

## CREATION OF MULTIMEDIA RESOURCES OF PHYSICAL PROPERTIES OF P-N-JUNCTION DIODES

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### ANNOTATION

This paper describes how the physical properties of p-n-junction diodes can be explained by some software for creating multimedia resources. The software allows you to process the data in the most diverse way, making various mathematical changes on them.

**KEYWORDS:** *semiconductors, p-n junction, diode, multimedia, computer modeling, Corel Draw, Macromedia Flash, Adobe Flash.*

### АННОТАЦИЯ

В этой статье описывается, как физические свойства диодов с p-n-переходом могут быть объяснены с помощью некоторого программного обеспечения для создания мультимедийных ресурсов. Программа позволяет обрабатывать данные самым разнообразным образом, внося в них различные математические изменения.

**Ключевые слова:** *полупроводники, p-n переход, диод, мультимедиа, компьютерное моделирование, Corel Draw, Macromedia Flash, Adobe Flash.*

### 1. INTRODUCTION

The rapid development of information and communication technologies in recent years has led to a sharp increase in the volume of information, as well as the speed of information flow, as well as the growing demand for information resources.

In such cases, the user by creating a mathematical model, methods and algorithms that systematize, store, transmit, receive, process discrete-continuous information resources of different shapes and sizes, provide an easy and convenient reference interface, compatibility of flow in time and time. it is important to provide information that is clear, reliable, complete, easy to understand and master.<sup>[1]</sup>

Multimedia is a rapidly evolving modern information technology.

Multimedia is a set of different computer technologies that use information in various shapes and forms, such as graphics, text, video, photography, animation and sound effects (Figure 1).



**Figure 1: Multimedia technologies.**

With the consistent development of multimedia technologies, the possibilities of storing, processing, accessing and presenting various types of discrete-continuous information have also expanded. A discrete-continuous system is composed of many different elements (text, sound, audio, video, etc.) by nature, in particular, the state is characterized by continuous processes, limited time and discrete cases of insignificant cases of event exposure time for the analysis of an elementary system. is a parallel and branched dynamic system represented by processes. Of course, computer modeling is also important in the development of this technology.<sup>[2]</sup>

## 2. Main Part

Computer modeling (Figure 2) allows for the acquisition of vivid dynamic movements that are not achievable in the real physical world of physical experiments and events, and for the multiplication of subtle details that bypass their observations of reality.<sup>[3]</sup>

The essence of the method is that a mathematical model is created on the basis of certain laws of events already studied - an abstract object that obeys the same laws. A mathematical model described in computer language has the potential to “come back to life”. In this case, it is possible to gradually add to the consideration additional factors that gradually complicate the model and bring it closer to a real physical phenomenon. By changing the time, the event can be observed in dynamics and the time scale of the model can be much lower than the real one, allowing the observation of the event to take several minutes to observe the reality in a few minutes. Computer modeling is environmentally friendly and does not pose a threat to nature or humans.



*Figure 2: Computer modeling.*

It is extremely useful for researchers to work with computer models, which allow them to understand the basic physical laws and phenomena, the essence of physical experiments (mathematical and spring pendulum, spacecraft flight, Brownian motion). By changing some of the input parameters, you can track the changes that occur with the model and thus perform many virtual experiments. Such interactivity opens up vast knowledge opportunities for researchers, making them not only observers but also active participants in the experiments.

Some models allow you to simultaneously observe the structure of the corresponding graphical relationships during experiments, which increases their clarity.

Another of the most important advantages of a computer is the ability to use the electronic version of the laboratory room. It is impossible to study physics without laboratory work, but the technical equipment of the physics room does not always allow you to perform laboratory work in full. Multimedia technologies developed by computer programs help the researcher to understand the physical properties of complex equipment and the processes that take place in them. One such tool is to describe the physical properties of a diode using multimedia technology.<sup>[4,5]</sup>

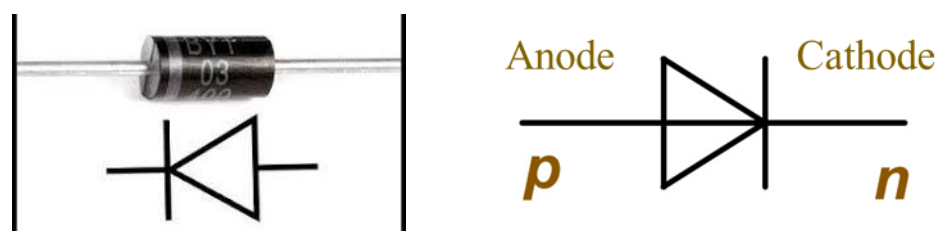
### 3. RESULTS AND DISCUSSIONS

A diode is a device that has one or more electrical connections and two outputs to connect to an external circuit. Semiconductor diodes are classified in reference books according to their field of application or function in radio equipment.

There are substances in nature that have fewer electrons per unit volume than conductors, but more than insulators (dielectrics). That is why such substances are called semiconductors.

To reduce the effects of light, air, and external electric and magnetic fields on a semiconductor diode, a germanium crystal is placed in a hermetically sealed metal shell.<sup>[6]</sup>

The symbol for a semiconductor diode is shown in Figure 3.



**Figure 3: Symbol of semiconductor diodes.**

Almost all semiconductor devices are based on p-n-junction properties. The p-n-junction is the part of a semiconductor that passes from one type to another, where the conductivity is mainly due to electrons on one side and holes due to holes on the other.

A semiconductor device with a single p-n-junction is called a semiconductor diode.

It is not enough to mechanically connect two semiconductors with p- and n-type conductivity to form a p-n-junction in a semiconductor. Because in this case, the gap between them will be larger. The thickness of the p- and n-type transitions must be small enough to be equal to the distance between the atoms. Therefore, indium is welded to one of the surfaces of the germanium single crystal with the donor mixture. Due to the diffusion phenomenon, indium atoms enter the germanium single crystal. The result is a p-type permeable area on the germanium surface.

The area of the Germanium single crystal that does not contain indium atoms will still have n-type conductivity. A p-n-junction is formed in the intermediate field.

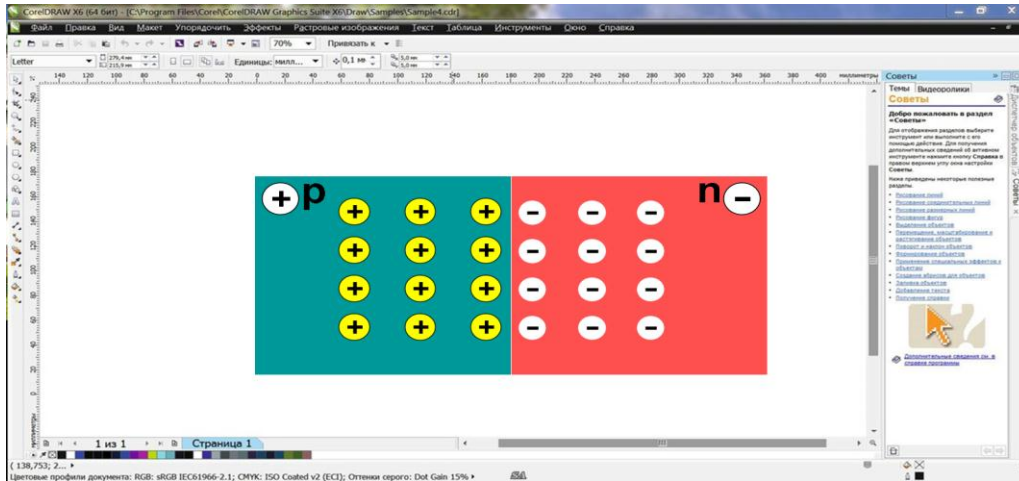
This means that on one side of the p-n-junction, electrons are the main charge carriers and the holes are the non-primary charge carriers, while on the other side, the opposite is true. In fact, the p-n-junction can be obtained by contacting electronic and perforated semiconductors.<sup>[7]</sup>

There are many information technology programs available today (Macromedia Flash, Adobe Flash, Macromedia Director, Formula Graphics Multimedia System, Multimedia Creator, Asymetrix ToolBook, AuthorWare Professional, iSpring, MS Power Point iSpring, Corel Draw).

Let's explain the p-n-junction, which is the basis of the above diodes, by some programs.

1. One of the graphics creation and editing programs is Corel Draw. The basic technological principle of Corel Draw is to work with objects. An object is a concept that allows you to do different things on it. The user has to work on objects while working on them. In the vector method of encoding, geometric shapes, curves and straight lines, circles, squares, ellipses, and partial images are stored in computer memory in the form of geometric abstractions such as mathematical formulas. For example, to encode a circle, it does not have to be in separate pixels. Its radius, focal point coordinates, and color will suffice. For a rectangle, you need to remember the length, location, and color of its sides. Different forms can be interpreted using mathematical formulas.<sup>[8]</sup>

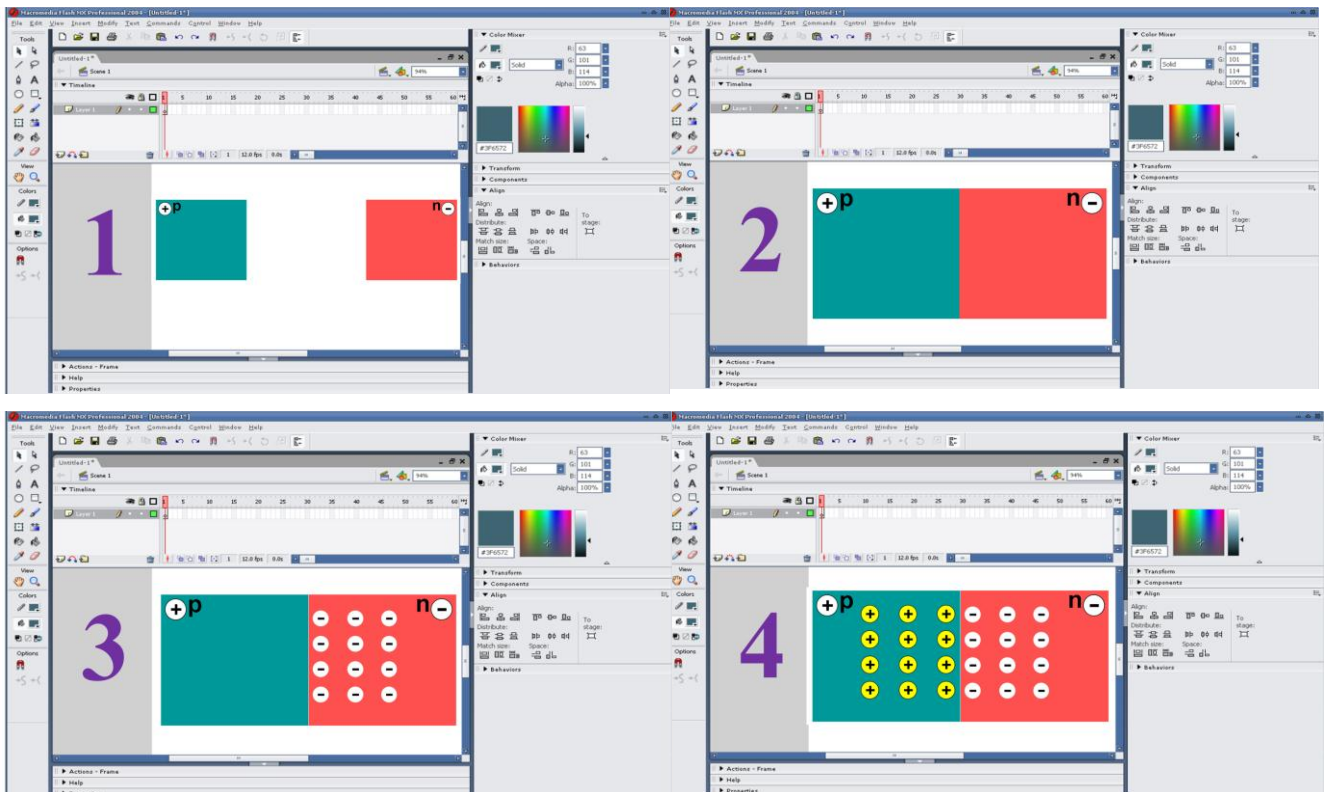
Using the above program, we can illustrate the p-n-junction process as shown in Figure 4.



**Figure 4: Description of the p-n-junction process using Corel Draw.**

2. The development of computer technology today makes it possible to create compact and elegant, user-friendly mobile applications. In addition to working with Netscape Navigator (NN), these programs also work with Internet Explorer (IE). One such program was developed by Macromedia, the Flash package program, which allows you to take full advantage of technical WEB-design tools.<sup>[9-11]</sup>

Figure 5 illustrates the use of Macromedia Flash to explain the p-n-junction.



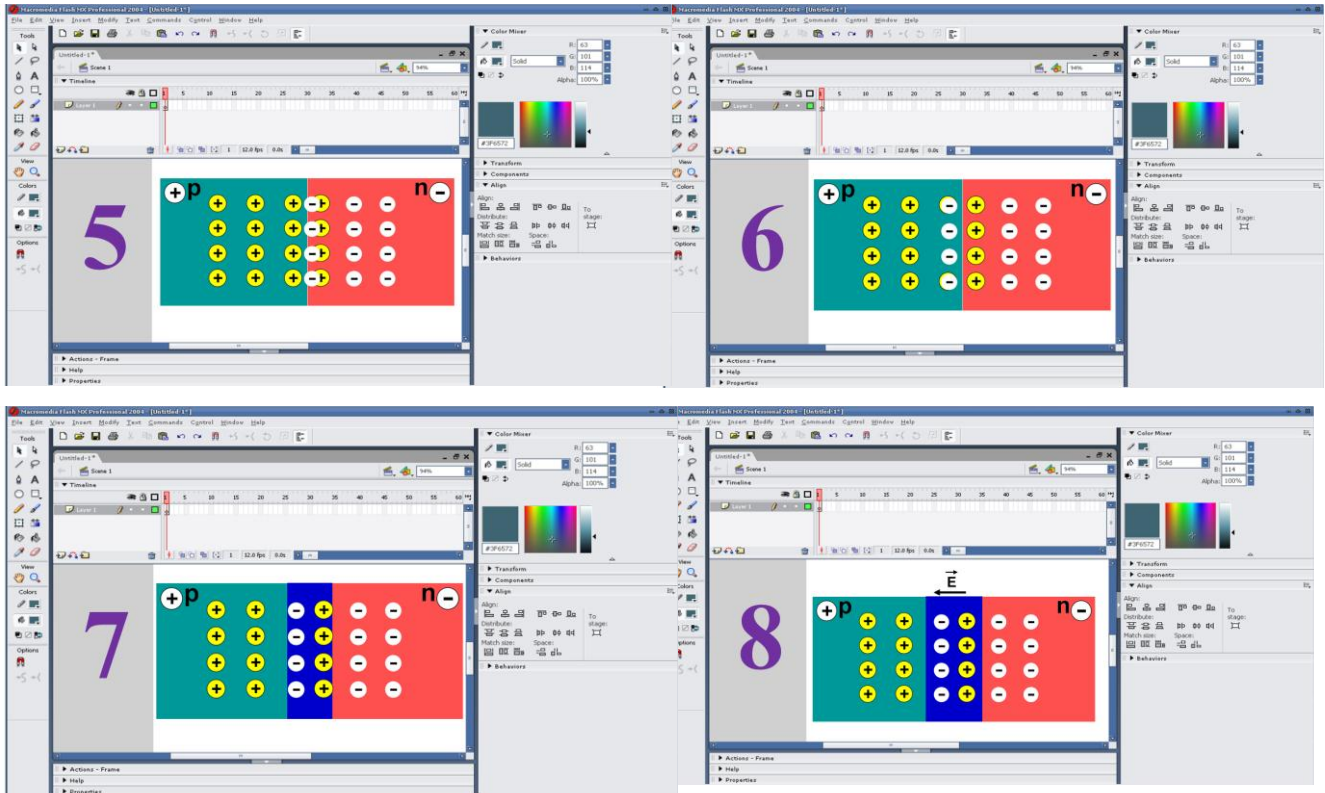


Figure 5: Description of the p-n-junction using Macromedia Flash.

#### 4. CONCLUSION

In short, the software allows you to process the data in the most diverse way, to make various mathematical changes on them. At each stage of data processing, it is possible to display graphical data on the dependence of the physical quantity studied on time or on the dependence of one quantity measured experimentally on another. The researcher can change the initial parameters of the experiments at will, observe how the event itself changes as a result, analyze what he sees, draw appropriate conclusions and use it in solving problems.

The above practice shows that it is possible to create modern software packages without resorting to the services of specialists.

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