Ya. S. Shur. *Magnetization reversal of magnetically uniaxial highly anisotropic ferromagnetics.* Interest in ferromagnetics of this class stems from the fact that the alloys from which the best modern permanent magnets are made have been identified among them in recent years.

High anisotropy is manifested in the fact that after preliminary magnetization, a crystal of arbitrary shape will not be demagnetized under the action of its intrinsic demagnetizing field. This occurs when $K \gg 2\pi I_s^2$, where K is the constant of magnetic anisotropy and I_s is the saturation magnetization. In this case, $H_c = 2K/$

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$J_s = H_a$ in magnetically uniaxial crystals, where H_c is the coercive force and H_a is the magnetic anisotropy field. However, this has not been confirmed experimentally, since $H_c < H_a$. Thus, $H_a \sim 400$ kOe in SmCo$_5$, the best modern alloy for permanent magnets, whereas the highest coercive force reached in experiment is $H_c \sim 50$ kOe.

The Institute of Metal Physics (IFM) Laboratory of Ferromagnetism has been studying the causes of this discrepancy for several years. Most of the progress has been made in studies of the magnetic properties of single-crystal films of the compound MnBi. The Kerr magneto-optical effect in these films was used to study the domain structure, which was compared with magnetization curves measured on the same specimens with both partial and complete hysteresis loops. The following patterns were established on certain specimens. A multidomain structure was observed in the demagnetized crystals. Applying and switching off a field H_1 that does not cause disappearance of the domain structure produces a reversible shift of the domain boundaries. This indicates that the crystal is free of defects. Consequently, no hysteresis loops appeared on cyclic variation of H_1. But if the domain structure disappears completely in a magnetizing field $H_2 > H_1$, magnetization reversal occurs in large fields equal to H_a. The hysteresis loop is then square, and the crystal's magnetization is reversed all at once. A specimen brought into this state can no longer be demagnetized by the field. Thus, it was shown for the first time in the case of these crystals that $H_c = H_a$ in defect-free crystals. A narrow hysteresis loop was observed even in weak fields in other MnBi film crystals. As the magnetizing field and the subsequent magnetization reversal increased, the latter became abrupt. The fields at which these jumps occur increase with increasing magnetizing field. The field at the largest jump is considerably smaller than the anisotropy field. This behavior of the jump field results from the fact that permanent magnetization-reversal nuclei that possess varying stabilities to the magnetization-reversal field persist in the crystal.

It was shown by observing the structure of a samarium orthoferrite single crystal that the residual nuclei may be fixed on structural defects of the crystal. Therefore the basic reason why $H_c < H_a$ in the crystals the presence of microscopic defective zones with low values of K, which, owing to their small volume, are not detected in measurements of K. Magnetization-reversal nuclei of two types are formed in these microscopic volumes. Type A nuclei appear in the magnetizing process and are permanent nuclei that spread out on magnetization reversal by shifting the boundaries and therefore demagnetize the crystal in fields smaller than H_a. Type B magnetization-reversal nuclei, which form as the field decreases, premagnetize the crystal at the point where K is low. The differing natures of the partial and limiting magnetization-reversal jumps are confirmed by their variation with temperature: the limiting-jump field changes more sharply with temperature than the partial-jump field. This is also confirmed theoretically, since the temperature curve of the partial jumps can be described on the basis of inclusion theory, and that of the limit jumps with the aid of a nucleation model.

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