The magnetocaloric effect in amorphous and nanostructured materials

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The magnetocaloric effect, i.e. the reversible temperature change experienced by a magnetic material upon the application/removal of a magnetic field, is becoming a topic of increasing research interest due to the potential applications of this phenomenon for energy efficient and environmental friendly refrigeration at room temperature [1].

From the materials science point of view, research on this topic is mainly focused on the discovery of new materials with low cost and enhanced performance (namely, magnetic entropy change, ΔS_M, refrigerant capacity, RC, and adiabatic temperature change, ΔT_{ad}).

An alternative approach is to employ materials engineering techniques for the optimization of already existing materials. The use of known materials as building blocks for developing composites, graded materials, etc. is already giving promising results due to the deep knowledge of the constituent phases that has been already achieved [2]. It is also important to mention the possibility of employing nanostructured materials for magnetic refrigeration, which is emerging in the recent years. It has been shown recently that nanostructuring can alter not only the quantitative magnetocaloric response of a material, but also its qualitative behavior, which can be completely different from that of the bulk counterpart [3].

This talk is an overview of the magnetocaloric properties of amorphous and nanostructured materials which undergo second order phase transitions, paying special attention to open problems which need to be solved to enhance the applicability of these materials for magnetic refrigeration.

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[3] V. Franco, K.R. Pirota, V.M. Prida, A.M.J.C. Neto, A. Conde, M. Knobel, B. Hernando, M. Vázquez, Phys. Rev. B **77** (2008) 104434.