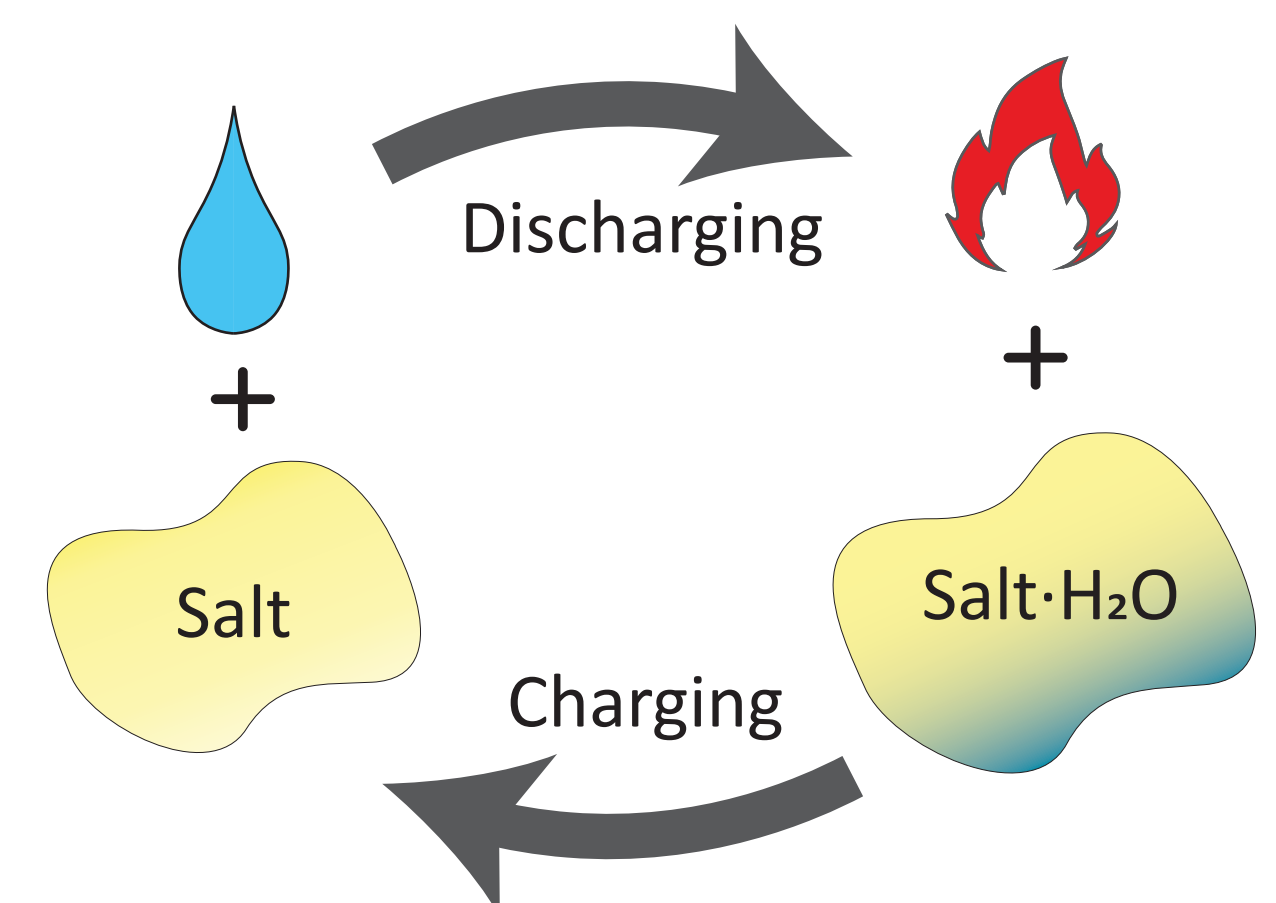
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Problem statement

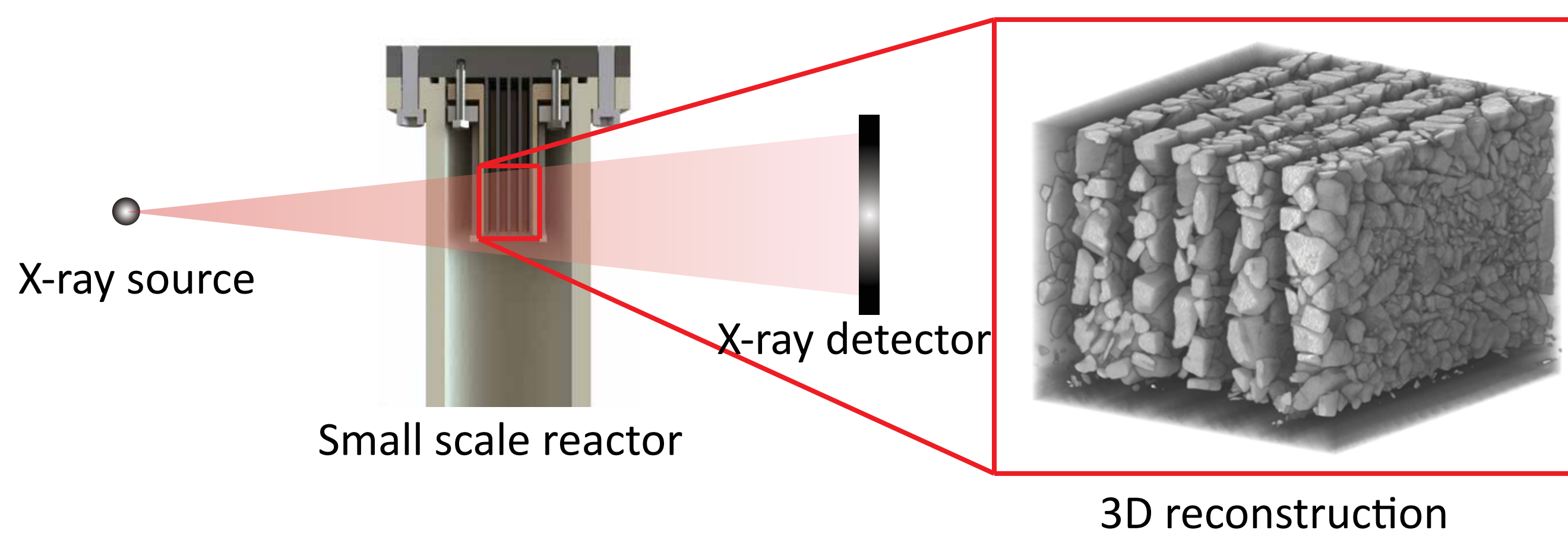
- Heat is stored through a reversible reaction
- Reactive salt is placed in a heat exchanger (shown right)
- Swelling of the material changes the heat and vapor transfer, affecting performance and stability



Mechanism



In-situ characterization of a thermochemical heat storage reactor

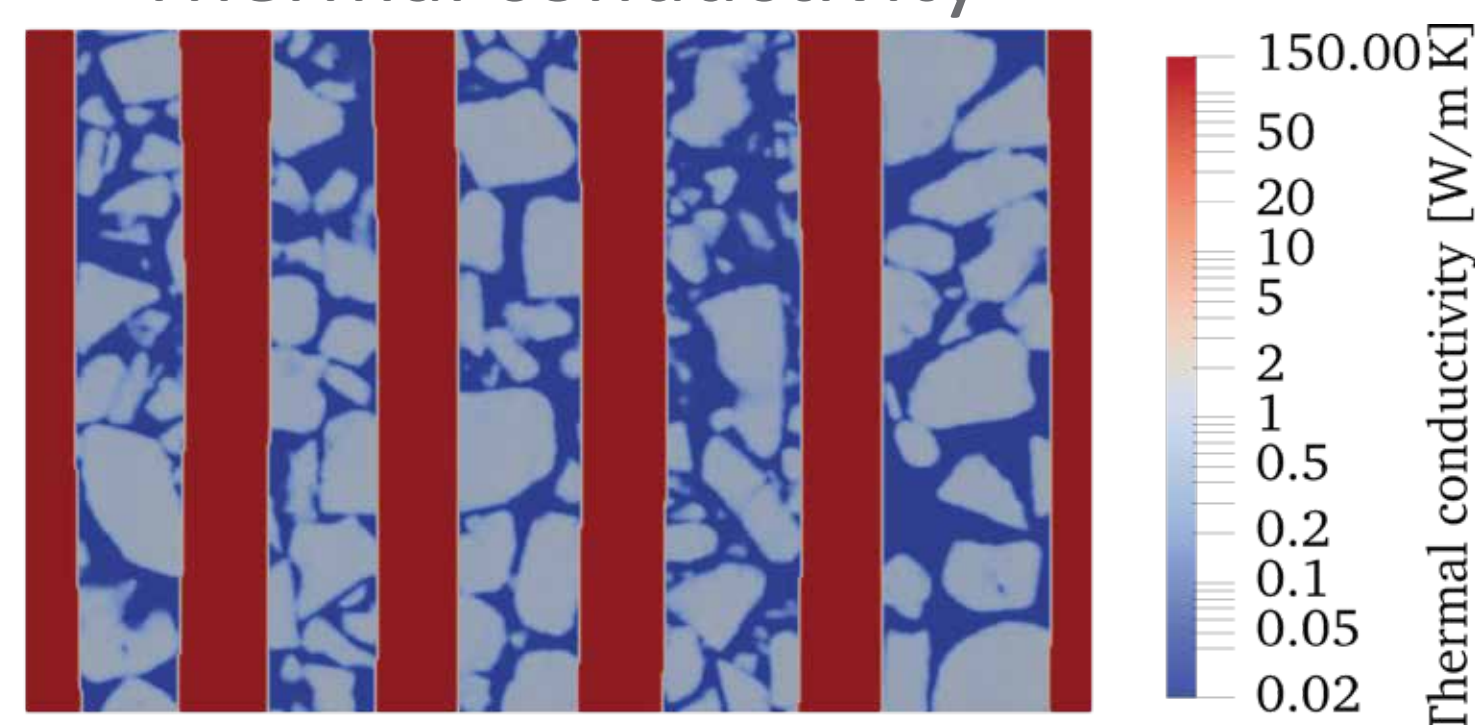


A small scale vacuum reactor is built and operated to obtain 3D images, which are used to characterize morphological changes through swelling.

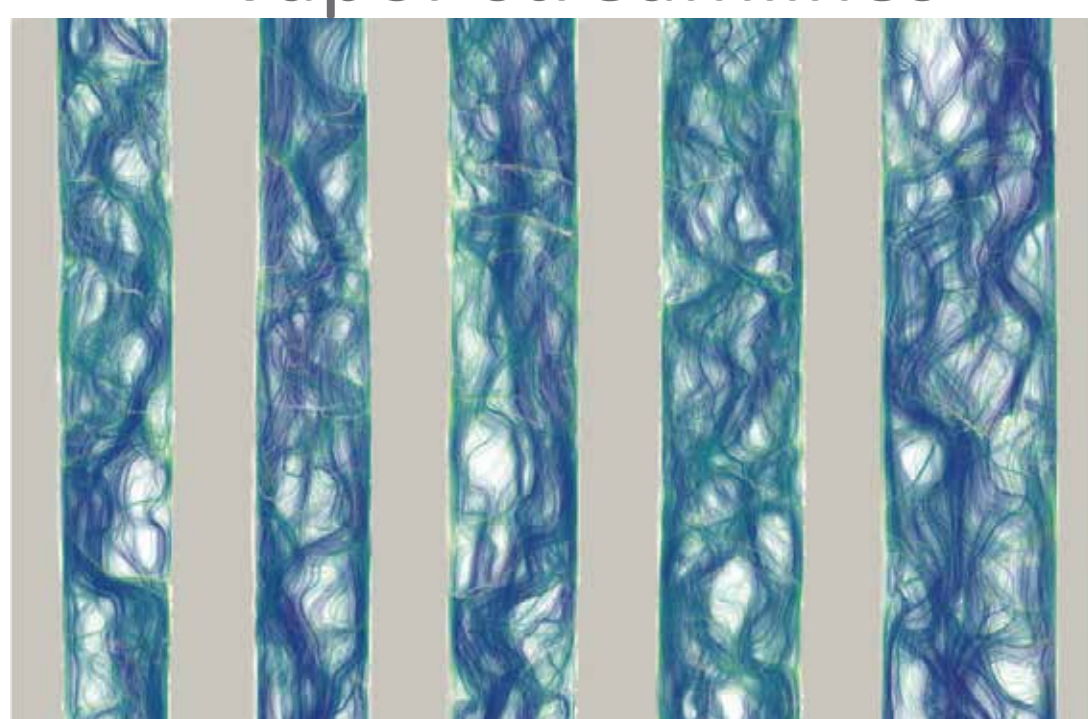
Numerical results

Direct numerical simulations are done on the 3D images to evaluate the heat and vapor transfer characteristics throughout charging and discharging

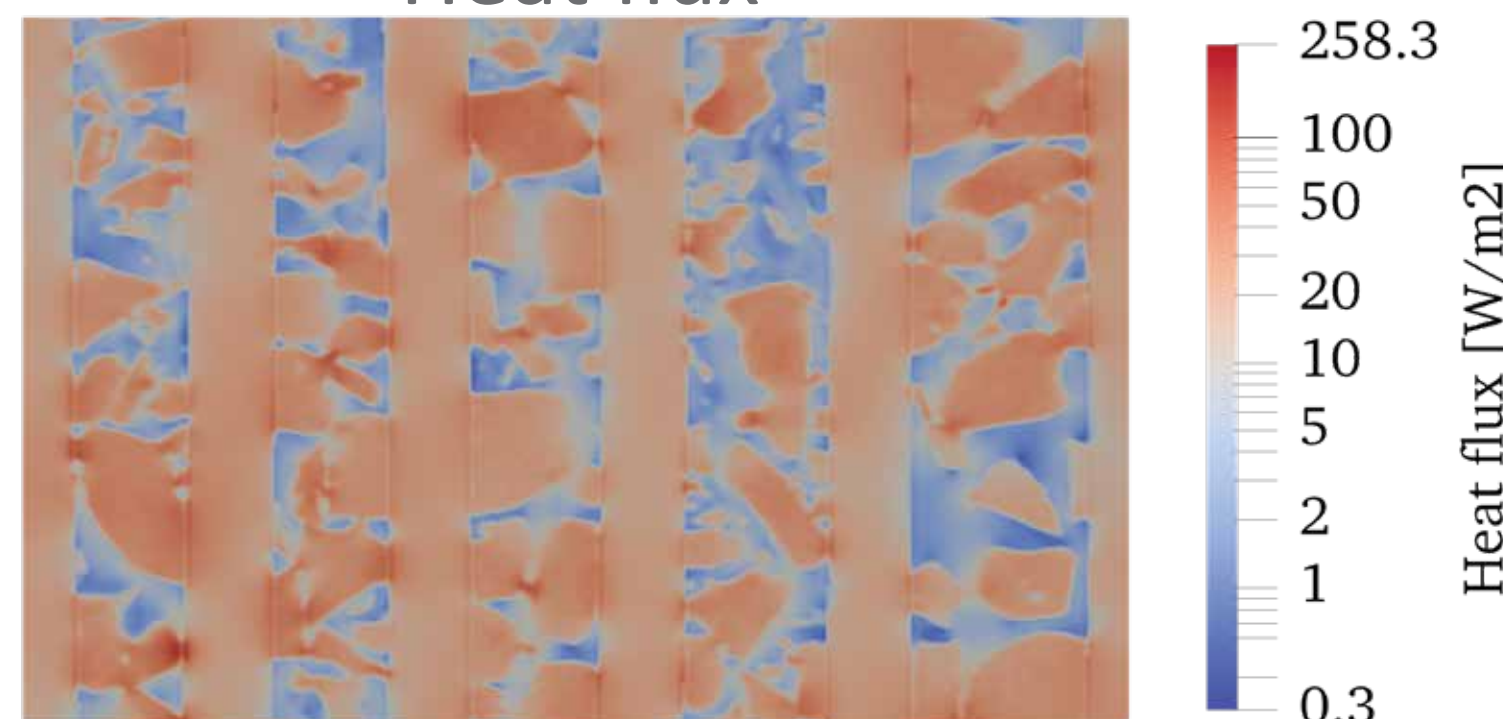
Thermal conductivity



Vapor streamlines



Heat flux



Next steps

1

Formulate relations for macroscopic bed properties (effective conductivity, permeability)

2

Create continuum model of the full scale reactor

3

Validate results against data from prototype experiments