Universität Stuttgart

Thermal Insulation of an Ultra-High Temperature Thermal Energy Store for Concentrated Solar Power

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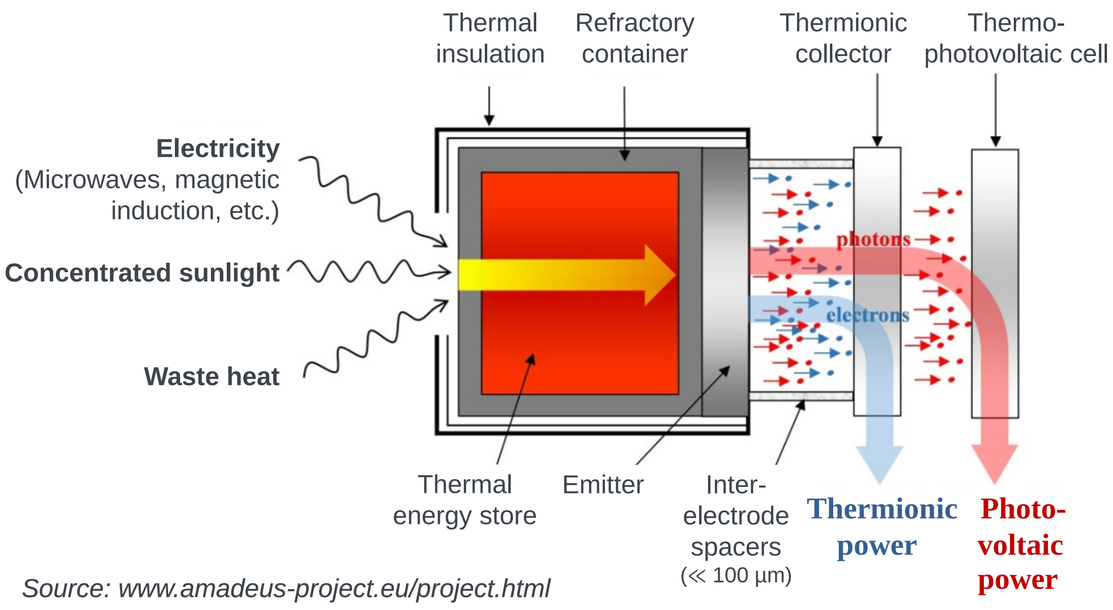
Within the EU funded research project AMADEUS (www.amadeus-project.eu) a new concept for latent heat thermal energy storage and power to heat to power is being developed. Heat sources can be concentrated solar power like solar furnace and solar power tower systems. The thermal energy store will operate at temperatures up to 2 000 °C.

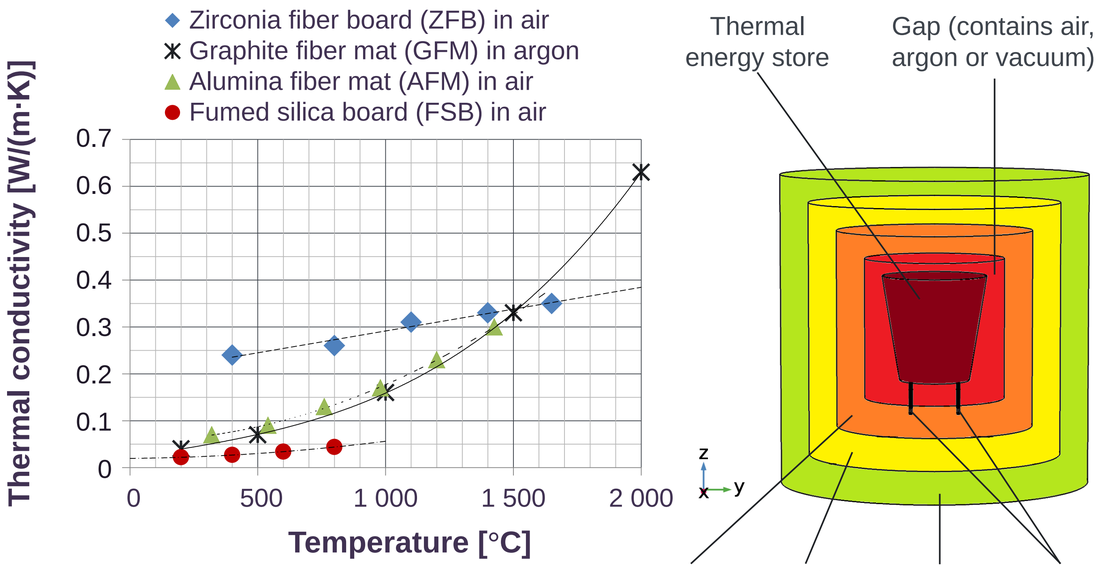
The thermal insulation of this ultra-high temperature thermal energy store is one of the project's crucial challenges. This poster presents simulation results of a multi-layer thermal insulation concept for this thermal energy store.

Thermal Energy Store



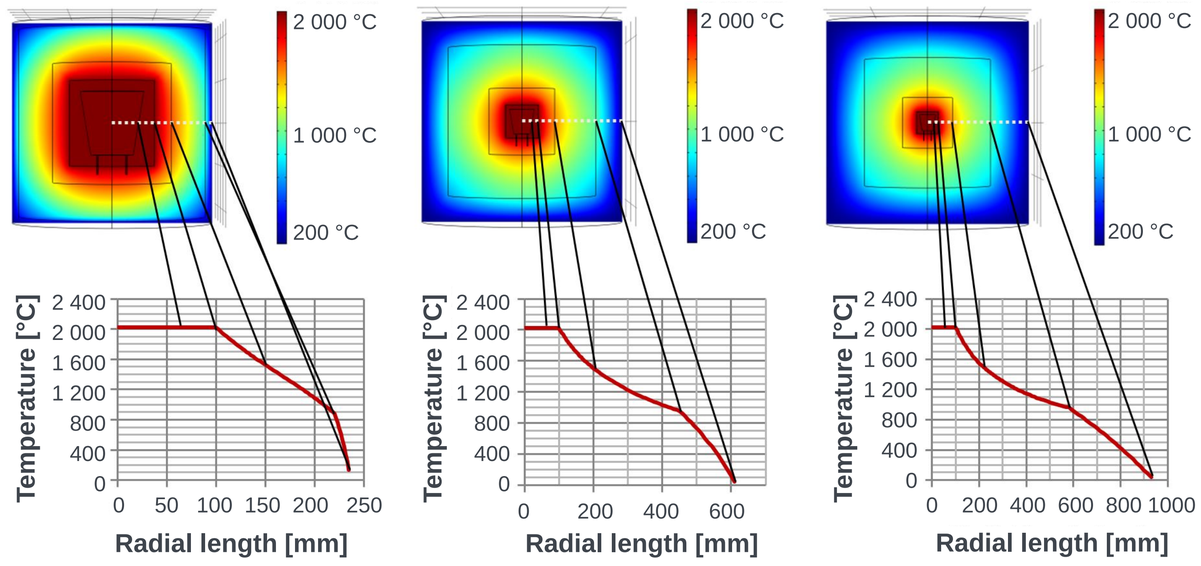
Source: www.amadeus-project.eu/project.html

Thermal Insulation Materials and Simulation Model



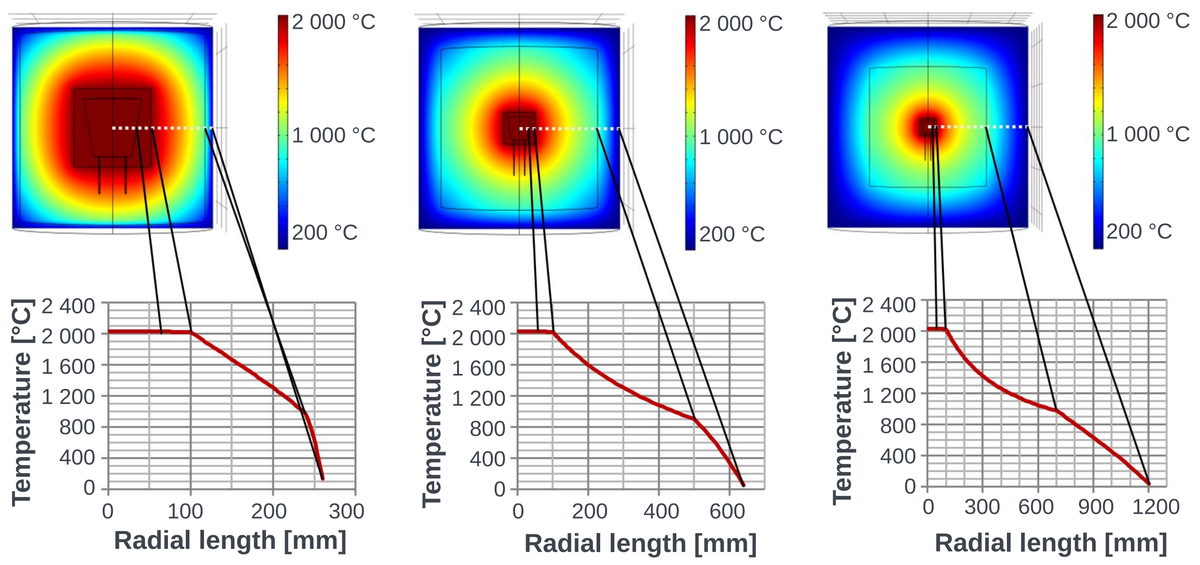
Simulation Results

The following figures show thermographic images of a plane section through the center of the thermal energy store (TES). The diagrams below show the temperature as a function of the radial length from the centre of the TES to the outer surface of the thermal insulation. Additionally the corresponding heat loss rate is mentioned.



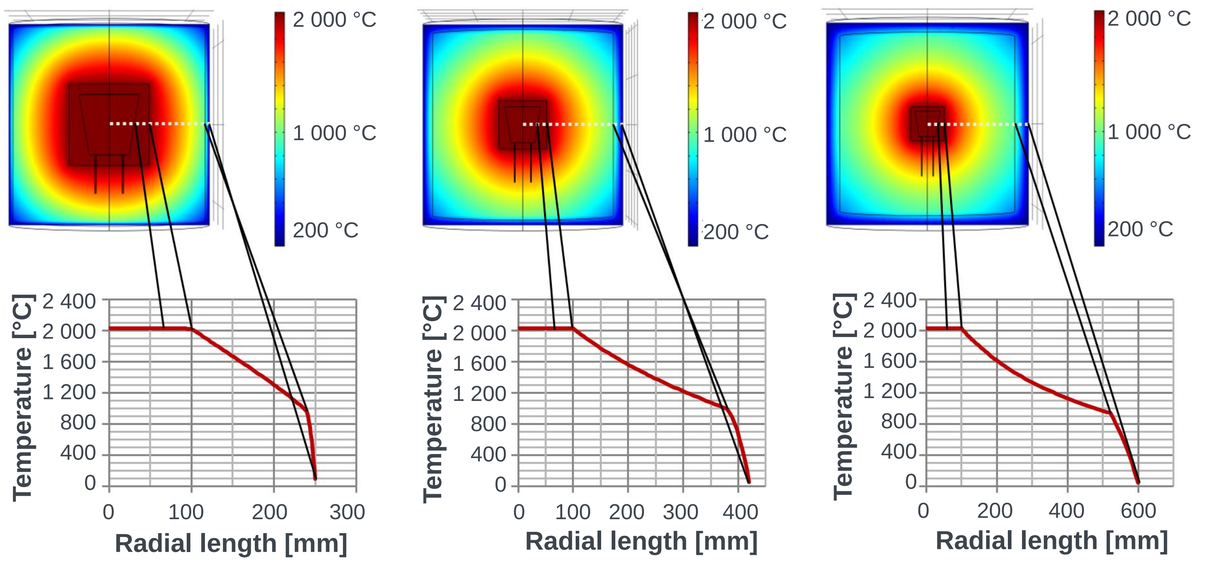
Heat loss rate: 1 026 W | **Heat loss rate: 662 W** | **Heat loss rate: 614 W**

Insulation layers: inside: Zirconia fiber board, middle: Alumina fiber mat, outside: Fumed silica board. Fluid in gap and pores of the thermal insulation materials: air.



Heat loss rate: 1 060 W | **Heat loss rate: 754 W** | **Heat loss rate: 675 W**

Insulation layers: inside: Graphite fiber mat, outside: Fumed silica board. Fluid in gap and pores of the thermal insulation materials: argon.



Heat loss rate: 533 W | **Heat loss rate: 404 W** | **Heat loss rate: 370 W**

Insulation layers: inside: Graphite fiber mat, outside: Fumed silica board. Fluid in gap and pores of the thermal insulation materials: vacuum.

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