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MAGNETOCALORIC EFFECTS IN MANGANITES WITH PEROVSKITE STRUCTURE

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Magnetocaloric refrigeration is a promising alternative technique for low-temperature cooling to replace the conventional gas expansion-compression technique based on the use of toxic gases like the CFC or the HCFC. This novel technology presents several advantages, in fact besides the property of being environmentally friendly (it does not use coolants or emit greenhouse gases), it undergoes a higher efficiency and it is compact in size.

Magnetocaloric materials, when subjected to a magnetic applied field at their phase transition temperature, undergo a magnetic transition which results in the entropy change of the magnetocaloric materials. This phenomenon is known as the magnetocaloric effect (MCE). This entropy change results in a temperature change that can be used to heat/cool the coolant. Amongst the different materials that exhibit MCE (Gd, $Gd_5Si_2Ge_2$, Ni-Mn-Ga, Mn-As-Sb, …), the family of magnetic oxides with perovskite structure known as manganites have also shown interesting MCE, for a large temperature range around room temperature.

In this work, we are interested in the study of the MCE deduced from isothermal magnetization curves in manganites with several compositions in order to achieve materials witch are suitable to be used in magnetic refrigeration technique. Several compounds with general formula $La_{1-x}M_xMnO_3$ where M is a divalent alkali-earth (Ca, Ba, Sr) or monovalent (Na, Ag, K) elements have been elaborated using the solid state reaction method at high temperature and characterized by X-Ray diffraction and magnetization measurements versus temperature and versus magnetic applied field. The entropy change versus temperature and versus magnetic applied field has been deduced from the magnetic measurements and will be presented. Our results, compared to that observed in Gd or GdSiGe for example, show that the manganites exhibit a giant MCE around or above room temperature and are suitable for applications in the magnetic refrigeration area.