FYSICA 2013 Focus session

Energy for the future

Materials for magnetic refrigeration

F. Guillou, Fundamental Aspects of Materials and Energy (FAME), Faculty of Applied Sciences, Delft University of Technology

The magnetocaloric effect (MCE) is the temperature change of a magnetic material resulting from an external magnetic field change. Involving this effect into a thermodynamic cycle could lead to a broad range of applications, from thermomagnetic devices where the machine converts a thermal energy into a magnetic work (and latter to electricity), to heat pumps where a magnetic work is used to transfer thermal energy from a cold source to a hot sink or *vice versa*.

Currently, one of the most attractive MCE application is the magnetic refrigeration at room temperature. This cooling technic offers the possibility to advantageously replace the conventional vapour compression technology since it has an higher efficiency and it does not use refrigerant gases which are greenhouse gases.

The search for magnetocaloric materials displaying large performances paves the way for the development of the magnetic refrigeration and all the other hypothetic MCE applications. Since more than one decade, a special interest is paid on materials having their MCE around first order magnetic transitions. However, working around solid-solid discontinuous phase transitions also leads to drawbacks (hysteresis, volume change...) that could make these materials unsuitable for applications. Here, will be presented a few results on new materials, derived from the $Mn_{2-x}Fe_x(P,Si)$ family[1], combining an intense MCE and practical advantages that make them especially interesting for applications.

1- Nguyen H. Dung., *et al.*, Mixed Magnetism for Refrigeration and Energy Conversion, Adv. Energ. Mater. **1**, 1215 (2011).