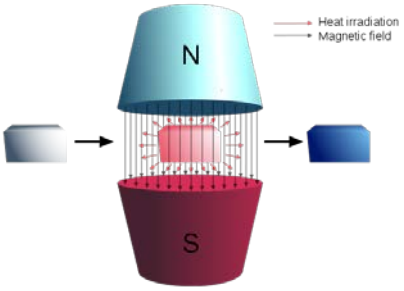
Université de Liège

Design and instrumentation of an experimental system for magnetic refrigeration

Context :
Magnetic refrigeration is an emerging technology relying on the properties of special materials exhibiting the so-called "magnetocaloric effect". When a magnetocaloric material is subjected to a magnetic field in adiabatic conditions, its temperature increases, while its temperature decreases when the magnetic field is switched off. It is therefore possible to design a refrigeration system based on adequate magnetization / demagnetization cycles that exploit successfully the cooling produced by the removal of the magnetic field. This refrigeration method has several advantages compared to traditional techniques, including a better cooling performance and being environmentally friendly.



https://commons.wikimedia.org/wiki/File:Magnetocaloric_effect1_04a.svg

There are however several parameters to be optimized : configuration and amplitude of the magnetic field to be applied, methods of applying and removing the field, shape and size of the magnetocaloric material, duration of the cycles, heat transfer between the magnetic material and the regeneration fluid… The purpose of the present work is to design and construct an experimental system in which the cooling performances of a magnetocaloric material can be demonstrated.

Description of the work :
The master thesis work consists in designing and realising an experimental setup based on several sensors (flow sensors, temperature sensors, Hall effect sensors) and in which the cooling produced by a magnetocaloric material can be demonstrated and monitored. The work consists in designing the magnet configuration, the magnetic material shape and size and the coolant circuitry. This work, involving a strong experimental part, will be carried out in the "Electronics, Microsystems, Measurements & Instrumentation Laboratory" (Prof. P. Vanderbemden) in close connection with "Energy Systems Research Group" of the "Thermodynamics Laboratory" (Prof. V. Lemort).

Profile : electrical engineering, electro-mechanical engineering or physics engineering.
The candidate should have a strong interest for experimental work.

Co-requisite : MECA 0445-2 "Heat transfer" (P. Dewalleff and V. Terrapon).

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