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ION IMPLANTATION AND QUANTUM STRUCTURES

Abstract: Creating such objects in silicon crystals, which is considered the main material of modern electronic technology, is a very promising issue. The creation of such objects in silicon crystals, which is considered the main material of modern electronic technology, is a very promising issue. The amount of impurities introduced into the silicon crystal depends on their solubility in silicon I am limited.

Key words: Ion implantation, Application of quantum structures, Resonant tunnel diode, Lasers based on quantum depths, inverse density, high-frequency tunnel diodes, transistors, semiconductors, lasers, various sensors for quantum computers.

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ИОННАЯ ИМПЛАНТАЦИЯ И КВАНТОВЫЕ СТРУКТУРЫ

Аннотация: Создание подобных объектов в кристаллах кремния, который считается основным материалом современной электронной техники, является весьма перспективной задачей. Создание подобных объектов в кристаллах кремния, который считается основным материалом современной электронной техники, является весьма перспективной задачей. Количество примесей, вводимых в кристалл кремния, зависит от их растворимости в кремнии. Я ограничен.

Ключевые слова: Ионная имплантация, Применение квантовых структур, Резонансно-туннельный диод, Лазеры на основе квантовых глубин, обратная плотность, высокочастотные туннельные диоды,

транзисторы, полупроводники, лазеры, различные датчики для квантовых компьютеров.

Ion implantation is the bombardment of ions of another element (eg, Ge, Mn, Fe, Ni) into the base material (eg, silicon) [1].

In this case, the intended amount of foreign atoms is introduced into the substrate by controlling the energy and dose of ions. Due to the processes of self-organization, a large number of introduced and unbalanced atoms form nanoclusters, a single-point combination of a large number of up to 10,000 atoms, and they are called quantum properties [2].

In recent years, the formation of KNs on the surface of semiconductors using the method of ion implantation and the study of their properties are rapidly developing. In particular, in many scientific centers of the world, there are a number of scientific works dedicated to the formation of KNs with the help of implantation of germanium ions in silicon crystal, and the study of their shape and properties [3].

The creation of such objects in silicon crystals, which is considered the main material of modern electronic technology, is a very promising issue. The amount of impurities introduced into the silicon crystal depends on their solubility in silicon

I am limited. One of the methods used to change this limit is the method of ion implantation. The introduction of atoms of transition group elements into silicon fundamentally changes their physical and recombination parameters. Due to this, silicon samples containing such mixtures are used as highly sensitive probes in various sectors of the economy. The formation of CNs composed of such mixtures is of course very interesting from a practical point of view [4].

A number of experiments were conducted to study the conditions for the formation of KNs and their effect on the electrophysical and photoelectric properties of FeQ and MnQ ions introduced into the silicon crystal with the help of ion implantation. Indeed, in such samples with KN, anomalously large photosensitivity in the near and mid-infrared region of the spectrum, various heterogeneous current instabilities, giant magnetoresistance, and the like have many interesting and practically promising results received [5,6]. They are explained by the formation of complex molecules (for example: Mn6, Mnl2, Fe8, Fel0, etc.), i.e. KNs, in the ionized state of atoms of iron and elements belonging to the transition group.

In fact, in recent times, the elements of the firing group, such as Fe, Co, Ni, Mn, have a very large spin due to the processes of self-organization by interacting with oxygen, hydrogen and carbon atoms under certain conditions. (S=12) formation of huge magnetic molecules, study of their magnetic properties is being carried out rapidly.

Application of quantum structures. Quantum structures are already widely used in all aspects of electronics [7]. In particular, ultra-high-frequency tunnel diodes, transistors, semiconductors created on the basis of quantum structures lasers, various sensors and microprocessors for quantum computers are considered the basis of modern electronics.

Resonant tunnel diode is a classic particle, full, it exceeds the energy of the potential barrier only if it is greater than it, if it is less, the particle returns from the barrier and moves in the opposite direction. A quantum particle moves differently: even if its energy is insufficient, it can overcome the barrier like a wave. Even if the total energy is less than the potential energy, there is a possibility to pass the barrier without increasing [8]. This quantum phenomenon has been named the "tunneling effect" and is used in resonant tunneling diodes.

Lasers based on quantum depths. Quantum structures are successfully used in the preparation of lasers. Today, effective laser devices created on the basis of quantum wells have reached the consumer market and are successfully used in fiber-optic communication [9]. The structure and operation of the devices are as follows: first, for any laser, it is necessary to increase the inverse density of energy levels. In other words, more electrons should be located in the higher energy level than in the lower one, and this is less during the state of thermal equilibrium.

Secondly, each laser needs an optical resonator or a system of calculators that collect electromagnetic radiation into a working volume.

In order to turn a quantum well into a laser, it must be connected to two contacts that allow electrons to flow in and out. An electron entering the conduction band of the contact arc jumps, passes from the conduction band to the valence band and radiates its excess energy in the form of a quantum, that is, an electromagnetic wave. Then it leaves the valence zone through another contact [10]. In quantum mechanics, the radiation frequency hv=Ed-Ev (5) with the condition is known to be identified. Here Ev Ev1 is suitable. energy of the first energy levels in the conduction band and the valence band.

Electromagnetic radiation generated by the laser should be concentrated in the central working area of the device. For this, the refractive index of the inner layers should be greater than the outer one. It can also be said that the inner field acts as a wave transmitter. Reflecting mirrors are installed on the boundaries of the waveguide, which act as a resonator Lasers based on quantum wells have several advantages over conventional semiconductor lasers [11]. The following can be included in them: the ability to control the generated laser frequency, the lack of useless fading in optical radiation, the ease of creating inverse density in electronic gases, which requires less current and provides more light. Due to this, their efficiency reaches up to 60%.

Currently, extensive work is being carried out in many laboratories of the world on the preparation of lasers based on quantum depths. In 2003, Russian scientist J. Alfyorov was awarded the Nobel Prize for his services in creating lasers used in fiber-optic communication [12].

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