Structure and Dynamics of Magnetocaloric Materials

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The search for more efficient use of energy has been leading to a growing interest in the research field of magnetocaloric materials. The magnetocaloric effect (MCE) describes the change of temperature or entropy of a material when exposed to a change of the magnetic field and forms the basis of magnetocaloric refrigeration technologies [1].

In the last years there has been an upsurge in the knowledge of the MCE and many materials have been investigated for their MCE characteristics [2]. In the context of this talk, I will present the field direction dependence of the thermo-magnetic behavior in single crystalline compounds $MnFe_4Si_3$ and Mn_5Ge_3. The emphasis will be on the direct measurement of the adiabatic temperature change ΔT_{ad} in pulsed magnetic fields as it provides the opportunity to examine the sample temperature response to the magnetic field on a time scale close to the real process used in applications [3]. A discussion of how the anisotropy affects the magnetocaloric effect and a comparison between $MnFe_4Si_3$ compound, which exhibits easy plane anisotropy, and Mn_5Ge_3 which features uniaxial anisotropy, will be also presented [4].

The Mn_5Si_3 compound exhibits inverse MCE related to the antiferromagnetic order phase transition AF1 to AF2, and direct MCE related to the AF2 to the paramagnetic phase transitions. Previous studies indicate a transition from the AF1 to AF1' before reaching the AF2 phase [5]. The magnetic structures of the AF1 and AF2 phases have been established [6, 7], while the magnetic structure of the AF1' phase has not been studied before. Therefore, the second part of the talk will be devoted to discuss the results of the investigation of the nuclear and magnetic structure of the intermediate phase AF1' of the single crystalline compound Mn_5Si_3.

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