

Ph.D.-defense

Rasmus Bjørk defends his Ph.D. thesis Monday 28 June at 2 p.m. in Niels Bohr Auditorium. The title of thesis is "Designing a magnet for magnetic refrigeration".

The opponents will be: Peter Vang Hendriksen (ABF)
Professor John Michael David Coey (Trinity College, Dublin, Ireland)
Assoc. Professor Andrew Rowe (Univ. Victoria, Canada)

Abstract

The thesis investigates the design and optimization of a permanent magnet assembly for use in a magnetic refrigeration device. In order to design an ideal magnet assembly the properties and performance of magnetocaloric materials as a function of magnetic field are investigated. Following this the process utilized by a magnetic refrigerator to provide cooling, called active magnetic regeneration (AMR), is described and the performance of the AMR as a function of the magnetic field is investigated. Other published magnet designs used in magnetic refrigeration devices are also evaluated, using a figure of merit based on the properties of the investigated magnetocaloric materials, to learn the properties of the best magnet designs to date. Once it has been determined which properties are desirable for a magnet used in magnetic refrigeration the design of a new magnet for a new magnetic refrigeration device being built at Risø DTU is described. As a basis for the magnet design the concentric Halbach cylinder design is chosen. This design is then optimized by employing several developed optimization schemes that lower the flux density in a specific region and lower the amount of magnet material used in a given magnet assembly. These schemes are applied to a numerical model of the magnet design. Afterwards the magnet design is dimensioned and segmented to allow construction. This design has been constructed and the flux density measured. Finally, the magnetic forces internally in the magnet design and on the magnetocaloric material inside the magnet assembly are analyzed.