Mo.L-P08 - KINETICS OF PHASE TRANSITIONS IN MAGNETOCALORIC MATERIALS

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The problem of rate of phase transitions (PTs) requires an indispensable solution, because the creation of new technologies based on “giant” effects in vicinity of PTs in magnetic materials is impossibly without solving of this problem. The magnetocaloric effect reaches its peaks near the PTs in magnetics, therefore knowledge of PT’s rate is necessary for creation of new technology of magnetic refrigeration at room temperature. The rate of PT limits the frequency of thermodynamic cycles. Accordingly, the power of refrigeration will depend on the frequency of cycles, and it is difficult to judge the profitability and competitiveness of the creation of this machine without determining the parameters of power. In this paper, we present a new technique for experimental study of the kinetics of the magnetic PTs under low alternating magnetic field, and the theoretical calculations of respective kinetic processes. The new dynamic thermo-magnetometer (DTM) is proposed for solving the problem of the experimental study the rate of the magnetic PT with response time of 10 ms. DTM is designed for measuring the time dependence of the magnetic susceptibility of thin plates of ferromagnets at an abrupt temperature change in water flow. The experimental measurements of the magnetic susceptibility of the samples were carried out with the help of a three-coil differential transformer. An AC signal with a frequency of 1-10 kHz was supplied to the outside coils. The measured signal was taken from the central coil. The temperatures of both samples and water were measured using thin differential thermocouples. As a result of experiments for Gd near Tc = 20 C relaxation time of magnetization is about 50 ms. Then the frequency of the cycles of a magnetic refrigerator with a working body made of Gd plates will be restricted to a value of f = 10 Hz.