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Practical Significance of Studying Diffusion Processes in Semiconductors

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Abstract: This article shows the practical relevance of studying diffusion processes in semiconductors, which has educational and scientific-practical significance for the creation of semiconductor devices with specified properties and their production technologies.

Keywords: diffusion, diffusion process parameters, diffusion coefficient, current density, gas, solid-state, liquid, heterodiffusion, crystal lattice, electronics, microelectronics, semiconductor devices, semiconductor device manufacturing technologies, scientific research centers, institutes, mathematical numerical modeling.

Semiconductors electronics and microelectronics in the fields very wide used, modern electricity of equipment almost all from computers pulling until mobile contact to their phones semiconductor to technologies based on In everyday life, in techniques and technologies, lubricants and tools and devices made on their basis are increasingly widely used. The main reasons for this are the excellent properties of semiconductor materials: semiconductors are very sensitive to various external influences, devices manufactured on their basis are small in size, have a long service life, and perform many tasks. In addition, they are resistant to various shocks.

Semiconductors belong to the class of substances that occupy an intermediate position between substances that conduct electricity well and substances that practically do not conduct electricity in terms of electrical conductivity. By changing the amount of input in the semiconductor to 0.1-1%, its electrical conductivity can be increased in a very large range **(** up to millions **).**

The diffusion process occurs in gas, liquid or solid bodies and its rate depends on the density, viscosity, temperature and nature of the diffusing substance and a number of other factors. As the temperature rises, the diffusion process accelerates.

There are many types of diffusion, namely:

1) Self-diffusion (in single-mixed systems);

2) Heterodiffusion (in multi-mixed systems).

Swedish scientist Svente Arrhenius theoretically studied diffusion processes in semiconductors and found that the crystal lattice determined that the self-diffusion of atoms through nodes and between nodes and the diffusion mechanisms of various elements are determined depending on

the type of solid solution formed in the crystal lattice. In addition, in 1855, the Swedish scientist Fick created his first (Fick's first law) and second (Fick's second law) laws to describe diffusion processes in ideal gases and solutions. Fick's first and second laws determine the distribution of atoms of a substance along the coordinate, the surface diffusion of a substance, the amount of a substance, and other quantities when the initial and boundary conditions and the diffusion coefficient are given [1-15].

So, what is the practical significance of studying diffusion processes in semiconductors ?

Currently, the current density of the diffusible input substance, N is the concentration of impurity atoms, D_0 is the constant and D is the diffusion coefficient, E_d is the diffusion activation energy, the distribution graphs of impurities in the semiconductor material, the rate of diffusion of the substance in the semiconductor, the ratio of concentrations, mobilities and determining a number of other parameters serves as a basis for creating new modern wound-conducting devices. In addition, it is very difficult to create technologies for creating devices based on semiconductors without determining the above-mentioned parameters of diffusion in semiconductors.

In this direction, Uzbekistan (A number of scientific research institutes within the Academy of Sciences of Uzbekistan, National University of Uzbekistan named after Mirzo Ulugbek Faculty of Physics, Institute of Semiconductor Physics and Microelectronics under Mirzo Ulugbek National University of Uzbekistan, Tashkent State Technical University named after Islam Karimov, Andijan State University, Bukhara State University, etc.), Russian Federation (Moscow State University named after MV Lomonosov, St. Petersburg University, Russian Academy of Sciences, Physical and Technical Scientific Research Institute named after AF Ioffe), America (University of California, University of Washington, University of Chicago,), China (Tsinghua University, Fudan University, Peking University,) and several hundreds of scientific centers researching diffusion processes in semiconductors are effectively operating in European countries.

Studying the diffusion of various elements into the materials based on them is of practical importance in the creation of semiconductor devices. For example, knowing the parameters of diffusion processes is an actual task in the manufacture of semiconductor devices with pre-planned, special properties. But by the end of the last century, due to the fact that the technologies of their creation in the production of semiconductor devices require a lot of time, mathematical numerical modeling methods (specially created programs) began to be used in the study of diffusion processes in certain semiconductors. An example as one series study and scientific in the centers wide spread out digital models - Diffusion, HD DIFFUSION, FYS4310 (Material Science of Semiconductors), Comsol was created. It's digital models half in conductors diffusion processes in learning many amenities brought about, most importantly saved many researchers time.

In conclusion that is, semiconductors in physics in advance defined, known to parameters have was semiconductor tools Create and them work release technologies study for and scientific in terms of important practical important have was in semiconductors atoms diffusion present of the day current from directions is one.

REFERENCE

1. Hamdamov J.J., S.O. Saidov, Nasullaev B.S.O. Issledovanie vliyaniya razlichnyx vidov izlucheniy na elektrofizicheskie svoystva kremnievyx struktur, legirovannyx perekhodnymi elementami. Current physical problems. Materialy mejdunarodnoy nauchnoy and scientific-technical conference. Bukhara State University. November 25-26, 2022 68-70 p. - Mode is friendly: URL:

   https://journal.buxdu.uz/index.php/journals_buxdu/article/download/8231/5238/22790 .

2. Saidov Safo Olimovich, Kamolov J'orabek Jalal son Technology polucheniya tonkosloyn yx heterostructure n - CdS / p - CeF_3 i issledovanie ix elektricheskikh svoystv. // Miasto

Przysztosci. 2022. - V. 29.- P. 72-78. - Mode is accessible: URL: https://miastoprzyszlosci.com.pl/index.php/mp/article/view/708 .

3. S.O. Saidov, K.S. Ejkova. ROL FIZIKI DLYa SPETsIALNOSTEY LEGKOY PROMYSHLENNOSTI. "NATIONAL RESEARCH IN UZBEKISTAN: PERIODIC CONFERENCES". https://conferences.uz/plugins/themes/bootstrap3/pdf/conf_36_2022/17.Fizika_matematika_1_qism.pdf#page=44.
4. SO Saidov, IB Raupova. https://philpapers.org/go.pl?id=SAITRO-8&proxyId=&u=https%3A%2F%2Fscholarzest.com%2Findex.php%2Fesj%2Farticle%2Fview%2F2143.
5. S.O. Saidov, Z.I. Tuksanova. SOME KEY ISSUES OF MODERN PHYSICS TEACHING IN HIGHER EDUCATION. http://journal.buxdu.uz/index.php/journals_buxdu/article/view/697.
6. Saidov SO, Badriddinov Islambek Strong son HIGHER EDUCATION AND TEACHING MODERN PHYSICS IN IT. https://gejournal.net/index.php/IJSSIR/article/view/388/.
7. Saidov SO, Atoyeva MF, Faiziyeva KH.A. meat all. The Elements Of Organization Of The Educational Process On The Basis Of New Pedagogical Technologies. https://inlibrary.uz/index.php/tajas/article/view/10356.
8. Kamolov Jurabek Jalal Ugli, Saidov Safo Olimovich. RAZRABOTKA MATEMATIChESKOY MODELI NESTATSIONARNOGO PROCESSA NAGREVA I OKHLAJDENIYA TONKOY PLASTINKI S KERMETNYM POKRYTIEM. https://scientists.uz/uploads/202206/A-109.pdf/
9. S.O. Saidov, M. Sharofova. Position and role of modern physics and higher education. https://miastoprzyszlosci.com.pl/index.php/mp/article/view/1864
10. S. Zainobiddinov, Sh. Yolchiyev, D. Nazirov, M. Nosirov. In semiconductors atoms diffusion. Education manual. " Uzbekistan philosophers national society. Tashkent. 2012. 176 p.
11. P.T. Oreshkin. Physics of semiconductors and dielectrics. Uchebnoe posobie. M.: Vysshaya school. 1977. 448 p.
12. M.A. Azizov " Semiconductors physics ". Teacher publishing house, Tashkent-1974.
13. https :// www . ziyauz com / books / college _ and _ atomic _ textbooks / physics / Diffusion %20 of atoms % 20 in semiconductors % 20 (S. Zaynobiddinov , % 20 Sh . Yo'lchiyev) . pdf
14. https :// en . Wikipedia . org / wiki / Diffusion
15. https://link.springer.com/referenceworkentry/10.1007/978-0-387-29185-7_6