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TECHNOLOGY FOR OBTAINING NANOMATERIALS

Inyaminov Yuldash Arifkhonovich
Jizzakh Polytechnic Institute

Babanov Dilmurad Tashpulatovich
Jizzakh Polytechnic Institute

Annotation

The task of the stage was the formation and primary structuring of the subject area of search and extraction of knowledge in a given thematic area of activity of the NNS. On the basis of available literature data and search activities on the Internet, a description and analysis of the current state of research in the field of nanomaterials and nanotechnologies in nanoelectronics are carried out. The structuring and description of the interrelations of the elements of the received information in the form of concepts of the subject area is carried out.

Keyword. Non-size, structure, elements, object area.

Annatatsiya

Bosqichning vazifasi NNS faoliyatining ma'lum bir tematik sohasida bilimlarni izlash va olish ob'ektini shakllantirish va birlamchi tizimlashtirish edi. Mavjud adabiyotlar ma'lumotlari va Internetdagi qidiruv faoliyati asosida nanoelektronikada nanomateriallar va nanotexnologiyalar sohasidagi tadqiqotlarning hozirgi holatini tavsiflash va tahlil qilish amalga oshiriladi. Olingan ma'lumotlar elementlarining o'zaro bog'liqliklarini ob'ekt sohasi tushunchalari ko'rinishida tizimlashtirish va tavsiflash amalga oshiriladi.

Kalit so'z. Nonorazmir, struktura, elemental, ob'ekt soxasi.

Abstract

The task of the stage was the formation and primary structuring of the subject area of search and extraction of knowledge in a given thematic area of activity of the NNS. On the basis of available literature data and search activities on the Internet, a description and analysis of the current state of research in the field of nanomaterials and nanotechnologies in nanoelectronics are carried out. The structuring and description of the interrelations of the elements of the received information in the form of concepts of the subject area is carried out.

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Introduction

An infological model of the subject area is proposed, which includes five main types of nanomaterials. Among them: various types of low-dimensional semiconductor nanostructures (zero, one and two-dimensional), magnetic nanostructures, two-dimensional multilayer structures of nanometer-thick films and layers of quantum dots (superlattice structures), molecular nanostructures, fullerene-like materials, as well as methods for their diagnostics. The contents of the information content of databases on nanomaterials, nanotechnologies and nanodevices are proposed, on the basis of which a logical model of the data warehouse, a prototype of the future database, will be formed at the next stage. An optimal list of information sources in the direction and a methodology for search work have been developed. As a result of the search for information on established sources, preliminary registers of nanomaterials and nanotechnologies were developed in the direction of nanoelectronics. The development of modern semiconductor electronics includes the use of nanotechnologies, which are defined as the science and technology of creating, manufacturing, characterizing and implementing materials and functional structures and devices at the atomic, nanometer levels. Nanotechnologies must have atomic precision in obtaining semiconductor nanosystems with the required chemical composition and configuration and include methods for complex diagnostics of nanostructures, including control during manufacture and control of technological processes on this basis. The development of nanotechnologies was stimulated by the development of semiconductor nanostructures grown by molecular beam and organometallic epitaxy, and the creation on their basis of fundamentally new devices and devices in electronics and optoelectronics, which are now widely used in systems for storing, transmitting and processing information (lasers based on quantum wells and superlattices, microwave transistors with a two-dimensional electron gas, etc.). Powerful The impetus for the development of nanotechnology was the discovery of tunneling microscopy in the 1980s, the ideas of which formed the basis for the development of a wide range of modern probe methods for diagnosing materials at the nanolevel, as well as a number of technological methods (nan lithography, molecular assembly, self-organization). Known technologies (electron and X-ray lithography, focused ion beam technique) and diagnostic methods (super-resolution electron microscopy, scanning probe microscopy, X-ray methods, including those using synchrotron radiation, femtosecond spectroscopy) have been significantly improved, which makes it possible to create nanostructures in a controlled manner,

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nanomaterials and devices for various purposes based on them. Modern experience in the development of devices and devices based on quantum heterostructures (quantum dot lasers, ultrafast transistors, memory devices with giant magnetoresistance) shows that the results of fundamental research in this area find practical application in a very short time . These achievements in the coming years can lead to fundamental changes in many areas of human activity - in electronics, computer science, energy, medicine, etc. According to foreign experts, the volume of the world nanotechnology market by 2010 will be more than 1 trillion. US dollars. The development of nanotechnologies and related areas of science, technology and production in the country is aimed at increasing the competitiveness and expansion of Russia's presence in the world market, improving the country's security through the widespread introduction of special nanosystem technology, improving weapons, military and special equipment. with the foregoing, the state scientific, technical and innovation policy in this area of activity should be a priority and have, first of all, a technological focus, including an analysis of the market for science-intensive nanotechnological products, forecasting the possible development of certain technological areas in the field of creating nanosystems.

Ensuring the transition from research to the use of their results for the development of the foundations of the nanoindustry is to create favorable conditions to support the work, including information support. This is served by the regional segment of the telecommunications national nanotechnological network (NNN) and the database on the thematic area of activity of the NNN nanoelectronics, which are being developed within the framework of this work, providing information technology and analytical support for research and development in the field of nanoelectronics, as well as experimental design work, aimed at creating competitive products in this area, their accelerated industrial development and commercialization. Modern scientific and technological progress is undoubtedly determined by the development of electronics, which is based on achievements in various fields of fundamental sciences, mainly solid state physics, semiconductor physics, and solid state technology. . Recent advances in science show that, in contrast to traditional microelectronics, whose potentialities will apparently be exhausted in the next decade, further development of electronics is possible only on the basis of fundamentally new physical and technological ideas. Thus, over a number of decades, an increase in functional complexity and speed of systems was achieved by increasing the density of placement and reducing the size of elements, the principle of operation of which did not depend on their scale. When moving to element sizes of the order of tens or units of nanometers, a qualitatively new situation arises, consisting in the fact that quantum effects (tunneling, size

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quantization, interference effects) have a decisive influence on physical processes in nanostructures and the operation of devices based on them. also the creation of nanostructures in which the role of functional elements is performed by individual molecules. In the future, this will make it possible to use the principles of receiving and processing information implemented in biological objects (molecular nanoelectronics). New opportunities in increasing power, temperature and radiation resistance, expanding the frequency range, improving the ergonomic characteristics of devices open up a direction in which the ideas and technological achievements of vacuum and solid-state electronics (vacuum nanoelectronics) are synthesized. the level of solid-state surface and multilayer structures with a given electronic spectrum and the necessary electrical, optical, magnetic and other properties.[3] (dimensional quantization), changing the degree of connection between the layers ("wave function engineering"). Along with quantum-dimensional planar structures (two-dimensional electron gas in quantum wells, superlattices), one- and zero-dimensional quantum objects (quantum wires and dots) are being investigated, interest in which is associated with hopes for the discovery of new physical phenomena and, as a consequence, for obtaining new opportunities for effective control of electronic and light fluxes in such structures. Nanotechnologies are designed to solve the following problems in electronics [2]: - a sharp increase in the performance of computer systems;

- A sharp increase in the throughput of communication channels;
- A sharp increase in the information capacity and quality of information display systems with a simultaneous reduction in energy costs;
- A sharp increase in the sensitivity of sensor devices and an expansion of the range of measured values, which is important, in particular, for environmental problems;
- Creation of highly economical solid-state lighting devices;
- A significant increase in the proportion of the use of electronic and optoelectronic components in medical, biological, chemical, engineering and other technologies.

A sharp increase in the performance of computing systems is necessary in connection with the transition of integrated circuit technology to a nanometer scale. In table. Table 1 shows a forecast of a decrease in the characteristic dimensions of memory ICs and processors (ITRS Roadmap 2002), in Table. 2 - the prospect of reducing energy per switching.

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Table 1

	Year of production, нм	2003	2010	2013	2016
DRAM	1/2 Pitch	100	45	32	22
MPU	1/2 Pitch	107	45	32	22
MPU	Printed Gate Length	65	25	18	13
MPU	Physical Gate Length	45	18	13	9

Thus, the development of "traditional microelectronics" implies a transition to nanotechnology. The development of nanotechnology will make it possible to design fundamentally new IC elements, such as, for example, “single-electron” devices that consume extremely low switching energies, or ultra-fast bipolar Si–Ge transistors with bases several nanometers thick. Devices based on nanostructures are fundamentally necessary for reading information in the computing process due to extremely low signal levels. [1] An example is magnetic readers based on the giant magnetoresistance effect that occurs in layered metallic magnetically ordered media with a layer thickness of several nanometers.

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