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Scientific Frontiers and Applications of New Optoelectronic Functional Devices

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Abstract

Simply a function of photoelectric device on the generalized Angle is the photoelectric transformation for the fundamental mode of the device, mainly used for traffic information and energy conversion, the period of photoelectric function as the base of using photoelectric systems, and radio and television function of photoelectric device is the optics and electronics, and so on a series of method combined with the link between the main and related disciplines, Therefore, the photoelectric functional devices have a very important role and significance in optics, optoelectronics and related disciplines. In this paper, the future scientific development and related applications of new photoelectric functional devices are analyzed and the corresponding suggestions and measures are put forward.

Keywords

Novel Optoelectronic Functional Devices; Practical Application; Science Frontier; The Development Trend.

1. Introduction

Compared with inorganic semiconductor materials, organic semiconductor materials are characterized by high cost performance, fast response speed and easy processing into large-area flexible devices, etc. Therefore, in recent years, organic semiconductor materials have been widely used in the fields of solar cells, transistors, biosensors, high-density storage and new flat-panel display. However, it lacks sufficient stability, excellent stability, diversity of electronic structure and light and heat are the main characteristics of inorganic materials, but the processing and molding is difficult, the price of the material is expensive.

Therefore, trying to combine the functional characteristics of organic and inorganic materials to achieve synergistic optimization and functional complementarity, so as to make the performance of photoelectric functional materials more outstanding, has become a core content of the research of photoelectric materials at the present stage, attracting attention and hot discussion from many parties.

2. Overview of new optoelectronic devices

The so-called photoelectric device is a general term for making various multifunctional components by using the photoelectric conversion effect. From the perspective of photoelectronic devices, it is designed by changing the way that the external field guides the wave light to propagate. The new photoelectric devices are different from the traditional ones.

The core of optoelectronic technology development lies in optoelectronic devices, which are the mainstay of information technology development and one of the key projects of modern optoelectronic and micro-electronic technology research and development.

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3. The development trend of photoelectric function period

3.1 Intelligent development of photoelectric functional devices

The intellectualization of photoelectric functional device is to install microprocessor into the internal structure of the functional device, so that it can make logical judgment, store data, automatic compensation and detection, etc.

With the improvement of end-user experience and ever-changing consumption habits, optoelectronic functional devices should have the advantages of communication function, strong adaptability, anti-interference, longer transmission distance, and strong privacy, etc. Therefore, in the future, we will increase research and development efforts in the intelligent aspect of optoelectronic functional devices.

3.2 Development of miniaturization of optoelectronic functional devices

Single function, small application range, inconvenient to carry, large volume and so on are the common characteristics of traditional photoelectric functional devices. As integrated circuits, microelectronics, the sustained and rapid development of precision machining technology and the wide application of new materials, functional device of adjusting circuit, interface element, such as sensitive element is becoming more and more small volume, from the beginning of millimeter level, gradually to the micron or even nanoscale, it's for device miniaturization development provides a powerful motivation.

3.3 Multi-functional development of optoelectronic functional devices

In terms of general situation, a functional device can only be tested on a measured variable, but in most applications, in order to make the objective environment and obtain accurate and comprehensive reflect things, often have to be synchronous detection of multiple variables, so the function of diversification has become a function of photoelectric device technology development trend in the future. As photoelectric functional devices play a role in more fields, thanks to the common promotion of modern technologies such as assembly technology, micro-machining technology and lithography technology, it is possible for a variety of sensitive components to be used on the same substrate.

The integration standard of terminal application accelerates the development speed of multi-function of functional devices.

4. The scientific frontier of new optoelectronic functional devices

Dr. Tang is the inventor of organic light-emitting diodes (OLEDs). He has made great contributions to the fields of organic photovoltaic devices and organic electroluminescence. He is a pioneer in these two fields and enjoys a high international reputation and academic status.

“Organic Electronics-Opportunities and Challenges”

He presented a report entitled "Organic Electronics-Opportunities and Challenges".

In the presentation, Dr. Tang discussed the development history of organic optoelectronic materials and devices, as well as the opportunities and challenges facing them in the future.

He is beginning to point out organic semiconductor liquid crystal in the field of radio, film and television, organic photoconductor, organic thin film transistor, the application of organic photovoltaic cells, organic light-emitting diodes (leds), in different application fields, the performance requirements of organic semiconductor also exist certain differences, such as current density, working voltage, the migration rate are different.

At present, liquid crystals and organic semiconductors have been widely used in the field of flat panel display and laser printing.

In the field of the display, the highest popularity of organic light-emitting diodes (leds), such as mobile phones, such as organic light-emitting diodes (oleds) TV, with the advantage of the power efficiency in more than 50 lm/W, further improve its competitive advantage in high efficiency and

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energy saving lighting source, but at the moment, because the hair blue organic light-emitting diodes, the efficiency remains to be improved. Moreover, the large-area film-forming technology is not mature enough and the cost cannot be controlled, so compared with other flat-panel display technologies, it still does not show much advantage.

The performance of organic thin film transistors has made great progress in recent years, and the mobility of many organic materials is far ahead of that of amorphous silicon, which has full potential in the field of commercial development. Therefore, organic thin film transistors in the future to continue to improve the direction of mobility, to achieve the standard of polysilicon, so as to be used in the driving circuit of flat panel display, on the other hand, we need to solve the drift of threshold voltage work, organic/insulator interface instability problems.

In the aspect of organic photovoltaic cells, it has not been put into practical application at present. Due to the influence of factors such as low absorption rate of sunlight, low carrier mobility and lack of long exciton diffusion distance, the photoelectric conversion efficiency of organic photovoltaic cells remains at the downstream level for a long time.

To solve the problems mentioned above, Dr. Tang analyzed the physical mechanism and proposed some countermeasures from the aspects of material design and device structure improvement.

After Dr. Tang's presentation, hundreds of attendees raised questions and exchanged ideas with each other.

Application of organic light-emitting diodes, organic photovoltaic cells, organic photoelectric functional materials and organic thin film transistors in the organic field “Materials for Thin Film Flexible Electronics”. Professor Bao Zhenan from Stanford University gave a report entitled "Materials for Thin Film Flexible Electronics".

In the process of the report, Professor Bao first introduced that the research group used octadecyl trichlorosilane to modify the surface of the silicon dioxide of the organic thin film transistor, and then arranged the monolayer of the substance in order to remove the hydroxyl group on the surface of the silicon dioxide, so that the surface passivation reaction occurred, and the nucleation density became smaller. The larger organic semiconductor crystals appeared on the monolayer of octadecyltrichlorosilane, which resulted in a significant decrease in the generation of grain boundaries. Finally, it was found that the mobility of the organic thin film transistor increased by no less than one order of magnitude. Then, in combination with the problem of poor stability of pentacene, she placed large substituents at the 6 and 13 positions of pentacene, such as triisopropyl silicyl acetylene group, and replaced the benzene ring at both ends of pentacene with thiophene ring, so that the HOMO energy level rose. By adjusting the accumulation mode of organic semiconductor molecules,

Organic p-type materials with mobility above $1cm^2/(Vs)$ and good air stability were obtained.

She concludes by suggesting ways to make chemical improvements on organic semiconductor molecules. Dr. David B. Mitzi, IBM, USA, submitted the entry as "Hybrid Perovskites:

From Basic Chemistry Device Applications” From Basic Chemistry Device Applications, he will present a presentation on a novel organic/inorganic composite semiconductor material called hybrid perovskite structural materials. The material can be self-assembled into a compound with layered structure, in which the inorganic layer and organic layer are arranged alternately, which is the basis for the development of two-dimensional superlattice quantum well structure.

The hybrid perovskite structure material combines organic and inorganic molecules on a single molecule in an orderly way, so that a molecular complex has the advantages of both, and completely transforms its photoelectric and chemical properties at the molecular level.

Inorganic combination of crystal structure, solid framework, and the strong covalent bond or electrovalent bond exhibit features, such as thermal stability, high mobility, organic ingredients provided by molecular tailoring shift photoelectric properties and good film forming and self-assembly properties, can let the organic material such as hybrid materials generally under the condition of low temperature process, and the cost is not high also.

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5. New optoelectronic functional devices and applications

5.1 Photoelectric strip deviation detector

In the process of producing tape, film, paper feeding, printing and dyeing, the most critical equipment is the photoelectric strip deviation detector. In the processing zone type material, it can be on the material of the position, direction, size, and so on the real-time monitoring, and will rectify the control circuit of the signal transmission to rectify, as shown in figure shows is photoelectric strip running deviation detector, the operation principle of light through the lens of the light from the 2 May form parallel to the speed of light, by receiving lens 3, then the convergence in photosensitive resistance on the surface. When the traveling beam is transmitted from lens 2 to lens 3, the measured strip will block part of the light, so the light flux received by the photosensitive resistor will be reduced.The schematic diagram of the measuring circuit can be referred to. R1 and R2 are two similar types of photosensitive resistors. Below the strip is the photosensitive resistor R1, and the photosensitive resistor R2 is covered by the light shield.

If the position of the strip does not deviate, then R1, R2, R3, and R4 will form a balanced bridge, and the amplifier output voltage U0=0.On the contrary, if the strip position deviates (assuming left), the shading area and the resistance value of photosensitive resistor R1 will be reduced, resulting in the loss of the original balance of the bridge.

The differential amplifier will directly amplify the unbalanced voltage, and the output voltage will show a negative value, from which we can then observe the size and specific direction of the strip deviation.

The output signal U0 is divided into two parts and sent randomly to the display and the actuator.

5.2 Automatic door sensing

Automatic door in the elevator and subway doors, the most commonly used is the automatic door sensing technology.A transmitter and a receiver are mounted within the distance of the automatic door, and the lens position of the transmitter and the receiver is adjusted so that the two components are in the same level line and maintain the correct state.In this way, objects on the optical axis can be detected, and the diameter of opaque objects must not exceed 35mm.

For the position of the space between the train car body and the security, if the passengers and large goods accidentally caught in this position, will block the infrared light to normal transport, which detects the presence of obstacles, then start alarm device will be in the shortest possible time, station management, train drivers after hearing the alarm signal to the corresponding measures.In order to effectively avoid the situation of mutual interference between two pairs of sensors, the frequency of transmitter 1 and receiver 1 can be adjusted to frequency A.

The frequency of transmitter 2 and receiver 2 is adjusted to frequency B.

In order to avoid the impact of direct sunlight and other external ambient light, or the interference caused by long-term dust accumulation and dust falling on the lens, the circular sleeve can be installed directly in front of the transmitter and receiver lens.

6. To summarize

Photoelectric device with power components and photosensor, themselves have photoelectric conversion mode and function, with the rapid development of industrialization and information technology in our country at present stage, automatic and intelligent development speed increasing, this article mainly aims at the scientific frontier of the new function of photoelectric devices and applications are analyzed.

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