NNN 8 P FERROMAGNETISM IN SUPRACONDUCTING BICRYSTALS OF Bi-Sb ALLOYS

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The coexistence of superconductivity and weak ferromagnetism is one of most charming problems of solid state physics. We studied the magnetic moment $m(T)$ of superconducting bicrystals of B_{1-x} - Sb_x ($x \leq 0.2$) alloys (diamagnetic and paramagnetic), as a function of applied magnetic field up to 20 kOe at several temperatures (2-100 K). Large magnetic hysteresis loops [see Figure 1(a)] characteristic of type-II superconductors with lower critical field

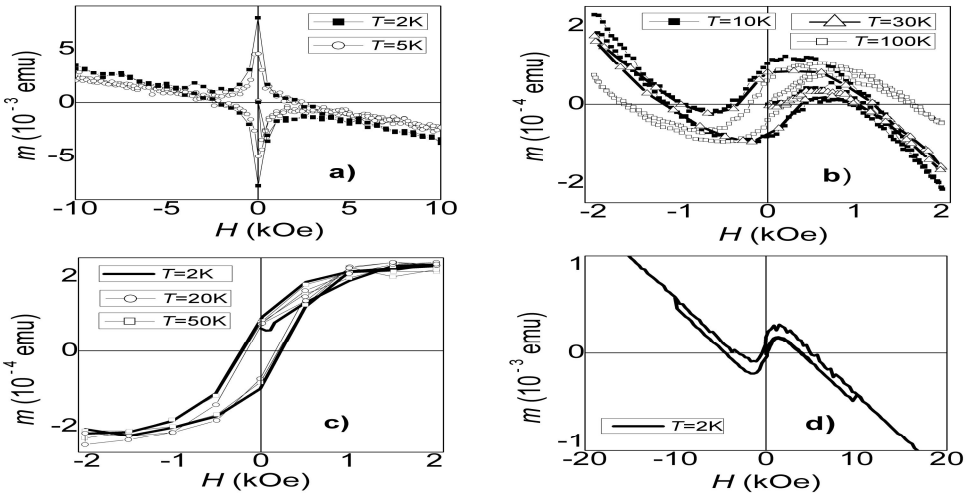

Fig 1. Magnetic hysteresis loops of bicrystals of Bi_{1-x} - Sb_x ($x \leq 0.2$) alloys

$H_{c1} \sim$ (100-130) Oe were revealed at $T < 9$ K in bicrystals with diamagnetic dependencies of $m(T)$. As the temperature increases above 9 K, the hysteresis loops change significantly and resemble those of feromagnetic materials [see Figure 1(b)]. On the other hand, in our bicrystals with paramagnetic dependencies $m(T)$, ferromagnetic hysteresis loops [see Figure 1(c,d)] are observed in the whole temperature interval under study, despite of diamagnetic response at $T < 5$ K. At the same time, no noticeable change in the form and width of hysteresis loops on temperature was detected. The exception is the hysteresis loops of some samples at $T < 4$ K which are closed by an unusual jump and which extend into higher magnetic fields.

The revealed features of magnetic properties of bicrystals of Bi_{1-x} - Sb_x ($x \leq 0.2$) alloys are not caused by CI reorganization. It is clearly shown by the similar Fermi surface consisting of CI layer components and crystalline blocks. At the same time, the deformation and the increase of volume of the isoenergetic surfaces of charge carriers at CI observed in our bicrystals specify common electronic origin of these phenomena, which, together with the updating of the phonon spectra, favor spin independent coupling and superconductivity or lead to the magnetic ground state and ferromagnetism.