Elastocaloric cooling: From basic concepts towards novel air cooling devices

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The talk gives an overview of recent results concerning the development of a tensile NiTi-based elastocaloric air cooling device. First, a specifically designed test rig for conductive heat transfer concepts between solid copper blocks has been built that allowing for a systematic investigation of process parameters [1,2]. An analysis of training effects, strain increment, strain rate, or phase angle between loading/unloading and heat transfer on cooling power, temperature span and COP [3,4] identifies optimal processes implementing a hybrid adiabatic/isothermal concept.

The test rig has subsequently been modified to enable experiments with NiTi wires under convective air cooling, which then serve as basis for the design of a novel continuously operating machine. The machine design is presented along with an illustrative simulation tool that assists the design by predicting mechanical and thermal output parameters as a function of, e.g. wire number and diameter, rotational frequency, air flow rate, inlet temperature and loading/unloading profile and hence cooling power and COP [5,6]. Finally, first pictures of the assembled air-cooling device are presented together with infrared measurements to verify the concept.

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