Numerical Simulation of Redox Oxides-Based Thermochemical Heat Exchanger / Thermal Booster for Concentrated Solar Power Generation

Zhen Cao* (z.cao@utwente.nl), Abhishek K. Singh (a.k.singh@utwente.nl)

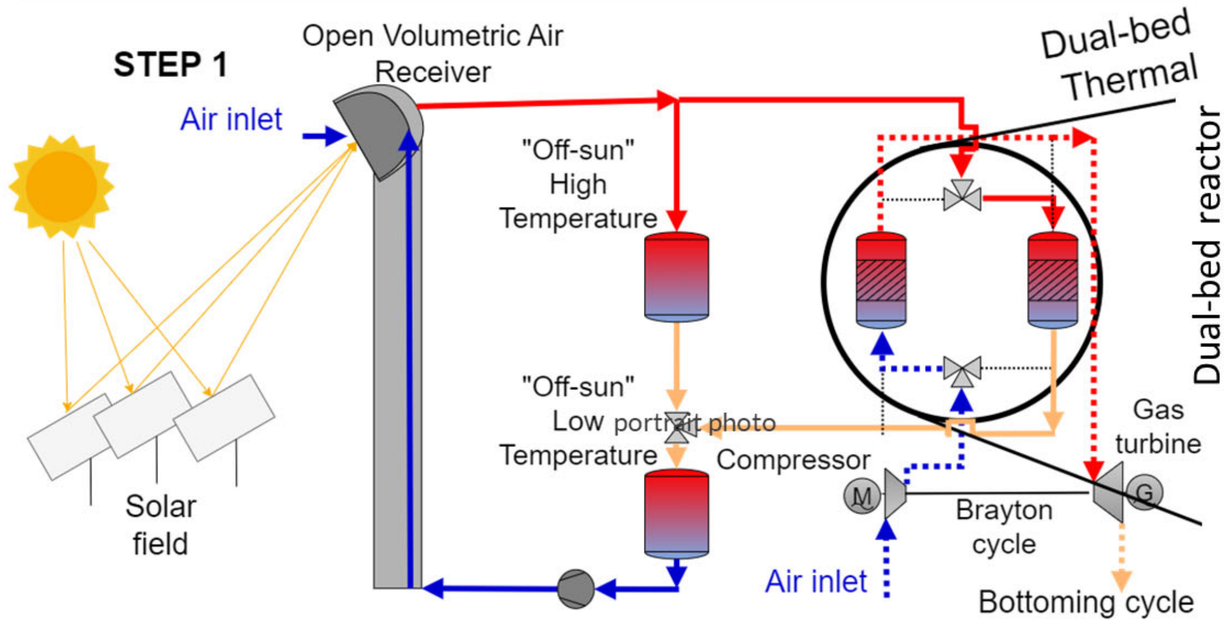
Department of Thermal & Fluid Engineering, University of Twente, Netherlands

ABraytCSPfuture

1. Abstract

- Multiphysics models were developed to explore the heat storage performance of honeycomb thermochemical reactors.
- The model was validated by experiments and then parametric studies were carried out, i.e., honeycomb porosity and reactive site density.
- This study provides insights into the design and optimization of the reactor.

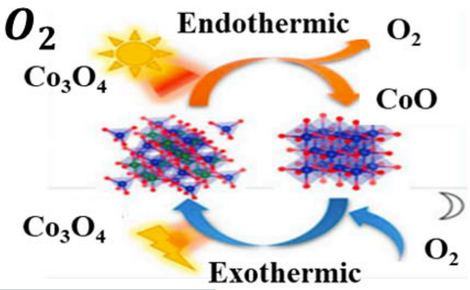
2. Introduction



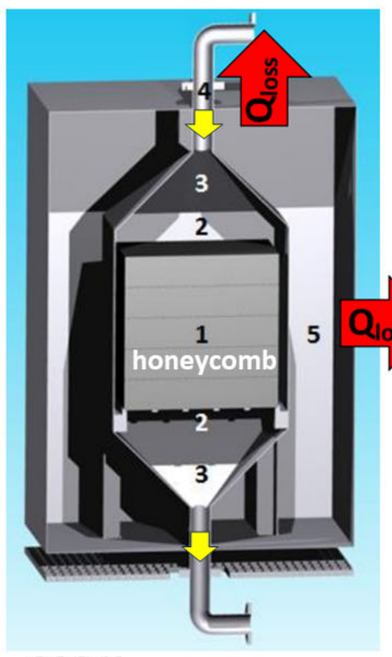
Funded by Horizon Europe, ***ABraytCSPfuture*** aims to develop novel redox oxide materials and design thermochemical reactors to achieve ultra-high temperature (>1000°C) heat storage and upgrade to improve air Brayton cycle efficiency of a CSP power plant.

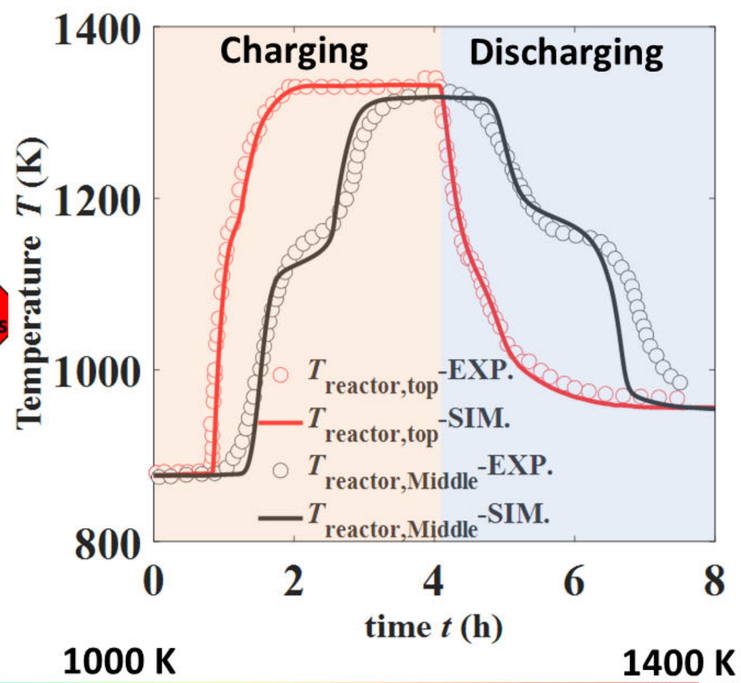
3. Numerical model

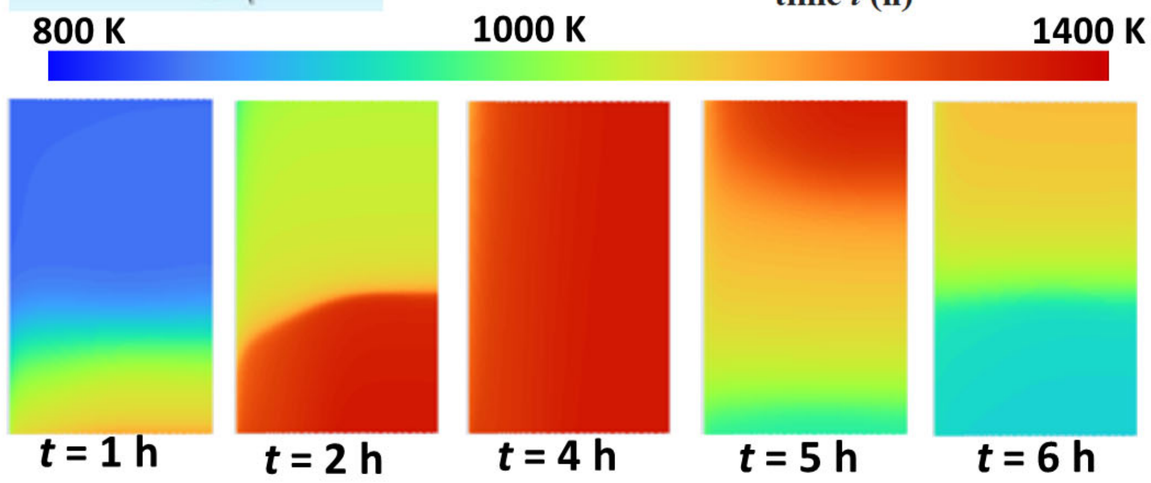
$$Co_3O_4 + \Delta H_r \rightleftarrows 3CoO + 0.5O_2$$



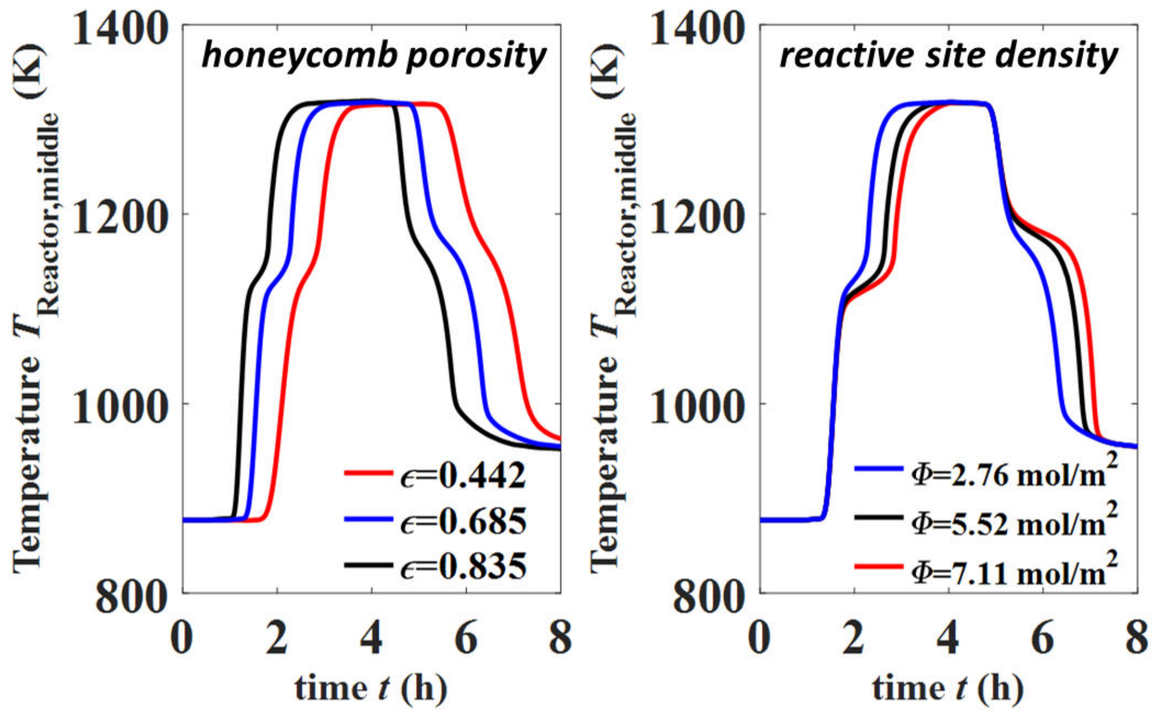
4. Model validation







5. Reactor parameter study



6. Summary and ongoing work

- Numerical models were developed for heat storage by the Co_3O_4/CoO pair.
- Novel Perovskites and reaction kinetics are being explored by DLR and CERTH
- Thermal properties and numerical models are being examined and developed for the new materials at UT

Funded by the European Union's Horizon Europe research and innovation programme under grant agreement **No. 101084569**. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the institutions of the European Union.

@ABraytCSPfuture

www.linkedin.com/company/abraytcspfuture-project/

UNIVERSITY OF TWENTE.