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HIGH-FREQUENCY MAGNETOCALORIC MODULES WITH HEAT GATES OPERATING WITH THE PELTIER EFFECT

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ABSTRACT

At present the most important limit to high-performance magnetic refrigerators is their low frequency. This results in large magnets assemblies which cause rather high costs of the envisaged alternative refrigeration machines. One possible proposal to overcome this situation was published by Kitanovski and Egolf (2009). There proposal is a solution that allows higher frequencies than in up-to-present realized prototypes of magnetic refrigerators and yields the basis of this work.

In this solution a thin magnetocaloric material layer is built into a sandwich structure, respectively between two layers (see FIG. 1). These layers are Péltier elements driven by a sweeping (rotating) magnetic field as it occurs in rotary magnetic refrigerators.

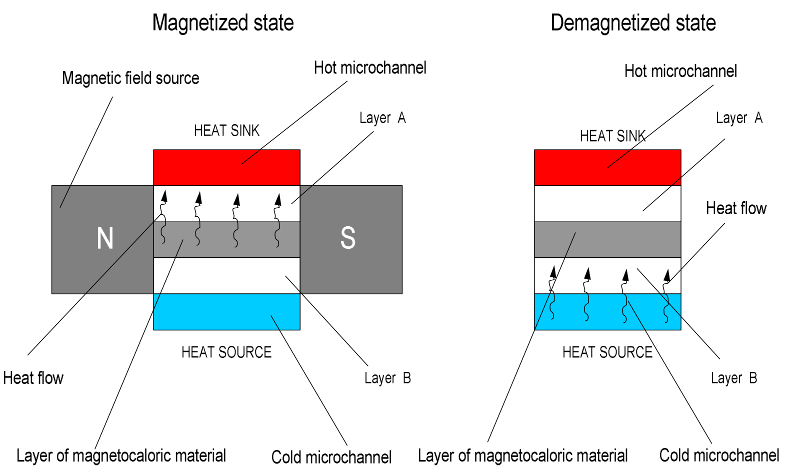

Figure 1: The proposed sandwich structure contains a magnetocaloric material layer between two thermomagnetic gates and two microchannel assemblies for the cold and hot fluid (picture taken from Kitanovski and Egolf, 2009). The thermoelectric switches allow and suppress heat flows by a half period each. By this the two fluid flows are in steady state conditions and high frequencies can be obtained.

The theory of these elements is outlined and based on this predictions of the coefficient of performance *COP* of such elements and of a complete machine – built with such elements – are presented. The predictions made by numerical simulations are based on experimentally determined characteristic quantities of nanotube thermoelectric switches, which are the Seebeck coefficient as a function of temperature, the thermal resistance and the electric resistance. Results on the highest achievable frequencies will be presented.

Kitanovski, A., Egolf, P.W. 2009. *Innovative ideas for future research on magnetocaloric technologies*. Int. J. Refr., **33 (3)**, 449-464.