Abstract

The magnetic cooling technique based on the magnetocaloric effect (MCE) shown by certain magnetic materials is considered in recent years as one of the best alternative to conventional systems, thanks to its benefits in terms of energy efficiency and environment safety [1,2]. The magnetocaloric material which plays the role of refrigerant in MCE-based devices is a key parameter for the development of this technology, since it impacts directly the device performance. For room-temperature tasks, a new class of compounds with giant MCE has been reported over the past two decades [1]. Today’s research activity is mainly devoted to the optimisation of their magnetic, magnetocaloric, chemical and mechanical properties. However, materials displaying excellent magnetocaloric properties in the low temperature regime are also required for use in several applications such as scientific experiments, hydrogen and helium liquefaction as well as space industry. Here, we report on the magnetic and magnetocaloric properties of some selected multiferroic oxides, such as HoMn$_2$O$_5$ and La$_2$(Ni,Co)MnO$_6$ compounds which exhibit phase transitions from 10 K up to almost room temperature. Different reasons are behind the study of the magnetocaloric effect in the multiferroics: 1) Their insulating character prevents thermal losses caused by eddy currents in magnetic refrigerators. 2) The potential modification of their full entropy by an electric field. 3) The Chemical stability and 4) The possibility to build multifunctional devices. Additionally, the gigantic magnetic anisotropy exhibited by certain multiferroics enables to obtain a large magnetocaloric effect simply by rotating these materials within a constant magnetic field [3] opening the avenue for the implementation of more compact and efficient magnetic liquefiers.