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VISION

The vision of the journals is to provide an academic platform to scholars all over the world to publish their novel, original, empirical and high quality research work. It propose to encourage research relating to latest trends and practices in international business, finance, banking, service marketing, human resource management, corporate governance, social responsibility and emerging paradigms in allied areas of management including social sciences , education and information & technology. It intends to reach the researcher's with plethora of knowledge to generate a pool of research content and propose problem solving models to address the current and emerging issues at the national and international level. Further, it aims to share and disseminate the empirical research findings with academia, industry, policy makers, and consultants with an approach to incorporate the research recommendations for the benefit of one and all.

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STUDIES OF PHOTOINDUCED CHANGES IN MODULATED MAGNETIC STRUCTURE PARAMETERS

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ABSTRACT

This article is devoted to the study of the dependence of the magnetically linear birefringence in a FeBO₃:Mg crystal on the orientation of the antiferromagnetic moment. The emergence of a magnetically modulated structure (MMS) in a crystal doped with an FeBO₃ impurity was studied by the magneto-optical method. The studies were carried out in the temperature range $80 \leq T \leq 290\text{K}$ in a magnetic field $H \leq 50\text{ Oe}$ with the orientation of the vector H parallel to the (111) plane. Illumination with a light flux and visual observations of the domain structure (DS) and measurements of the Faraday effect were carried out.

KEYWORDS: *Domain Structure, Modulated Magnetic Structure, Magnetic Linear Birefringence, Crystal, Domain, Magnetic Moment, Axis Of Magnetization, Illumination, Orientation Of Domains, Anisotropy.*

INTRODUCTION

In many magnetically ordered crystals, under the action of light, peculiar new magnetic and optical properties appear, which are absent without additional illumination. In a FeBO₃ crystal, Ni ions illuminated with unpolarized white light produce uniaxial magnetic anisotropy. This axis does not coincide with the crystallographic anisotropy axes [1]. In theory, the photoinduced excitation of MMS results from the magnetoacoustic interaction between the complexes formed by the matrix Fe ions and impurity Ni ions, which is insignificant in the absence of illumination, but the moment of exposure of the crystal increases. This, in principle, allows the occurrence of MMS in an FeBO₃ crystal with an impurity without additional illumination, thus the light effect should affect the modulation of the magnetic property of the crystal. [2] Determining such an effect on the MMS parameters would make it possible to analyze the reasons for the appearance of a stable inhomogeneous magnetic state in this crystal. To reveal the effect of additional illumination on the period and stability of FeBO₃:Mg MMS, photomagnetic studies of the crystal were carried out. The studies were carried out by the magneto-optical method in the frequency range of the optical transparency of the crystal (in the wavelength range of 0.5 μm). [3] Temperature range 80 ÷ 290 K in a magnetic field $H \leq 50\text{ Oe}$ with the orientation of the vector H

parallel to the (111) plane at small angles of light incidence on the sample plane. The light flux scanning the crystal was passed through a ZS-1 band-pass glass filter and had an intensity of $\sim 10^{-5}$ W/sm². It was found that pre-illumination of the sample (at $T = 80$ K, $H = 0$) changed the period and conditions for the existence of MMS, which is realized in the crystal when it is magnetized along difficult axes oriented at an angle of 30° to the Y axis. With this magnetization geometry, a system of bands appears at $H = H_1 \approx 5.5$ Oe. The bands exist in a certain T-dependent interval of the magnetizing field ΔH and disappear when the field reaches the value $H_c \approx 17$ Oe at $T = 80$ K. up to $H_c \approx 21$ Oe, and its period increased compared to the value of d observed on the “unilluminated” sample, while the jumplike nature of the dependences $d(H)$ and $d(T)$ was retained (Figure. 1, 2). The change in the parameters of the system of bands that arises at $H \parallel X$, occurred only when a sample pre-magnetized (in a field $H = 5$ Oe, $H \parallel X$) to a single-domain state was subjected to long-term exposure: in this case, an increase (by approximately 10%) in the period d and the interval ΔH of fields was also observed the existence of MMS. It turned out that in both cases the exposure. [4-9]

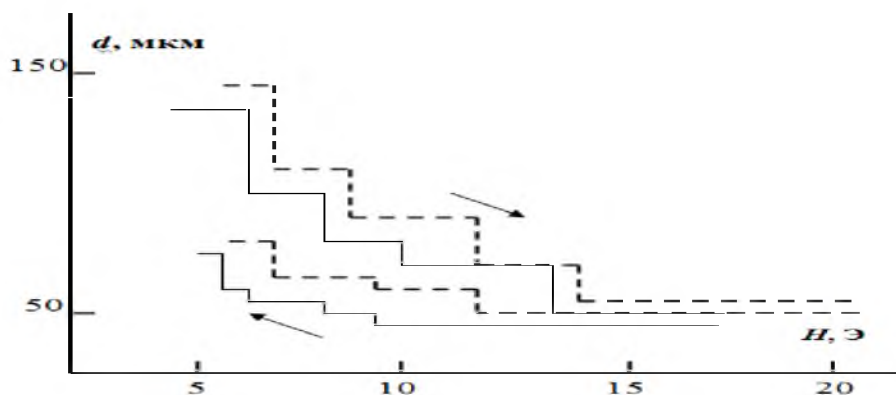


Figure. 1. Field dependence of the spatial period of the modulated FeBO₃:Mg magnetic structure obtained at $T = 80$ K (vector H lies in the (111) plane and is oriented at an angle of 30° to the Y axis). The solid broken line is the “unexposed” sample, the dotted broken line is the sample was preliminarily exposed to unpolarized white light at $H = 0$ for 10 min. The arrows indicate the direction of the magnetic field sweep [10-14].

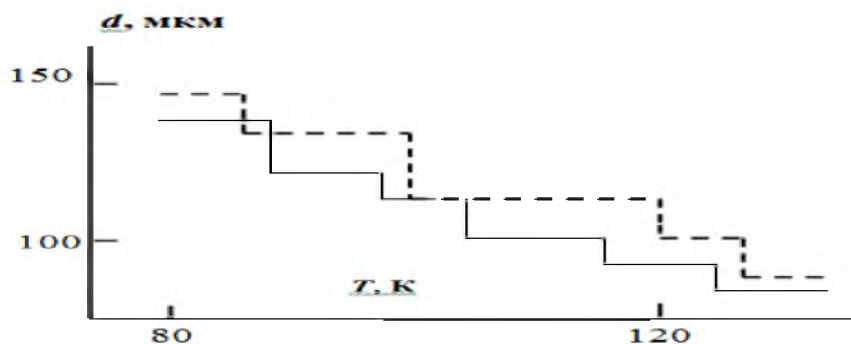


Figure. 2. Temperature dependence of the spatial period of the modulated FeBO₃:Mg magnetic structure obtained at $H = 6.5$ Oe (the H vector lies in the (111) plane and is oriented at an angle of 30° to the Y axis). The designations are the same as in Fig. one.

Sample under white light did not change (within the experimental error ± 2 K) the band disappearance temperature T_c .

The period of the MMS of the “exposed” (at $\tau = 10$ min) crystal realized at given H ($H_1 \leq H \leq H_c$) and T ($80 \leq T \leq 130$ K) (as well as the value of H_c) did not change further under the action of light. After turning off the additional illumination, the values of d and H_c slowly relaxed (at $T = 80$ K for ~ 60 min) to their values characteristic of an “unilluminated” crystal (relaxation occurs as a result of two or three abrupt changes in the values of d and H_c , bringing them closer to their equilibrium values for the given H and T values). After heating the “illuminated” sample to $T > T_c$ and its subsequent cooling (in the absence of additional illumination) to $T = 80$ K, the curves $d(H, T)$ and $F(H)$ coincided within the accuracy of the experiment with the corresponding curves obtained after the first sample cooling. T_c establish the spectral region of additional illumination, which most effectively affects the magnetic state of $\text{FeBO}_3:\text{Mg}$, experiments were carried out in which the spectral composition of the light incident on the sample was varied: by successively introducing filters with a clear transmission boundary into the additional illumination channel, various parts of the white light spectrum were cut off. As a result, it turned out that infrared radiation with $\lambda \sim 0.8 \div 0.9 \mu\text{m}$ has the most noticeable effect on the MMS and magnetic hysteresis loops of the studied crystal. As an illustration of this conclusion, the table shows the values of the fields H_c obtained from the dependences $F(H)$ of a sample preliminarily kept at $T = 80$ K for $\tau = 10$ min under a light flux with a different spectral composition (each value of H_c was obtained after heating the “exposed » sample up to $T > T_c$ and its subsequent exposure at $T = 80$ K, $H = 0$). Whence it can be seen that light with wavelengths $0.8 > \lambda > 0.9 \mu\text{m}$ has practically no effect on the value of H_c (for an “unexposed” sample, $H_c = 1.61$ Oe (see Fig. 1)). [15-23] It is significant that $\text{FeBO}_3:\text{Mg}$ illumination at $T > T_c$ did not change the parameters of the MMS; in addition, in all the experiments performed, no dependence of the photoinduced effects on the polarization of the light flux incident on the crystal was found.

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