

KNOW-HOW

July 2017

Short report on Caloric Workshop in Freiburg

- **Sources: Fraunhofer IPM and DKV e.V., compiled by Dr Rainer M. Jakobs**

Solid-state cooling as an alternative to traditional cooling systems formed the focus of the “Caloric Workshop” organised for the first time by Fraunhofer IPM in collaboration with the German Society of Refrigeration and Air Conditioning (DKV) on 28 March 2017. Around 80 participants from the fields of industry and research outlined the opportunities and technological challenges offered by systems based on caloric materials. These constitute a promising technology for both cooling and heating.

Acknowledged experts provided an overview of current developments and trends in magnetocaloric, electrocaloric and elastocaloric systems. Magnetocaloric systems made up the largest proportion of those covered by the workshop. To show how they work, Fraunhofer IPM displayed a number of operating magnetocaloric and elastocaloric demonstrator units from their research projects.

Employees of Fraunhofer IPM provided expert details. The individual presentations were as follows: Dr Rainer Jakobs, of DMJ Consulting, on Challenges in cooling, air-conditioning and heat pump technology.

Sebastian Fähler, of IFW Dresden, on Caloric effects in solid bodies: from new materials to novel concepts in cooling. Examples included the wine cooler from BASF, Astronautics and Haier, and the prototype blood cooler from Kirsch Medical and Cooltech. Fähler imagines a combination of caloric effects – “multi-calorics” – in the future.

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Industrial development of magnetocaloric LaFeSi combinations, by Dr Alexander Barcza, of VACUUMSCHMELZE in Hanau. The LaFeSi alloys have a Curie temperature of 5 K (working range). Cascades in the form of different alloys with coordinated temperature ranges and a temperature range of 20-80 K must be built up.

A presentation on the Central SME Innovation Programme (“ZIM”) network “Magnetocalorics” by Harald Eifert, EurA Consult, Hamburg. The network was established in 2016, with the goal of encouraging product development. It is currently sponsored by Germany’s Ministry for Economic Affairs and Energy (BMWi). See also: www.magnetokalorik.de

Practical challenges for magnetocaloric cooling machines in application, by Robin Langebach, Dresden University of Technology, Bitzer Chair of Refrigeration, Cryogenics and Compressor Technology. He presented the potentials for application in domestic cooling, hotel refrigerators, vehicle air-conditioning, air-conditioning of data centres and supermarkets, and commercial refrigeration.

Caloric cooling machines – on the way to power density and efficiency, by Christian Vogel, GSI Technology, Grünstadt. He explained how the efficiency rating of existing caloric cooling machines can be improved still further. “A key tool here is heat transfer.”

Alternative designs for caloric systems, by Kilian Bartholomé, Fraunhofer IPM. He showed how heat pipes could be used, taking a prototype as an example. This assembly makes it possible to passively transmit the heat that has to be dissipated, and thus much more efficiently than with current methods that dissipate the heat through active fluid pumping. This patented method can substantially increase the overall efficiency of caloric cooling circuits.

The event ended with a recap. Quote from the Fraunhofer IPM press release of 3 April 2017:

Much development work will be needed to construct cooling systems capable of surviving on the mass market based on the progress that has been made. In addition to efficiency and the avoidance of hazardous refrigerants, the fact that caloric cooling systems are noiseless could be a decisive plus in terms of marketability. Considering the ambitious climate goals formulated by Germany's federal government, there is significant market potential for alternative cooling technologies.

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