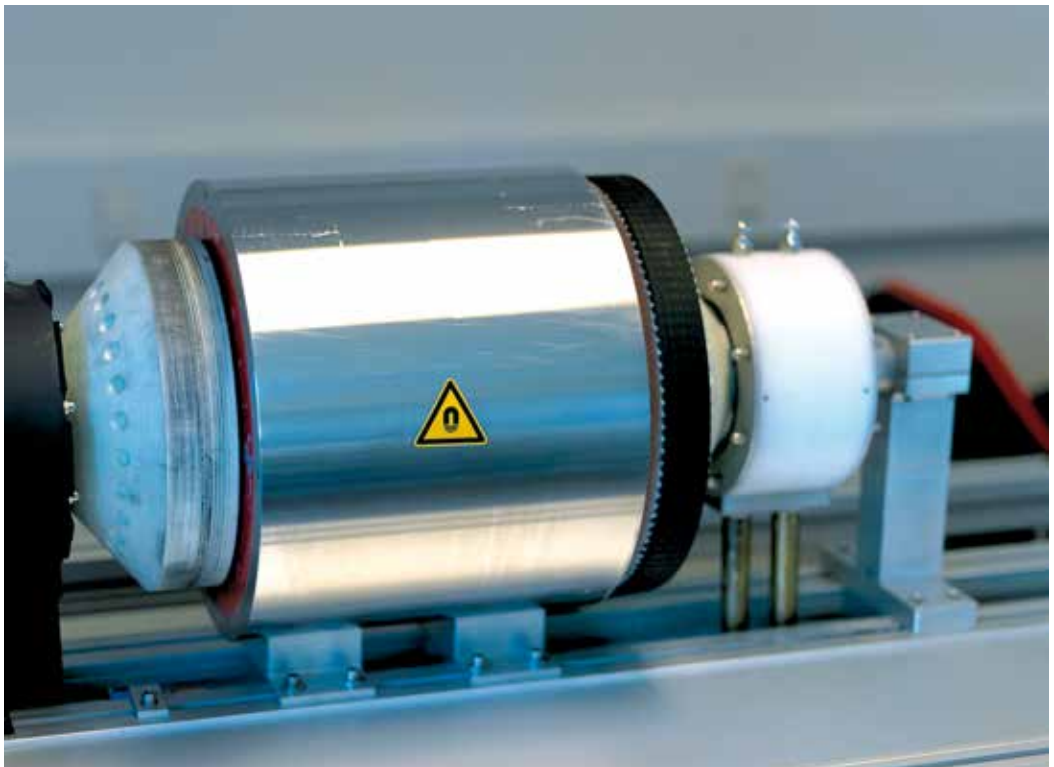


MAGNETIC REFRIGERATION

- EFFICIENT AND ENVIRONMENTALLY FRIENDLY COOLING



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Magnetic refrigeration is an emerging technology that uses solid, non-volatile magnetic materials as the active components and water or alcohol as the medium for heat transport. The technology has great potential for low energy consumption and environmentally friendly cooling at a competitive price.

Traditional refrigeration technology as found, for example, in household refrigerators, relies on compressors to achieve a cooling cycle consisting of the liquefaction and evaporation of a gaseous refrigerant. This is a mature and reliable technology, but it has a number of drawbacks - in particular, that the most widely used refrigerants are greenhouse gases and that small-scale compressors are inherently inefficient.

Magnetic refrigeration is based on a fundamental thermodynamic property of magnetic materials, the so-called magnetocaloric effect,

which causes a temperature change if the material is subject to a magnetic field applied under adiabatic conditions. Similar effects occur in other materials when subjected to, e.g., mechanical stress (elastocaloric) or electrical fields (electrocaloric). The fact that these effects are reversible allows a higher efficiency to be achieved. A caloric material can be used as the active element in a refrigeration apparatus, by subjecting it periodically to an external field while transferring heat to and from it.

The Department of Energy Conversion and Storage covers all aspects of magnetic refrigeration, including materials research and characterization, advanced numerical modelling, magnet design, and systems design and construction. We have developed a range of instruments and techniques for characterizing magnetic materials in detail which in combination with modelling allows for optimization of the systems design. The technology has been demonstrated in several prototype cooling devices with world class performance.

Like other cooling technologies, magnetic refrigeration can be used 'in reverse' as a heat pump. We are leading a large project funded by Innovation Fund Denmark with the goal of using magnetocaloric technology in domestic heat pumps. Based on our expertise in magneto-calorics we are also exploring the potential of other caloric technologies.

ABOUT THE DEPARTEMENT

We focus on functional materials and their applications for sustainable energy technologies

FURTHER INFORMATION

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