Nanoscale physics

Sharp-pointed susceptibility of ferromagnetic films with inhomogeneous in thickness magnetic anisotropy

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It is shown that in ferromagnetic films with inhomogeneous in thickness anisotropy, an interphase boundary can be formed for certain values and directions of the magnetic field.

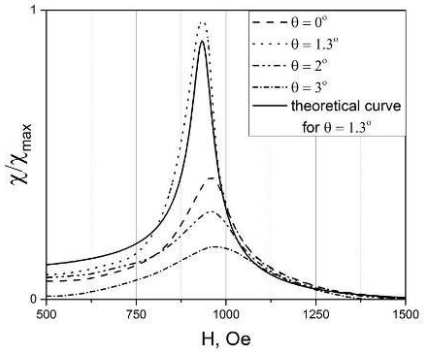

Fig.1. Susceptibility for various deviations of the magnetic field relative to the normal of the film

This boundary has a stable magnetic configuration. It is oriented parallel to the film plane and separates the regions with different orientation of the magnetization. In an alternating magnetic field the interphase boundary oscillates, which may be accompanied by resonance. The field and frequency dependences of the components of the magnetic susceptibility tensor are determined. It is shown that the susceptibility coefficients at resonance are extremely sensitive to the direction of the external magnetic field (Fig.1). Thus, if the magnetic field is deflected relative to the film normal from 0.5^O to 1.5^O, the susceptibility amplitude varies in several times.

A model to explain the observed phenomena has been developed. It is shown that for an insignificant deviation of the magnetic field $\Delta\mathbf{H}$ from the resonance values of **H**, the maximum value of the magnetic susceptibility can change by an order of magnitude, according to $\frac{(\chi_{zz})_{\max}}{\chi_{zz}} \approx \Omega\tau\left|\frac{\Delta H}{2H}\right|$ (where Ω – the resonant frequency, τ – the relaxation time, which for ferritgranate films is large, so that $\tau\Omega \gg 1$). The magnetic system considered in the paper suggests using the directions of the magnetic field as a highly sensitive sensor.