COMBINED STUDY OF MARTENSITIC AND MAGNETIC TRANSITIONS IN Cu-Mn ALLOYS

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The Cu_xMn_{1-x} alloys belong to those shape memory materials in which a strong correlation between the structural martensitic transformation and an antiferromagnetic ordering takes place [1]. It is generally assumed that this correlation is important for mechanical properties of the alloys because the structural transition into the martensitic phase could be initiated by the anisotropy of the exchange interaction. However, the nature and the mechanism of this phenomenon are not clear yet. To understand it the processes in both the lattice and the magnetic subsystems should be carefully studied. But the experimental methods used usually for these purposes are able to investigate mainly one of the subsystems. And the comparison of results obtained by different methods seems to be unreasonable if different samples were used. This is because the thermal treatment strongly effects the properties of samples with the same chemical composition.

Therefore a combined study of Cu_xMn_{1-x} samples treated by the same way was started in PNPI and St.Petersburg University. A set of the mechanical, electro-magnetic and nuclear-physical methods are planed to be used. The preliminary results for $Cu_{54}Mn_{46}$ alloy presented below.

The temperature dependence of the deformation under the constant strain 65 MPa showed that the martensitic transformation occured with the decreasing of temperature below 350 K. Contrary to the published data [1] no essential temperature hysteresis of the transformation was observed. The kinetics of the stress accumulation in the sample loaded by the strain 75 MPa at 90 K is presented in Fig.1. The stress accumulation rate was nearly constant in the interval 90-115 K but it was decreased above 120 K. This change of the rate could be caused by some structural transformation.

The behaviour of the elastic modulus E and the internal friction Q^{-1} was studied by the ultrasonic spectroscopy. The temperature dependence of E had only one minimum around 320K related obviously with the structural phase transition. Below 300K the elastic modulus was increasing with the decreasing of temperature without any singularities. The temperature dependence of Q^{-1} was more complicated and contained at least three peaks denoted as A,B and C in Fig.2. Two of them were caused by the structural transformation (A) and by the movement of the twin boundaries in the martensitic phase (B) [2]. The origin of the third peak C is not clear at present. It could be related with some change of the magnetic structure.

The magnetic subsystem was studied by μSR-method. Fig.3 represents the temperature dependence of the integral probability of the decay positron detection n_e measured along the initial muon polarization without an external magnetic field. At T>320 K the magnetic phase was paramagnetic and n_e had a maximal value. The decrease of n_e below 310 K indicated that spontaneous magnetic fields appeared in the sample due to the formation of a ordered magnetic phase. So, the magnetic phase transition occured at 310 K. Below 150 K the value of n_e seems to correspond to the case when a quasistatic internal magnetic field occupy the total volume of the sample. According to the measured temperature dependence of the muon

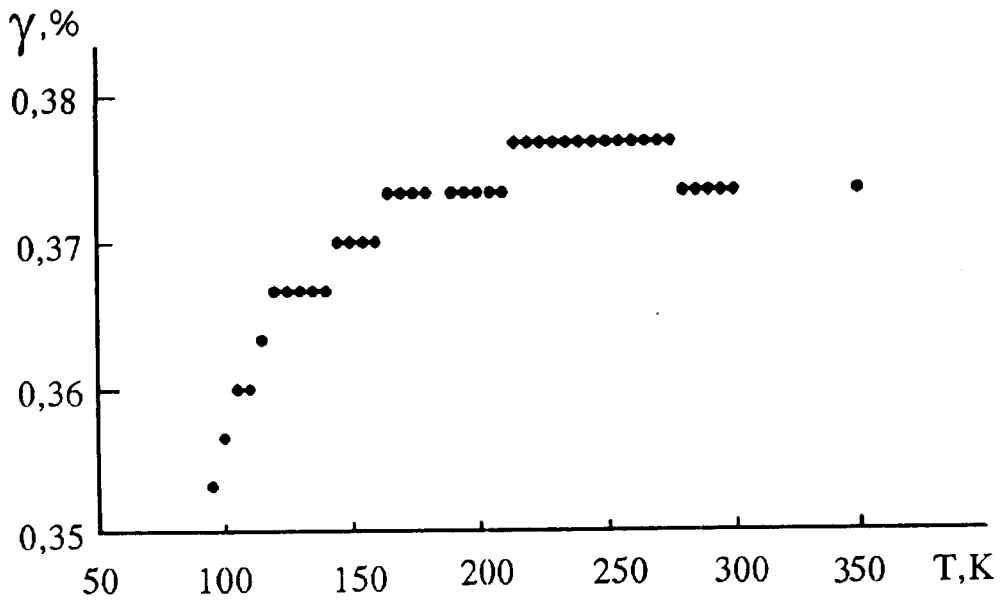

Fig.1. The temperature dependence of the deformation at the heating under the strain 75MPa

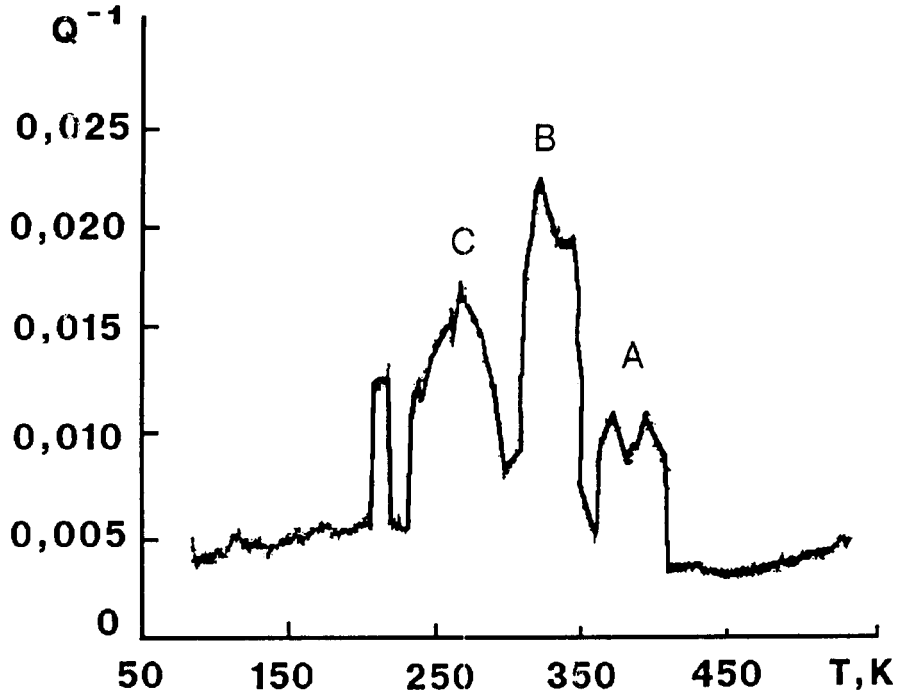

Fig.2. The temperature dependence of the internal friction

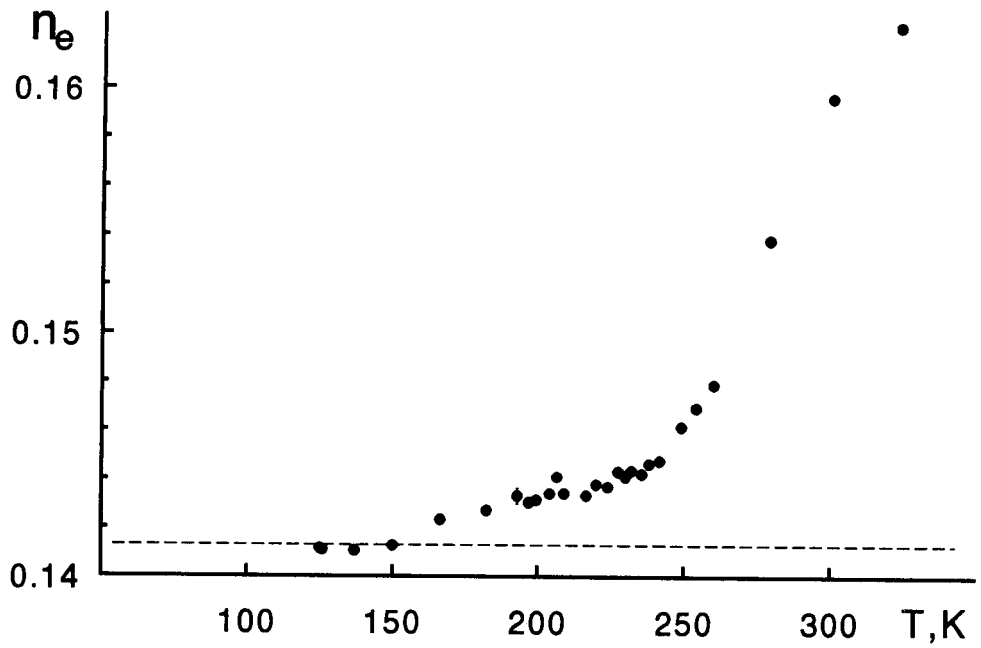

Fig.3. The temperature dependence of the integral probability of decay positron detection at $H = 0$

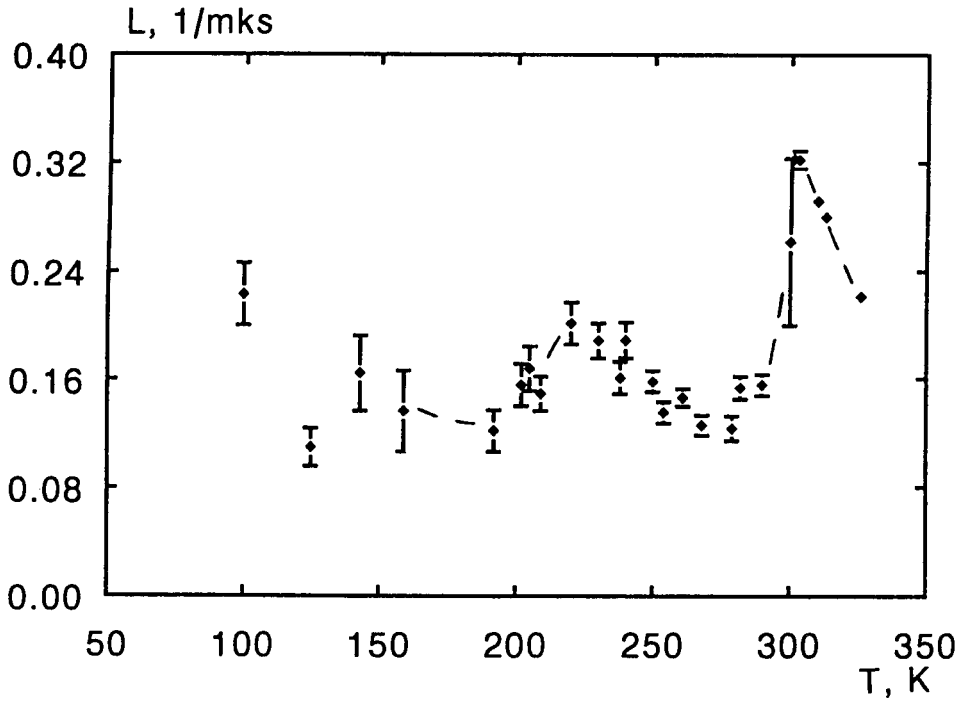

Fig.4. The temperature dependence of the muon depolarization rate at $H = 0$

depolarization rate L (Fig.4) a significant dynamics of the local fields remained well below the magnetic transition. The peak on $L(T)$ in the temperature interval 200-250 K could be caused by some change of either the magnetic or the crystallic structures.

So, the results obtained by each of the different experimental methods had some special features in nearly the same temperature regions. At 300-350 K these features were obviously related with the martensitic and the magnetic transitions. Of course, the preliminary data presented above do not allow to get any definition on the interrelation of the both transitions. They rather demonstrate the perspective of the further study. Besides, some interesting phenomena observed in the region 200-250 K should be also investigated.

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SPATIOTEMPORAL CHAOS AND SELF-ORGANIZATION OF CRITICAL STATE IN TWO-DIMENSIONAL JOSEPHSON LATTICE

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There was shown earlier [1] that the equations for currents in twodimensional Josephson lattice are equivalent to that of two-dimensional sandpile and hence the system is self-organized. In present work [2] we studied these equations and their generalized modifications in stationary state for the case of zero temperature both with closed and open boundary conditions. We found that an open system exhibits spatiotemporal shaos both for deterministic and stochastic source. For a closed system only periodic solutions were found.

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DEPENDENCE OF ELECTRICAL FIELD VECTOR ON THE ANGLE BETWEEN MAGNETIC FIELD AND TRANSPORT CURRENT FOR HTSC CERAMICS

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We have performed detailed measurements of both component of electrical firld vector E_z and E_y for samples of 1–2–3 Y-HTSC ceramics depending on transport current along axis z and on angle α between the external constant magnetic field, applied in plane of sample and direction of current. It should be noted that we could not find other works on