Ozone-friendly magnetic refrigerators – an alternative to conventional cooling technology for energy saving

Overview

Air conditioners and refrigeration make a major contribution to the global energy consumption. Conventional refrigerators work on energy-guzzling vapor-compression technique and they produce hydrofluorocarbons that are greenhouse gases that contribute to global climate change when they escape into the atmosphere. Thus, there is a strong thrust to develop an energy-efficient technology. Magnetic refrigeration is an environmentally friendly technology that uses magnetic fields to change a magnetic material's temperature (i.e. the magnetocaloric effect - MCE) and allows the solid material to serve as a refrigerant. This technology is energy efficient, eco-friendly and produces low vibration and noise. Thus, the need of the hour is to find suitable magnetocaloric materials that are cost-effective and exhibit large MCE spanning over a wide temperature range from low to room temperatures. Our research aims to develop magnetocaloric materials for active magnetic refrigeration applications.

Key Features

- Developing advanced materials with magnetocaloric effect for energy efficient refrigeration.
- Rare-earth free, economic Ni-Mn based Heusler alloys, Mn- based alloys, exhibiting first-order transition are being explored for magnetic refrigeration
- A huge inverse magnetic entropy of 17 J/kg-K in Ni-Mn based Heusler alloys and 19 J/kg-K in Mn-Fe-P-Si alloy (normal magnetic entropy) are obtained near ambient temperature at 3 T magnetic field

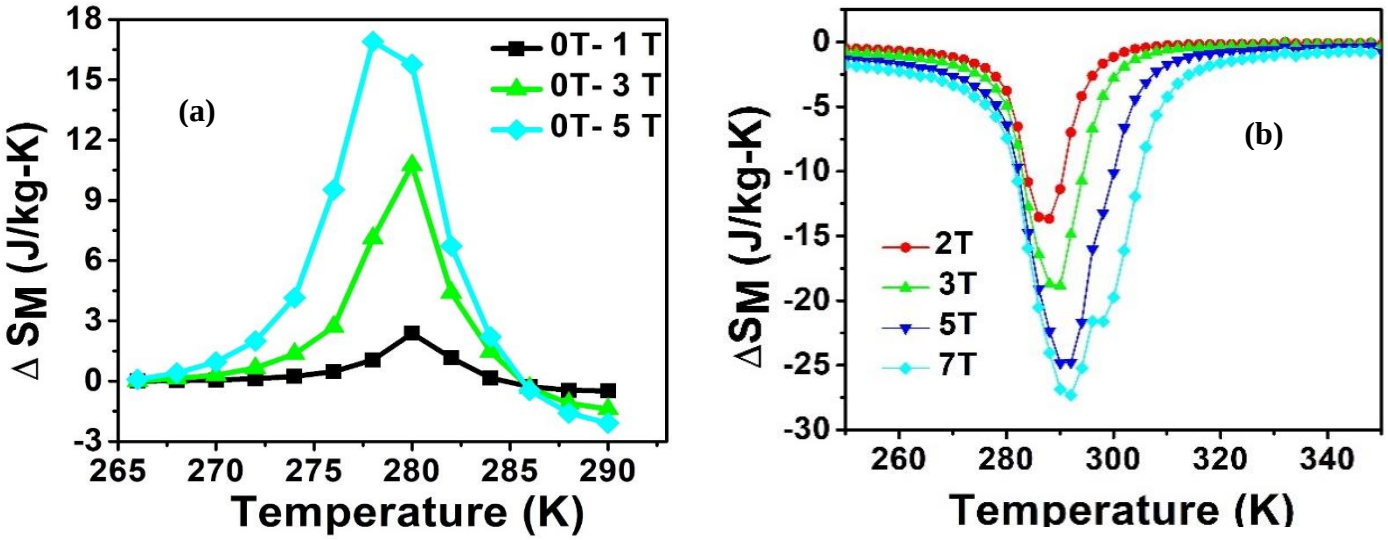
Potential Applications

- Household refrigerators
- Air-conditioning (Halls, automobiles etc.)
- Food preservation

Intellectual Property Development Indices (IDPI)

- Synthesized single phase and prudent Ni-Mn based and Mn based magnetocaloric materials, which exhibits magnetocaloric effect at ambient temperatures.
- Upscaling of the magnetocaloric materials is underway
- Development of prototype to demonstrate magnetic refrigeration is under progress.

Technology Readiness Level (TRL): TRL 3



Variation of magnetic entropy with temperature of (a) Ni-Mn-Sn Heusler alloy doped with B (b) Mn-Fe-P-Si alloy

Publications:

S.Kavita, V.V.Ramakrishna, Poonam Yadav, Sravani Kethavath, N.P.Lalla, Tiju Thomas and R.Gopalan, J.Alloys and Comp., **795**,519 (2019)