
Active Caloric Heat Pipe

New concept for caloric cooling

11.01.2019

K. Bartholomé

- Magnetocalorics:
Active Magnetocaloric Heatpipe

- Elastocalorics:
Active Elastocaloric Heatpipe

Active Magnetocaloric Heat Pipe (AMH)

Motivation

- In order to be competitive on the market in the future, magnetocaloric systems have to be energy as well as cost efficient.
- Essential therefore is a fast heat transfer from the magnetocaloric material to heat sink and source.
- Current systems are mainly based on the active magnetocaloric regeneration concept, where heat transfer fluids are actively pumped between source and sink – limiting the maximum operation frequency and system efficiency.
- In this project, a new concept is realized where the heat transfer is accomplished by evaporation and condensation of a working fluid, promising to enable much larger system frequencies and efficiencies.

Active Magnetocaloric Heat Pipe (AMH)

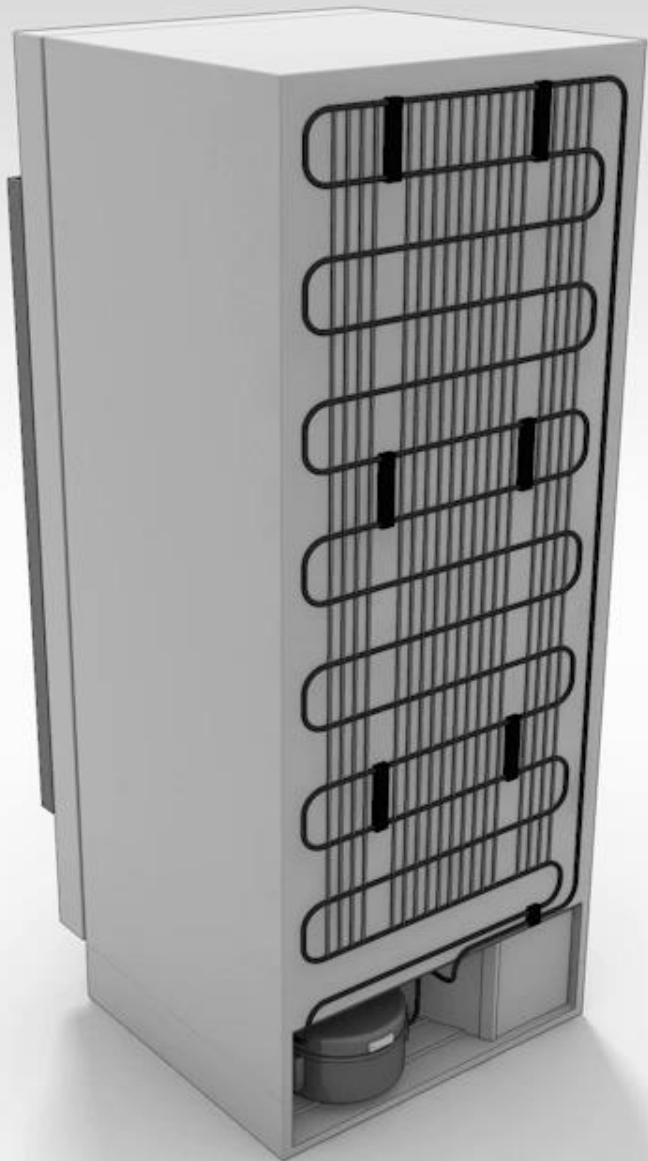
New concept for heat transfer in caloric systems

Alternative system approach

Fast and efficient heat transfer by combining

- Latent heat transfer:
Evaporation and condensation
- Thermal diode:
Passive, uni-directional heat transfer

Magneto-/ Electrocalorics: Patent DE10 2014 010 476
Elastocalorics: Patent pending

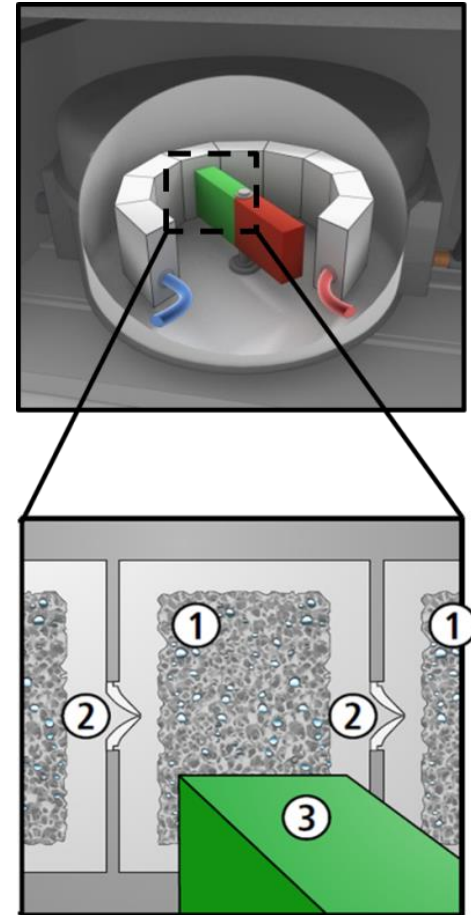


Active Magnetocaloric Heat Pipe (AMH)

New concept for heat transfer in caloric systems

Advantages

- Better heat transfer using latent heat:
 - Higher frequencies
 - Higher cooling power
- Passive heat transfer:
 - No pumps required
 - Higher system efficiency
 - Reduced system complexity



Patent DE10 2014 010 476

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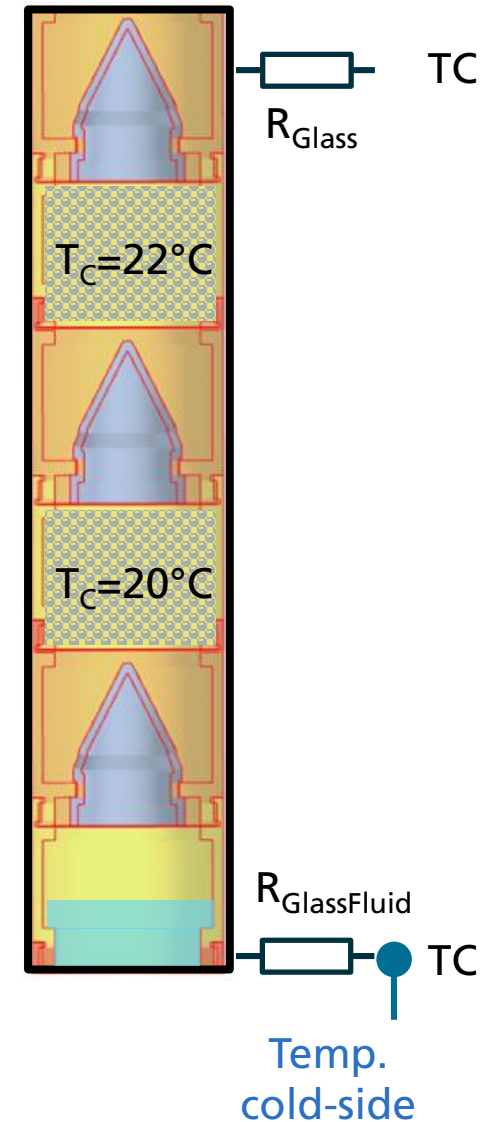
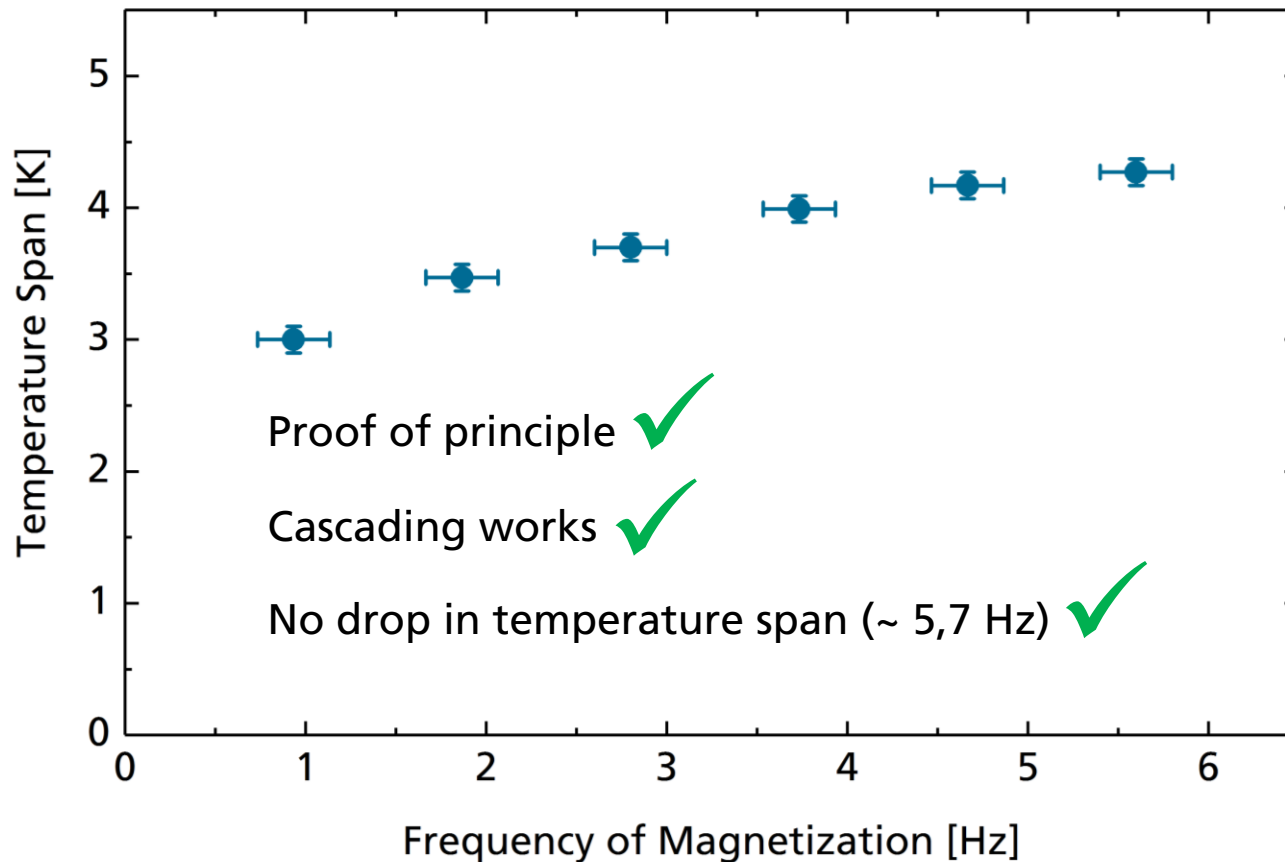
Project MagMed

- Project goal
 - Development of a deep freezer for medical applications based on the AMH-concept
- Project funding
 - BMWFi - Federal Ministry for Economic Affairs and Energy
 - FKZ: 03ET1478A
- Project partner
 - VACUUMSCHMELZE GmbH & Co. KG
 - GSI Technology UG
 - Philipp Kirsch GmbH
 - Fraunhofer IPM



Active Magnetocaloric Heat Pipe (AMH)

Current Experimental Data



Active Caloric Heat Pipe

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- **Magnetocalorics:**
Active Magnetocaloric Heatpipe

- **Elastocalorics:**
Active Elastocaloric Heatpipe

Active Elastocaloric Heat Pipe (AEH)

New concept for heat transfer in caloric systems

Equivalent heat transfer concept applied to elastocalorics:

- Better heat transfer using latent heat:

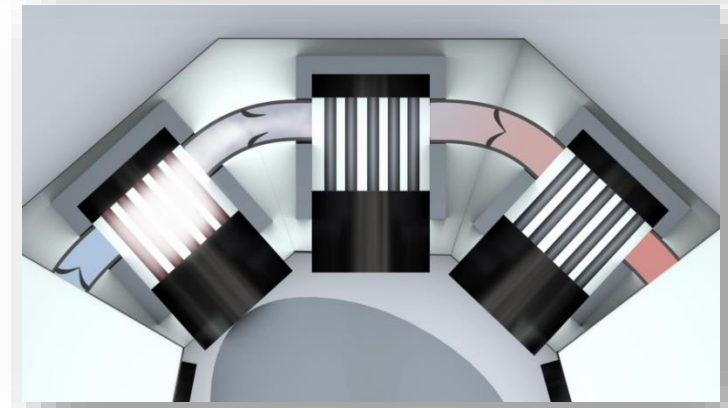
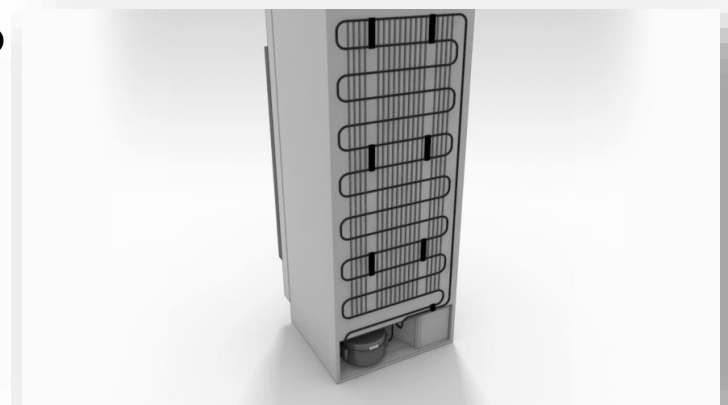
- Higher frequencies
- Higher cooling power

- Passive heat transfer:

- No pumps required
- Higher system efficiency
- Reduced system complexity

- Compression:

- Higher cyclic stability

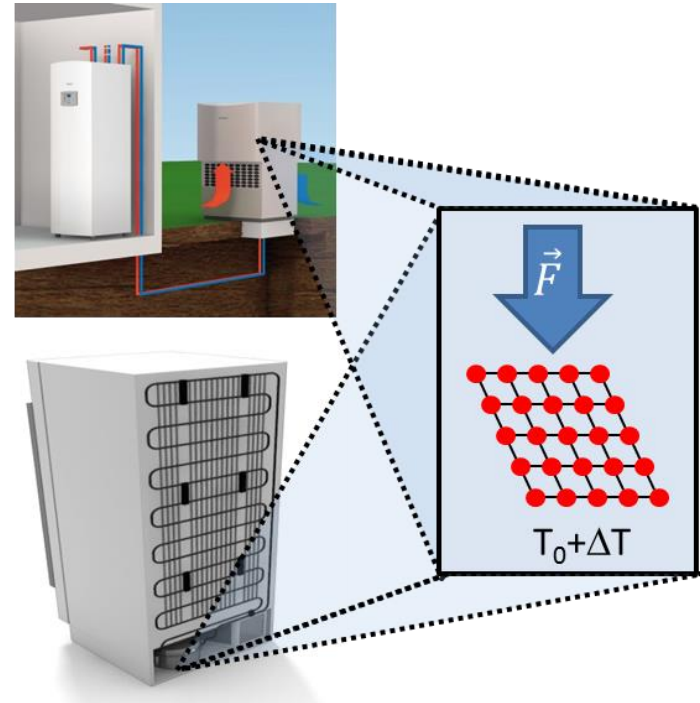


Patent pending

Active Elastocaloric Heat Pipe (AEH)

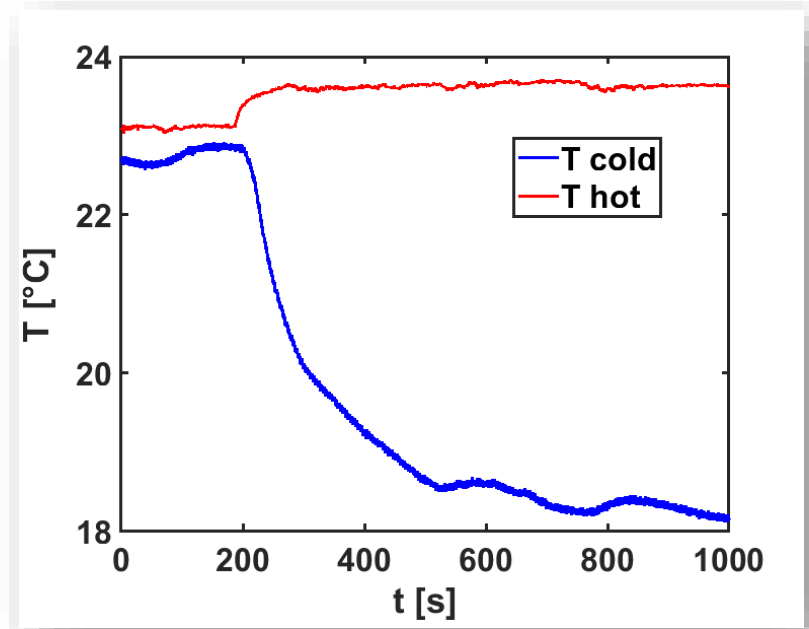
Project ElastoCool

- Project goal
Development of a heat pump based on the AEH-concept
- Project funding
BMBF - Federal Ministry of Education and Research
FKZ: 03VPO4670
- Project duration
08/2018 – 07/2021
- Project partner
Fraunhofer IPM

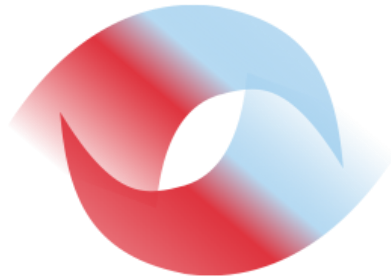


Active Elastocaloric Heat Pipe (AEH)

Current Experimental Data



Project Team



Caloric
Team



Thank you very much for your attention!