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Research Article

USING THE AFN-EFFECT IN GETTING AN ELECTROSTATIC FIELD FROM WIND ENERGY

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Abstract

Device technology conversion to do for equipment with it depends. He is the wind energy obtaining the electrostatic field (EF) using for is used and village work in release and, science and of technique another different in the fields too application can. The technical result of the invention is the construction of an optoelectronic transducer that converts the mechanical (kinetic) energy of the wind into an electrostatic field by means of an AFN-effect optoelectronic piezoelectric amplifier.

Keywords

AFN-effect , Piezoelement, MOP-transistor, AFN-element, photo receiver, EM, light diode.

Introduction

Very unique phenomena are observed in AFN-layers, and the use of their unique properties and properties for practical purposes makes it possible to create a new class of optoelectronic devices. Such devices are controlled by an electric and magnetic field and operate in the field of nanoampere currents [1-3]. To ensure the operation of optoelectronic devices and devices created on the basis of AFN-layers, a separate external power source is not required. In an environment with sufficient natural or artificial light, these devices can work autonomously without an external source [4-9]. This devices meet the requirements of microelectronics giving with thin layer technology are made. Such new optoelectronic instrument and from shocks one optoelectronic is a modifier [10-17]. The device belongs to the field of optoelectronic switching technology and serves to obtain an electrostatic field from wind energy. The device works independently, does not require a special external power supply. The device is a compact, efficient and energy-saving optoelectronic system, and low-cost electrostatic field generation is achieved by means of a piezo amplifier and an AFN-effect [1]. This optoelectronic converter can be used in many areas of the economy as a source of cheap convenient electrostatic field. In particular, it is possible to work remotely (in online mode) in measurement - control and other metrological systems [18-23].

The block diagram of the optoelectronic converter is given in Fig. 1. The wind power receiving part (2) of the device is made of low-temperature (t<573°C) SiO_2 β-quartz modified sin crystal with linear piezoelectric properties. This type of quartz is resistant to aqueous and acidic environments and melts at 1700°C. Considering its high stability, low temperature expansion ($8{*}10^{-6}$ – $13{*}10^{-6}$°C^{-1}), the specific electrical resistance at room temperature is high: it reaches 10^{14} – 10^{15} ohms [2]. Piezoelement (2) creates a potential difference of 60 V at a sufficiently large mechanical stress (~1 Gn cm^2). The voltage stabilized in the MOP-transistor (polarizable dielectric) (2) is supplied to the light diode (or fluorescent lamp) from the output of the block (3). It is a photogenerator and turns the circuit into (3_1). The light stream (3_1) is sent through the optical channel to the generator-type photo-receiver AFN-element (4). In the AFN-element circuit, the light stream received through the optical channel (3_1) is converted into a high-potential electric field and sent to the working mechanism (IM) [24-29].

The photoreceptor AFN-element is made of lead chalcogenide by vacuum evaporation [1] in the form of a thin film (0.5 - 2 μm) on a glass substrate. As a result of illumination of these samples ($R=5{*}10^{11}$ Ohm, T=77°C and illuminance 0.35 W/cm^2), it is possible to obtain photovoltage up to 6 kV. Most of the elements, the connecting parts of the blocks are made in the form of a thin film in a vacuum in a single technological process. This condition ensures the integration of the project with microcircuits.

A two-layer piezoelement specially made from quartz (natural) was used for polarization EM (Fig. 2) (Fig. 1 block 2).

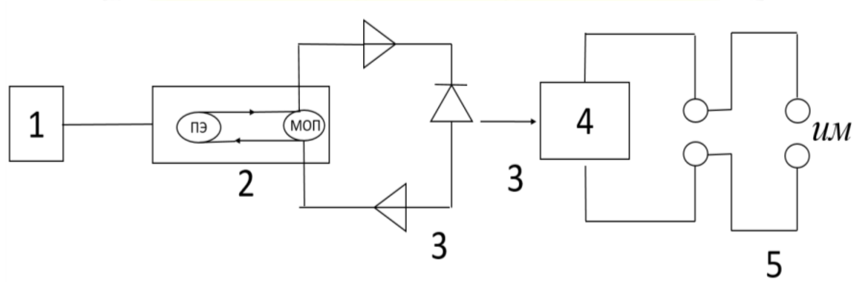

Figure 1. Optoelectronic switch

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1- wind flow, 2- piezo element electric circuit has a voltage stabilizing mop-element. MOP - the output of the element produces an electric voltage with the light diode (3). 3- the light diode produces a normal light flow (it has no thermal effect). -Consumer block (IM) with dielectric properties.

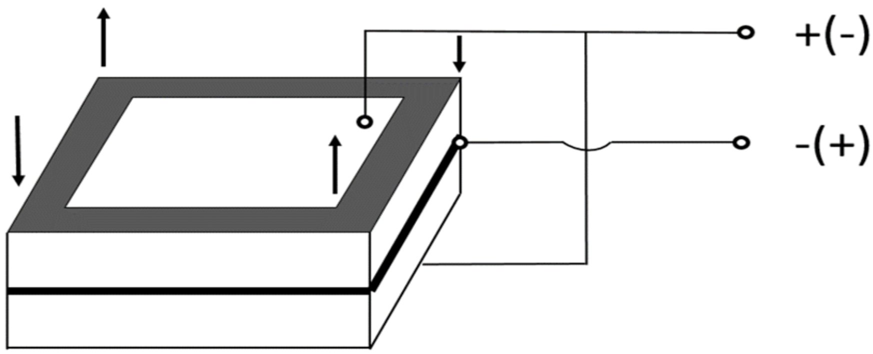

Figure 2. Double-layer quartz piezoelectric element.

Optoelectronic converters, which can be used in various sectors of the national economy on a domestic and industrial scale, from natural renewable non-conventional energy sources and artificial secondary energy sources, are always needed in any field due to their compactness, simplicity and the possibility of obtaining cheap EM. For this reason, energy efficiency as a device has been, and still is, an extremely important issue for human activity. Low-cost EM harvesting equipment from wind energy is one of the important sectors of the above-mentioned problem [30-35].

Such an EM receiving device can be used as a source of low-cost EM receiving in many sectors of the economy.

The surface of the working surface of the pzoelement (2) made of natural quartz with a flat surface by special methods is placed according to the direction of the wind (1). In proportion to the mechanical stress (F) acting on the surface of the piezoelectric element (2), electric polarization (R) occurs according to the correct piezoelectric effect.

$$P = kF, \qquad (1)$$

The k-proportionality coefficient is called the piezoelectric modulus.

Wind-induced mechanical stress causes mechanical deformation (d) in the piezoelectric element along with electrical stress.

$$P = ad \qquad (2)$$

α is the piezoelectric coefficient associated with deformation.

Equations (1 and 2) are the basic piezoelectric equations. The coefficients in Eqs There is a connection between (k and a) which is the theory of elasticity. It is found using Hooke's law:

$$C = \frac{F}{a} \qquad (3)$$

C- yu ng module.

Equations (1), (2) and (3) of piezoelectricity based on equations (1) and (2). the relationship between the coefficients (k and α) can be determined.

$$k = a / c, \quad (4)$$

Deformation caused by external mechanical stress can be expressed by field stress:

$$E = -dh, \qquad E = hd, \quad (5)$$

According to Tok's law (5), it is possible to derive the connection between the coefficients,

$$\frac{h}{g} = C \quad (6)$$

So, given that the polarization depends on the electric field strength,

$$P = \frac{\varepsilon E}{4\pi}, \quad (7)$$

Thus, piezoelectric (k,a) and electric field strength (g,h) coefficients are reciprocally connected through dielectric permittivity (e) and Young's modulus. That is,

$$K = -\frac{\varepsilon}{-4\pi} g \qquad a = -\frac{\varepsilon}{4\pi} h \quad (8)$$

In block (2) of the optoelectronic converter block diagram, electric polarization generated due to piezo effect is applied to electric voltage (3) through electric circuit to light diode (fluorescent lamp). In it, the electric signal turns into a light current (3 1), falls into a photoreceiver in the form of an electrogenerator in block 4, and turns into a high-voltage electric field (EM). This EM is used as the EM field source of the dielectric consumer working mechanism. In particular, such cheap EM can be used in electrostatic gas cleaners, in the electrostatic separation (sorting) of ore and similar materials, in varnishing, polishing and polymerization of materials. Dielectric materials can be widely used in transformers, especially due to the ponderating forces created by EM. Various uses in agriculture and medicine ensure energy efficiency and ease of use [4].

The optoelectronic converter, which converts wind energy into a strong electric field, consists of a cylindrical plastic case covered with E-6 type epoxy resin, and a thin flat diamond-modified quartz plate with high piezoelectric properties is attached to one of its bases [5]. The MOP circuit is connected to the photogenerator (light emitting diode, fluorescent) through special contact thin-film conductors. A photogenerator is an inventor-type lamp that converts piezoelectric electric potentials into a light signal. The resulting light stream sends the light signals directly to the photoreceiver, which converts the light signals into a high-potential electric field by means of a special optically transparent immersion medium. The photo receiver (AFN-element) is connected to dielectric consumers [6].

The technical characteristics of the optoelectronic converter are as follows:

- Mass 300-500g;
- Geometric dimensions 2cm*2cm*6cm;
- maintains a steady state (working state) in the structure up to a temperature of 870-1470 °C;°C
- Structural modification (piezoelement) is diamond type (SiO 2) ;
- The initial detection of light intensity in blocks (3--4) of optical coupling 3^1starts from 10 -6 VT/cm 2 ;
- The input resistance of the photo receiver unit (4) 10^(+12)÷10^14Ohm;
- Works in steady and pulsed modes;
- The consumer circuit is adapted to the dielectric load;
- The photo receiver in the output unit (4) works in adder mode;
- Working temperature range -40 °C....65°C.

Conclusions

It is also possible to make a simple and compact design that allows individual use. A strong electrostatic electric field can be obtained from wind energy, there are no optoelectronic and other similar prototypes, which is considered one of the important advantages of the presented project. This project, unlike other similar converters, is self-powered and operates in an independent autonomous energy mode. Another advantage is that it can provide remote service with minimal loss.

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