University of Ljubljana
Faculty of Mechanical Engineering

SUPERELASTIC POROUS STRUCTURES FOR EFFICIENT ELASTOCALORIC COOLING

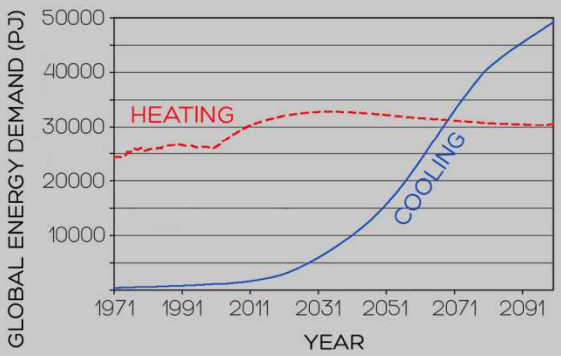
Jaka Tušek

erc
SUPERCOOL

NOW

VAPOUR - COMPRESSION COOLING

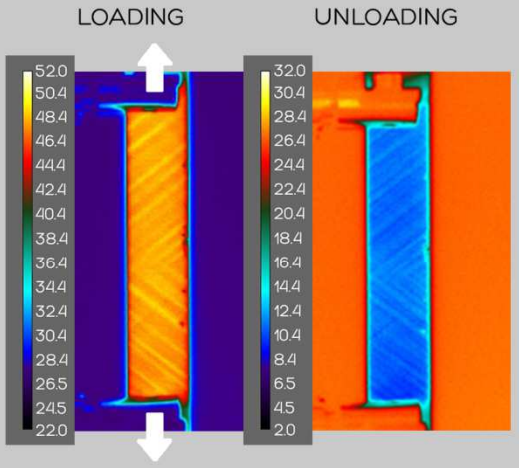
- Over a century old
- Efficiency only up to 30%
- Harmful refrigerants



M. Isaac et al., Energy Policy, 2009

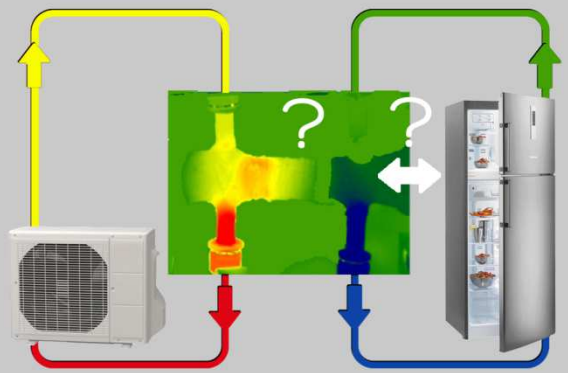
THE MOST PROMISING ALTERNATIVE

THE ELASTOCALORIC EFFECT



J. Tušek et al., Acta Materialia, 2018

ELASTOCALORIC REGENERATIVE THERMODYNAMIC CYCLE



J. Tušek et al., Advanced Energy Materials, 2015
J. Tušek et al., **Nature Energy**, 2016

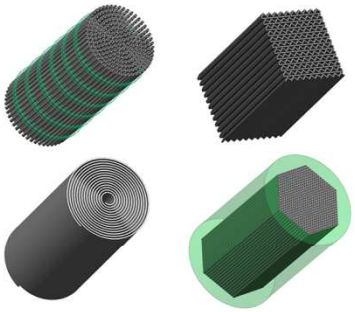
TWO FUNDAMENTAL CHALLENGES:

1. optimal superelastic porous structure
2. efficient driver mechanism with force recovery

SUPERCOOL

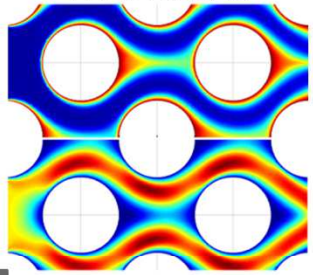
1 ELASTOCALORIC REGENERATOR

FORMING OF SUPERELASTIC STRUCTURES



WP1

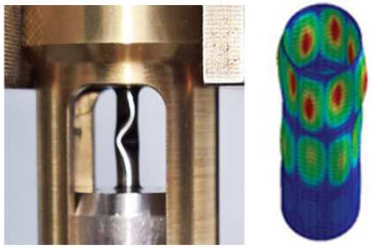
THERMO-HYDRAULIC PROPERTIES



WP2

A. Šarlah, J. Tušek et al., Journal of Mechanical Engineering, 2012

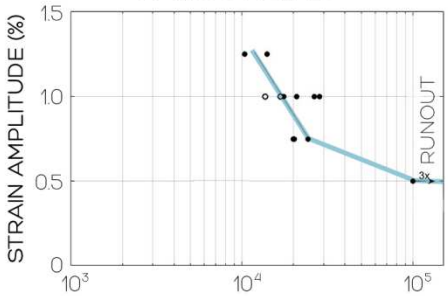
MECHANICAL MODELLING AND STABILITY



WP3

L. Porenta, J. Tušek et al., In progres, 2018

FATIGUE LIFE



WP4

J. Tušek et al., Acta Materialia, 2018

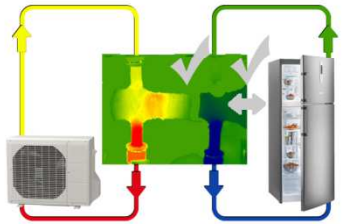
2 DRIVER WITH FORCE RECOVERY

DRIVER MECHANISM

WP5

3 SYNTHESIS

ELASTOCALORIC PROTOTYPE DEVICE



WP6

SUPERCOOL

IMPACT

A **breakthrough** in refrigeration and heat-pumping technologies.

Understanding of application potencial and limitations of elastocaloric technology.

Broader impact: material science, biomedical, civil and mechanical engineering.

LAB

WORLD LEADING LAB IN CALORIC COOLING

LAHDE
LABORATORY FOR REFRIGERATION AND DISTRICT ENERGY

EXTERNAL EXPERTS

LANEM

UNIVERSITAT DE BARCELONA

RUHR UNIVERSITÄT BOCHUM
RUB

CeMEK
Centre for Element and Structure Modelling

TEAM

PI Assist. Prof. Jaka Tušek

- 10 years of unique research experience on caloric cooling (>2 years abroad)
- PI of projects with >0.7Meur
- h-index: 19

PhD1 Žiga Ahcin, MSc (thermal engineering)

PhD2 Luka Porenta, MSc (mechanics)

PhD3 Jan Cerar, MSc (mechanics)

Post Doc1 Parham Kabirifar, PhD (material science)

Post Doc2 Andrej Žerovnik, PhD (design engineering)

Post Doc3 Stefano Dallolio, PhD (thermal engineering)