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# Communication

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## Investigation of yttrium iron garnet domain structures in laboratory magnetooptic arrangements

The aim of the research was to investigate the changes of the domain structure in a monocrystalic yttrium iron garnet due to magnetic field influence, by using certain laser arrangements designed for magnetooptic visualization of domain structures. Results obtained are helpful for the evaluation of magnetic materials and their applications.

The domain structure of the yttrium iron garnet ($Y_3Fe_5O_{12}$) was investigated by many authors by means of the Faraday magnetooptic method [1–8].

In the following research a YIG plate $100\pm10\mu$m thick with the area $5\times5$ mm was used. The plate was made by the Polfer Company in Warsaw. At first its surface and domain structure were investigated by a metallurgical microscope combined with polarizing elements and a laser. Next, the Biolar microscope with a white light source and polarizing elements were applied and finally, the MPI-5 microscope was used.

In case of no external field, it was quite easy to find a labyrinth domain structure of the sample and to observe it with amplitude and phase positions of the analyser and polarizer. It was also possible to see good controllability of the structure by means of a small permanent magnet placed close to the sample plate. In preliminary investigations the quality of images was poor.

Further investigations were performed on laser arrangements aimed at magnetooptic visualization of domain structures, having appropriate sources of homogeneous magnetic field, designed and made in our laboratory.

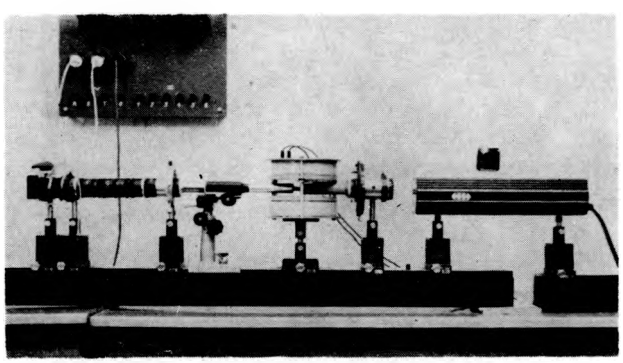

Fig. 1. Laser Faraday arrangement with tangent field generator

The arrangement used, shown in the figure, comprises:

– model LS-5 He–Ne laser, produced by CW Radiation, emitting continuous beam with 6328 Å wavelength, with 6 mV output power, linear polarization and $TEM_{00}$ mode;

– polycrystalline polarizing filters with angular scale;

– sample holder made with non-magnetic material, attached to a rotary table with angular scale;

– microscope from OSK-2 optical bench set of Soviet Union make, with $8\times$ objective and the aperture 0.2;

– generator of tangent magnetic field, made with stepped Helmholtz coils, generating field with the flux density 0.035 T, and homogeneity 1%, designed in a way facilitating the access to its interior (applicable in Faraday and Kerr arrangements);

– elements coupling the microscope with the Practica VLC camera;

– optical bench with associate equipment from the ZHB set, made by PZO.

YIG domain structure with magnetic field normal to the sample surface was investigated in the arrangement comprising a spherical coil generating field, with the flux density 0.1 T and homogeneity of 1%.

The arrangements used proved to be very useful for magnetooptic domain visualization. They are being improved actually in our laboratory.

### References

[1] Avayeva I. G, Monosov Ya. A., Nabokin P. I., Shakhunov V. A., FTT, Vol. 16, No. 9 (1974).
[2] Buda M. I., Przybylski W., Biuletyn WAT No. 10 (1974).
[3] Johansen T. R., Norman D. I., Torok E. I., J. Appl. Physics Vol. 42, No. 4 (1971).
[4] Kandaurova G. S., Zverev V. V., FTT Vol. 17, No. 4 (1975).
[5] Mykituk V. I., Solomko A. A., FTT Vol. 13, No 6 (1971).
[6] Mykituk V. I., Solomko A. A., FTT Vol. 13, No. 10 (1971).
[7] Mykituk V. I., Solomko A. A., Kvantovaya Elektronika No. 6 (1971).
[8] Scott G. B., Lacklison D. E., IEEE Trans. on Magnetics, MAG-12, No. 4 (1976).

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