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New Prospects of Using Elements with Anomalous Photo-Voltage in Optoelectronics

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ABSTRACT: The generator-type photodetectors (PDGT) with the effect of double refraction is described in the article. This effect allows to modulate light directly in optical waveguides. In this case, the design of the device is simplified, as a result, the optoelectronic functional device becomes nonvolatile, i.e. it works without additional electrical power.

KEY WORDS: photovoltage, generator, refraction, nonvolatility, autonomy, microminiaturization, optoelectronics.

I.INTRODUCTION

Since the new functional elements are called a very wide range of devices, we limit ourselves to elements where films (effects developed by us) with anomalous photovoltage effects (APV films) are used.

Functional devices are based on the principle of functional integration. A functional device is a solid body that performs the function of an optoelectronic, radio electronic device, but not on the principles of circuit electronics, but on the basis of using certain properties of a solid body. The functional device as a whole performs the functions of a specific device, which in the circuit design consists of a certain number of elements. In functional devices, the elements of electrical and optical circuits, as current, disappear, and their circuit functions are integrated in a solid. Functional devices have a great potential for improving the reliability and level of microminiaturization than integrated circuits. This is due to the fact that the formation of a functional device requires the creation in a solid of a smaller number of physical media and connections than at creating an integrated circuit that performs a similar function.

In functional devices, through a combination of a limited number of physical processes, it is possible to carry out a given function of the device, with the total number of local inhomogeneities created in a solid much smaller than in integrated circuits.

APV -films are anisotropically deposited on a substrate and exhibit an anisotropy of optical properties [2]. From the films, obtained by anisotropic evaporation, anisotropy is naturally expected to appear when the films are illuminated with polarized light. If an electric field is applied to the APV film, then in directions perpendicular to the propagation of light, the refractive indices are changing. Now, with the path of linearly polarized light through the APV film, the plane of polarization will rotate by an angle proportional to the path traveled by the light. By selecting the strength of the electric field, we can rotate the plane of polarization by 900.

In Fig.1. the basic design of the modulator operating on the basis of the APV effect is shown. The amplitude of the light transmitted through the APV films and the analyzer behind it will vary depending on the angle of rotation of the polarization plane. If we put in place of the analyzer the plate with double refraction, we get a polariscope, allowing us to analyze the polarization or a deflecting system. Such devices react even to a small change in the field and are a little inert. With the help of ultrasound, it is possible to locally change the optical density of the substance of the APV film, thereby creating a diffraction grating. The light passing through it will change direction due to refraction and diffraction. If the light enters at a characteristic angle for the grating, then the first diffraction order will deviate strongly from the original direction of the beam. The angle of the deviation can be changed by changing the frequency of ultrasound (Figure 2.

Passing the infrared light through the APV film and applying a magnetic field, we can also rotate the plane of polarization. By the analyzer (A) or double-beam plastic with refraction, it is possible to produce modulation or deflection of light. With the help of the electric field, it is possible to change the light absorption limit of the APV films,

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i.e spectral dependence of transparency (Franz-Keldysh effect in APV films). This effect allows us to modulate the light directly in optical waveguides.

Figure 3. shows the design of the modulator in which the APV film (APV 2) is used as a source of the electric field. In this case, the design of the device is simplified; as a result, the optoelectronic functional device becomes nonvolatile. (It works autonomously, it does not need to be given to a separate source of electrical energy).

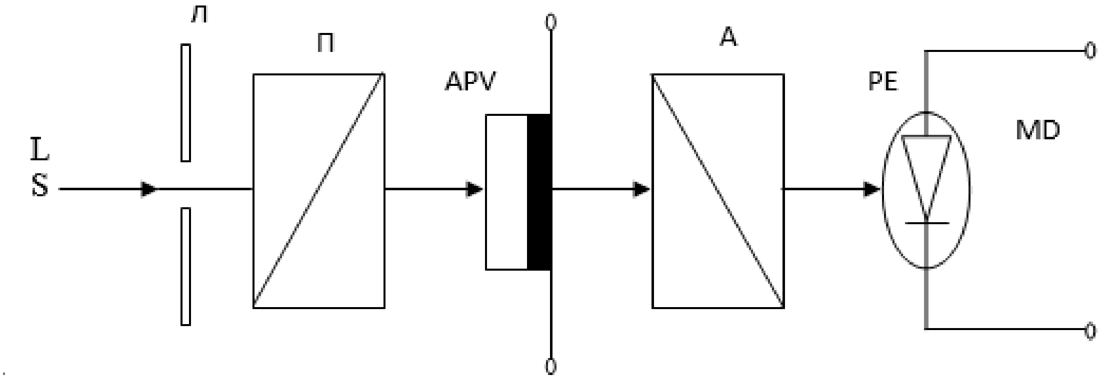

Fig.1. The block diagram of the modulator operating on the anomalous photovoltage. APV-Modulator, LS-Light source, D-diaphragm, APV-APV element, P-Polarizer, A- Analyzer.

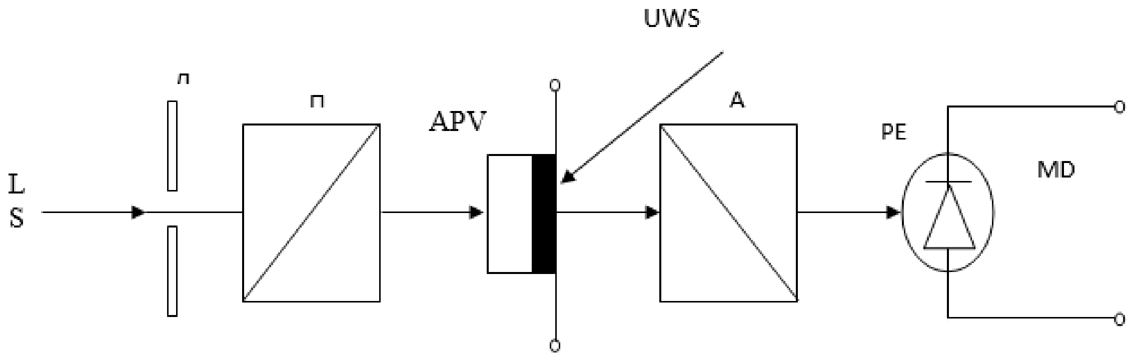

Fig. 2. Block diagram. of the polariscope and ultrasound source. APV - film, LS - Light source, D - Diaphragm, P - Polarizer, A - Analyzer, PhE - photocell, MD- measuring device, UWS - ultrasonic wave source.

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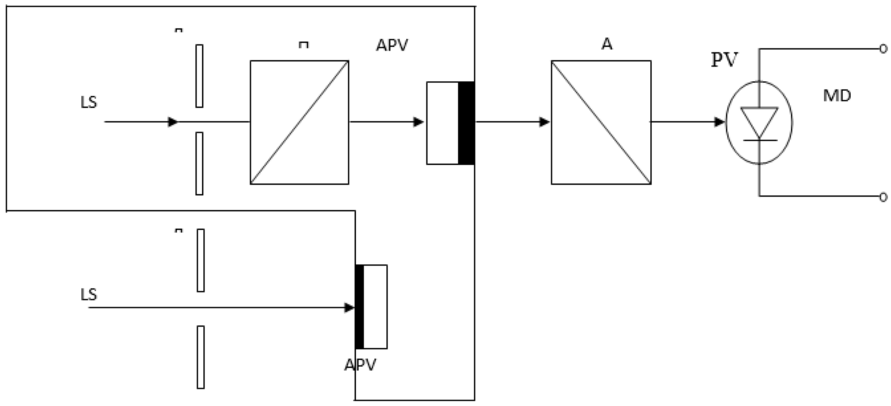

Fig.3. The block diagram of the autonomously operating nonvolatile modulator. APV-APV element, LS-Light source, D - Diaphragm, P-Polarizer, A- Analyzer, PV-photocell, EM-electrometer

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