Magnetic Cycles for Heating, Refrigeration, and Power Generation

The objective of this research is the development of efficient energy conversion devices using magnetic cycles. Heating, cooling, and thermal processes are estimated to drive ~50% of total world energy demand excluding transportation. Thus, thermal systems with higher efficiency can have a significant impact on reducing the consumption of primary energy supplies.

Magnetocaloric devices are reversible heat engines utilizing magnetic ordering to effect work and heat transfer. They can be used for refrigeration, heat pumping, and to generate power. The potential for increased efficiency comes from highly reversible work transfer coupled with inherent work recovery. The use of solid working materials and environmentally benign heat transfer fluids ensures that the production and release of GHG and ozone depleting substances are minimized. The ability to generate work provides a new approach to power generation from low-grade sources including solar, biomass, and waste-heat.

The main challenges in magnetic refrigerator development are determining the preferred magnetocaloric properties in a material and the optimal way to use them in a device. High efficiencies require optimal distribution of magnetic work throughout the regenerator. In addition, large power densities are desired so as to minimize capital costs, thus, high operating frequencies are preferred. This leads to challenges with regards to effective heat transfer. Close collaboration with material scientists and industrial partners has made UVic one of the global leaders in the field of applied magnetocalorics.

For further information, please contact Dr. Andrew Rowe.

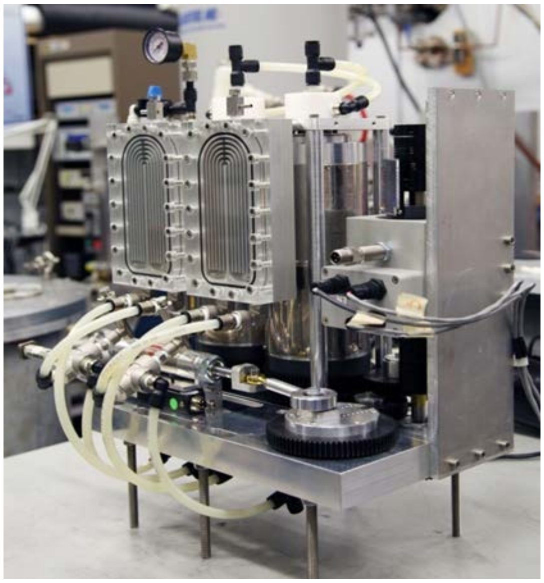

Figure 1. Two permanent magnet refrigeration systems (PM I and PM II) developed at UVic.

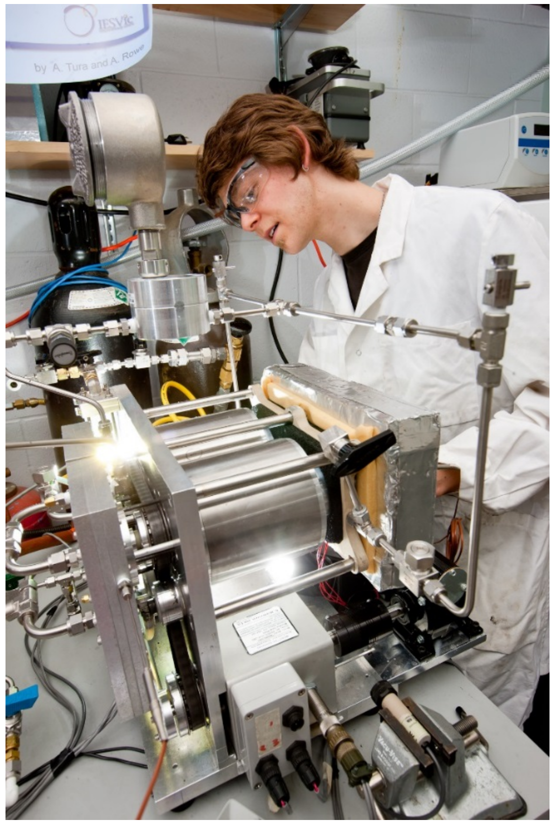

Figure 2. A researcher working with a magnet heat pump using permanent magnet field source.