A Study with Laser & Solar Radiation on the Thin Films

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Abstract
As a result of the numerous investigations it was found that the thermo magnetic method is most comfortable and cheap. The magnetic film is placed to the radiation area. The recording magnetic field is applied in the films plane. The influence of radiation occurs at the several parts of the magnetic film. It was found that at 973°K the perpendicular magnetic anisotropy have arise in the polycrystalline films, the films be come homogeneously magnetized. The films with the thickness of 100-150°A were obtained by the thermal evaporation of the alloys.

Keywords: The registration of laser, solar radiation, alloys, crystalloid structure, films, crystalline anisotropy.

Introduction

At present there are many methods for the registration of laser and solar radiation's structure. It was pointed out in these works, that in order to observe visually the recorded information, the thin magnetic film with the magnetic suspension, possessing the amplitude reflecting lattice, was used. The investigation of the thermo magnetic registers for the high-temperature heating range of the parabolic concentrator of the solar energy, for the first time have been carried out in the [Gurbanyazov W, 1984] work. In this work the strip-domain-type films (nickel-iron) was used as a working layers, the magnetization vector lying in the film's plane. At present, the magnetic thin films possessing the perpendicular magnetic an isotropy, are investigated [Kolbanowskaya I. 1975]. These films are magnetized at the direction normal to the film's surface.

Experimental Section

Under influence of radiation and recording field the irreversible turn of domains magnetization vectors occurs at the several parts of the magnetic film the deviation angle being dependent on the radiation flux's density. The method described provides the higher accuracy and wide range of spec oral sensibility. Because the magnetic film is the metallic layer, the exposure time must be small enough to provide the high resolution [Klukin L.M. 2001]. The results of registration of the laser radiation's structure in the various

wave length ranges on the thin ferromagnetic film are presented in [Gladyr W.I. 1972 & Liu Y. & Lian J. 2007]. The diffraction method of reading the recorded information strongly restricts the using of the strip-domain-type carriers under the real conditions (temperature and dynamic restriction, caused by the formation of the powder shapes). In order to expand the possibility to use the carriers mentioned. The thin films of the manganese bismuth, cobalt platinum iron platinum and iron palladium may be consider as a a materials. The crystalloid structure of films was investigated by the use of the electronic microscope VEMV-100K. The magnetic characteristics were measured by the use of the torque magnetometer. The single crystalline film was obtained at the previously heated unto 180-2000°C, LiF and MgO substrates. The obtained films possessed the disordered face-centered cubic lattice, the easy magnetization axis being within the film's plane. In order to accelerate the natural (spontaneous) formation of the atomic order the heat treatment was used.

Results and Discussion

The suspension contains the magnetic particles, which under the influence of collateral magnetic field copy the domains structure of the film. According to the estimations carried out, the register's resolution is not less than 6-7 strip pair per one millimeter. The magneto optic method of reading the recorded information was considered in [literature 2] work. It was confirmed that the magneto optic method's accuracy in the measurement of the domain's non-elastic turn angle, is not less than one degree, special resolution being not less than 5mkm.

In this work the strip-domain-type film (nickel-iron) was used as working layers, the magnetization vector lying in the film's plane. At present, the magnetic thin films possessing the perpendicular magnetic an isotropy, are investigated in [literature 2]. These films are magnetized at the direction normal to the film's surface. The expitaxial films of iron-platinum and cobalt-platinum alloys, with the thickness of 100-150°A were obtained by the use of the thermal evaporation of the alloy with the equiatomic content, after the heat treatment, carried out at the temperature of 650-700°C, the films were found to be ordered with the tetragonal lattice of L10 type, the lattice's "C"-axis being oriented along the normal to the film's plane. Thus, after the heat treatment, the films were homogeneously magnetized along the normal to the film's plane at the absence of the external magnetic field. The value of the coefficient of the crystalline anisotropy was found to be very large, i.e. about 2×10^7 erg/cc. It means that the film is able to remain homogeneously magnetized along the normal to the film's plane. The dependent of the optic absorption and faraday specific turn on the wave length °A within 0.3-1.2μcm range have been investigated. It was found that the optical absorption coefficient does not depend on the light's wavelength and film's thickness, and actually is constant for the iron-palladium and iron-platinum films ($d=1.1\times10^6 cm^{-1}$). The thermo magnetic recording have been carried out on the thin films of the ferromagnetic iron-platinum and iron-palladium alloys be the use of the solid laser at the λ=0.69μcm wave length [Pynko W.G. 1978, Batzener A. 2001]. The recording was carried out under the film's own demagnetizing field. In order to restore the recorded figure the Faraday-effect was used. The record density was found to the 1000 strip per mm. the torque moments for the films evaporated to the MgO substrate are presented at the fig.1 which shows curves, 1, before annealing, 2, at 873k, 3, at 929k and, 4, after annealing at 973k. It is obviously that all the films obtained are in polycrystalline state. After the heat treatment, carries out at 873°K temperature, the anisotropy constant increases, and the film remaining in the polycrystalline state.

The recording of the information was carried out as by the pointed end of the constant magnet's pole-piece, as well as by the laser beam. In order to clear up the influence of the substrate on formation of the ordered tetragonal lattice, possessing the perpendicular magnetic anisotropy, the polycrystalline films of the cobalt-platinum alloy have been obtained by the thermal evaporating to the single-, polycrystalline and amorphous substrates. The evaporation was carried out simultaneously from two crucibles.

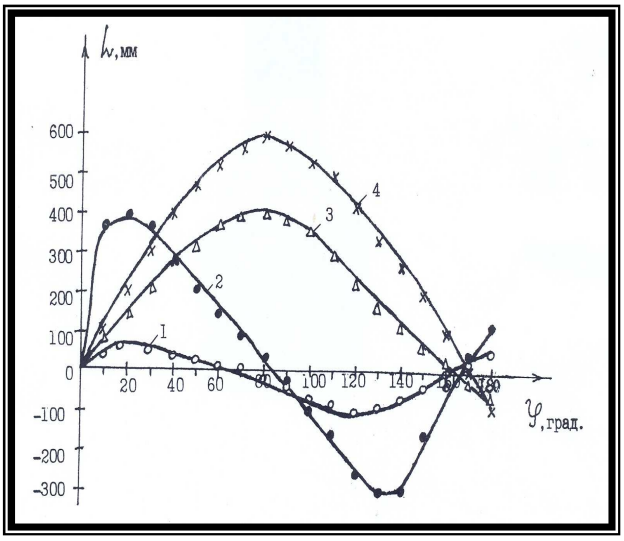

Fig.1. The curves before and after annealing

Conclusion

These films were found to be of use for the taper magnetic recording. As temperature of the heat treatment increases the sufficient changes take place at the torque curve's shape. When temperature rose the film's plane becomes the hard-magnetization plane. The uniaxial magnetic anisotropy takes place in the film's plane. It was found during work, that after heat treatment at the 973°K the perpendicular magnetic anisotropy have a rise in the polycrystalline films evaporated on the single crystalline substrate. It means that film becomes to be homogeneously magnetized along the normal direction to the film's plane. The perpendicular anisotropy was not found on the polycrystalline films evaporated on the amorphous substrates. Thus, the experimental results presented give the evidence that the resolution of the thermo magnetic method of the registration the laser and solar flux's structure can be sufficiently increased by the use of the magnetic films, possessing the perpendicular anisotropy.

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