

Knihovna FZÚ, Cukrovarnická 10, Praha 6

Čtvrtek, **8. 1. 2014** od **14:30** hod.

Direct Measurements of Magnetocaloric Properties of Magnetics in Bitter Magnet: New Techniques and Materials

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Recently there is a growing interest of researchers in different countries, in creating of the new solid state materials with large effects of change their internal energy in external fields. For example, it leads to magnetocaloric effect (MCE) in magnetic fields, under hydrostatic pressure to barocaloric effect (BCE), under external uniaxial tension to elastocaloric effect (ECE) and in general these effects and their combinations are treated as multicaloric effect.

In order to describe these effects in different solids quantitatively it is important to take into account main factors, particularly, temperature change in adiabatic conditions under action of the field, transferred heat in isothermal conditions and work of the external field at field cycling as the measure of irreversibility of the energy transferring processes. Thermal capacity dependence on temperature and external field is crucial for the quantitative description of these processes too. We present results on the tests of technique which allows one to measure in the field of Bitter coil magnet up to 14 T to measure all three quantities for MCE: ΔT in adiabatic regime, ΔQ in quasi-isothermal regime, to measure $M(T, H)$ in quasi-adiabatic regime, which give possibility to calculate work produced in quasi-adiabatic process by magnetic field at turning on and off the magnetic field and so to estimate fundamental irreversibility in the process. Results are presented for Gd, MnFe(P,Si,B) and Ni-Mn-Ga, Ni-Mn-In-Co Heusler alloys.