UDC 621.382 DOI: 10.15222/TKEA2019.1-2.34

Ph.D. V. N. LITVINENKO[1], D.Sc. I. M. VIKULIN[2], Ph.D. V. E. GORBACHEV[2]

Ukraine, [1]Kherson National Technical University;
[2]Odessa National Academy of Telecommunications named after A. S. Popov
E-mail: hersonlvn@gmail.com

IMPROVEMENT OF THE REVERSE CHARACTERISTICS OF SCHOTTKY DIODES USING GETTERING

The paper considers the causes and mechanisms of the influence of defects and impurities on the reverse current of the Schottky diode. The influence of two getter regions, which were created by different technologies on the working side and the reverse side of the plate, on the value of the reverse current of diodes was experimentally investigated, and the physical factors of such influence were analyzed. The proposed technology for creating getter regions allows one to significantly reduce the reverse current of diodes and increase the product yield.

Keywords: gettering, reverse current, Schottky diode, impurities, oxidation stacking faults.

Schottky diodes (**SD**s) are widely used in many areas of electronics as low and medium power rectifier diodes, as well as pulsed diodes [1, 2]. The purposeful using of SDs as pulsed diodes is explained by the fact that they are unipolar devices with no injection of minority charge carriers. Because of this, their speed is higher than that of pulsed diodes based on *p–n*-junctions, the speed of which is limited by the phenomenon of "resorption" of minority charge carriers during switching the voltage from forward to reverse [3]. Some series of SDs are used as pulse rectifier diodes.

It should be noted that the cost of the SDs remains relatively high due to the low yield of diodes, which is explained by a high value of their reverse current and a smaller breakdown voltage compared to *p–n*-junctions. These phenomena are associated with a significant dependence of the reverse current of the SD on the quality of the surface of the diode structure and the influence that structural defects and impurities have upon the reverse current [4—8]. First and foremost, one should note oxidation stacking faults (**OSF**s), which are formed in the active region of the diode during high-temperature operations [6, 7]. OSFs are usually located in the near-surface region of the crystal. OSFs which are not decorated with impurities have practically no effect on the inverse characteristics of the diodes [7]. The decoration of the OSF with heavy metal impurities during thermal oxidation leads to the fact that a high density of surface states is formed in the near-surface silicon layer. After deposition on a surface of molybdenum, which forms the Schottky barrier, the potential barrier at the metal/semiconductor interface becomes thin enough for the tunneling of electrons from the metal to the semiconductor at reverse bias of the junction [9].

Tunneling is one of the causes for the so-called soft reverse characteristics. In this case, the region near the edge of the metal contact is important, because the electric field lines are converged there. A strong electric field leads to a thinning of the potential barrier, and the action of image forces decreases its height. Both of these factors increase the reverse current of the *p–n*-junction. This effect is further enhanced if the near-boundary semiconductor layer is enriched by electrons as a result of the presence of a positive surface charge [10]. All these facts lead to an additional decreasing in the thickness of the barrier at the edge of the metal contact. Therefore, the value of reverse current of the Schottky diodes is largely determined by the quality of the protective SiO_2 layer, the Si/SiO_2 interface and the metal/Si interface.

The generation of charge carriers in the depletion region also significantly affects the reverse branch of the current-voltage ($I-V$) characteristic of the Schottky diode. The generation component of the reverse current IG is expressed [9] by the formula

$$I_g = qn_i d/(2\tau), \qquad (1)$$

where d is the width of the depletion region in the semiconductor;
τ is the carrier lifetime in the depletion region;
q is the electron charge;
n_i is the intrinsic carrier concentration in the semiconductor.

The generation of charge carriers in the depletion region is particularly intense when a high density of structural defects (e.g., OSF) is present in a semiconductor, since this significantly decreases carrier lifetime [7].

In order to reduce the density of bulk structural impurity defects in silicon, various gettering methods are used [11—14], but, as practice has shown, many of them are ineffective for reducing the reverse current of the diodes. Many different methods have been developed to improve the surface properties of the Schottky diode structures [15], but not all of them are effective for improving the inverse characteristics of diodes.

The goal of the work is to study how structural defects and impurity contaminations of the surface of the diode structure influence the level of the reverse current of the Schottky diodes and to determine the effectiveness of the proposed technology to create getter regions of the structures with respect to reducing the reverse current and increasing the yield of suitable devices.

Test samples

Structures of investigated diodes were fabricated by isoplanar technology [16] on silicon *n*-type epitaxial structures with a specific resistance of 1 Ω·cm and a thickness of 3 μm grown on a silicon substrate oriented along the (111) plane.

The basic technological route for manufacturing diode structures included the following main technological operations:

— standard chemical treatment of plates;

— sequential deposition of layers of nitride and silicon dioxide with a thickness of 0.1 and 0.3 μm, respectively;

— formation of 0.5 μm heigh mesa structures by photolithography methods with using the round sections of a silicon nitride film with a diameter of 50 μm as a mask;

— oxidation of mesa structures at the temperature of 1050°C for 2 hours alternately in dry O_2 (10 min), in water vapor (100 min) and again in dry O_2 (10 min);

— annealing in argon for 30 minutes at the temperature of the oxidation process (as a result, the thickness of the grown protective SiO_2 layer was 0.7 μm);

— removal of silicon nitride from the contact pads by placing the structures in boiling orthophosphoric acid for 30 min (for safety, in case there is a thin SiO_2 film on the surface of silicon nitride, structures were preliminarily kept in the etchant HF: H_2O = 1:20 for 20 s);

— deposition of a 0.3 μm thick molybdenum layer by vacuum thermal evaporation and formation of a rectifying contact with a diameter of 60 μm using photolithography;

— plate grinding on the substrate side to a thickness of 180—200 μm;

— formation of an ohmic contact on the back side of the plate by sequential deposition of layers of titanium, nickel (by vacuum thermal evaporation) and gold (by electroplating).

Implementing the above operations resulted in obtaining the diode structure shown at **Fig. 1**.

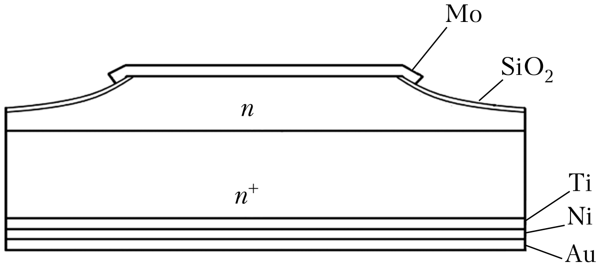

Fig. 1. The structure of the Schottky diode, manufactured according to the basic technology

Investigation of structural defects

Studies of diode structures that were rejected by the value of the reverse current showed the presence in their active regions of OSFs with a density of 10^4—10^5 cm^{-2}. Structural defects were detected by selective etching of the structures in the Sirtl reagent for 10—180 s. The type of structural defects and the assessment of their density were determined using a METAM-1 metallographic microscope. The density of OSFs was determined by the formula [17]

$$N = n/S,$$

where N is the defect density;
n is the average value of the number of defects in five areas;
S is the area of the field of view in the eyepiece of the microscope.

A micrograph of the surface of one of the studied diode structures after selective etching in a Sirtl reagent for 25 s is shown in **Fig. 2**.

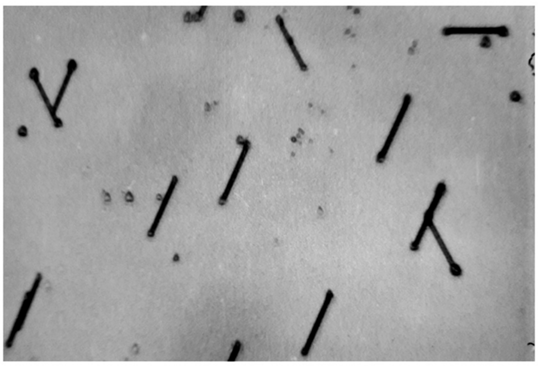

Fig. 2. The surface of the diode structure with the identified OSFs

Gettering technology

Firstly, in order to prevent the formation of OSFs, a gettering method was chosen that organically fit into the technological route of the diode manufacturing. Since OSFs start forming from the first high-temperature operation, i.e. thermal oxidation, it is obvious that gettering should be performed at the very beginning of the technological route for manufacturing the diode [11, 18]. Studies have shown that the most effective way to prevent the formation of OSFs is to create a getter area on the reverse side of the plate by implanting argon ions into it and then annealing the plate in a mixture of nitrogen and oxygen before precipitating silicon nitride layers [19].

The getter region **(GR)** was formed on the reverse side of the plate by implanting argon ions with an energy of 100 keV, by a dose of $5{\cdot}10^{15}$ cm^{-2} using the industrial plant for ion doping Vesuvius-5. Then the plates were annealed in a mixture of nitrogen (130 l/h) and oxygen (6 l/h) at the temperature of 1100 °C for 3 hours. Further, when referring to this method of creating an GR, we will use the designation G_{Ar}.

In order to improve the surface quality of the diode structures and thus to reduce the value of their reverse current, the authors tested a method of creating a getter by boron diffusion into the working side of structures after the formation of a protective SiO_2 layer [20]. Boron diffusion was carried out using the open tube method from a B_2O_3 source at the temperature of 950°C for 30 minutes in a mixture of argon (100 l/h) and dry oxygen (4 l/h). At the same time, a borosilicate glass (BSG) film was formed on the surface of the protective layer of SiO_2. This method of creating a getter will be further denoted as G_B.

Fig. 3 shows the structure of the Schottky diode, manufactured according to the developed technology with the using of double-sided gettering (G_{Ar+B} technology, combining G_{Ar} and G_B) before the grinding operation of the reverse side of the plate.

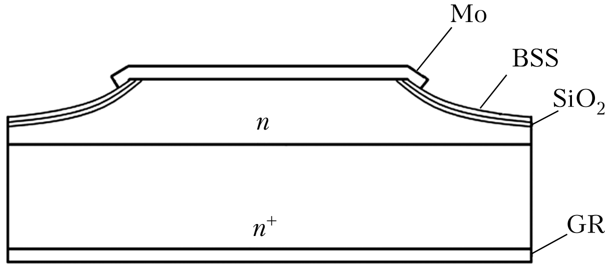

Fig. 3. The structure of the Schottky diode, manufactured according to the developed technology using double-sided gettering

The effect of additional boron diffusion on the surface quality of diode structures was estimated by the method given in [17, 21]. A SiO_2 film was grown on the initial plates under conditions similar to oxidation conditions of mesa structures, after which they were cut into two parts. One of them was left as a control, and the second was subjected to additional diffusion of boron into the SiO_2 layer in the mode corresponding to the developed technology. Then Al was sprayed onto all the plates, and MOS structures ($Al/SiO_2/Si$) were fabricated using photolithography. Then, the C–V-method was used to calculate the values of the total induced charge on the structure fabricated using additional boron diffusion (Q_{ss1}) and on the control MOS structure (Q_{ss2}). Voltage-Farad characteristics were measured using an RLC E7-12 instrument. The following results were obtained: $Q_{ss1} = 2.3{\cdot}10^{-9}$ C; $Q_{ss2} = 3.2{\cdot}10^{-9}$ C, the charge ratio was $Q_{ss2}/Q_{ss1} \approx 1.4$.

Thus, the additional diffusion of boron made it possible to reduce by 1.4 times the value of the total charge in SiO_2, which is adequate to decreasing the density of surface states at the Si/SiO_2 interface [17]. This makes it possible to significantly reduce the tunneling of charge carriers through a potential barrier and thereby reduce the value of the reverse current of the diode.

Testing the effectiveness of the developed technology

For this research, three experimental batches of diode structures were formed. Half of the structures in each batch were manufactured using the basic technology, the other half — using one of the methods described above (G_{Ar}, G_B, G_{Ar+B}). The effectiveness of the technology was evaluated by the number of suitable structures, which were selected based on results of metallographic studies and by the value of the reverse current Irev.

The validity criterion was set by limiting $I_{rev} \geq 1$ μA at a reverse voltage of 30 V. In accordance with this, the average value of the product yield for the structures manufactured using the basic technology was 84.1%, the proposed technology with the formation of a getter only on the reverse side of the plate (G_{Ar}) allowed for 88.2%, the technology with only boron diffusion into the working side of the plate (G_B) gave 89.7%, while the one with double-sided gettering (G_{Ar+B}) showed the result of 93.4%.

As can be seen, using any one of the proposed methods for obtaining diode structures allows us to increase the product yield by the criterion of smallness of the reverse current of the devices compared to the basic technology. Note that gettering significantly (from 2 to 6 times) reduces

ISSN 2225-5818

the value of the reverse current. Double-sided gettering allows increasing the percentage of product yield by 9.3% and to obtain a 3—6 times lower I_{rev}.

Before the formation of a rectifying contact, metallographic studies of diode structures were carried out. In the structures obtained by the G_{Ar} method, there were no oxidative stacking faults **(Fig. 4)**. In diode structures with a borosilicate glass (G_B) film, the density of OSF was 10^2—10^3 cm^{-2}, which is significantly (two orders of value) lower than on plates which were made by using the basic technology.

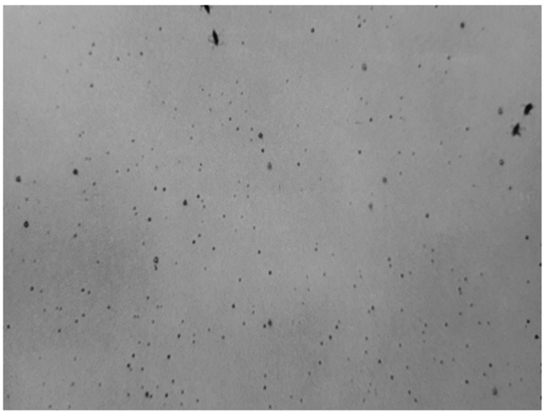

Fig. 4. The surface of the diode structure with the getter region created on the reverse side of the plate by the G_{Ar} method

Fig. 5 shows the reverse branches of current-voltage characteristics of diode structures which were made according to the basic technology and by using the developed methods for creating getter regions. It can be seen that using any of the proposed gettering methods can significantly reduce the level of the reverse current of the diodes increasing the diode breakdown voltage (possibly by eliminating surface breakdown). In this case, the G_B method is more effective than the G_{Ar}.

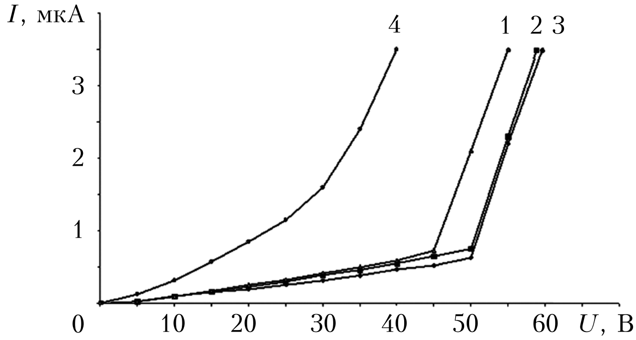

Fig. 5. Reverse I—V- characteristics of diode structures made by using various technologies:
1 – G_{Ar}; *2* – G_B; *3* – G_{Ar+B}; *4* – basic technology (curves were obtained at 20°C)

Let us analyze how the gettering regions created by the G_{Ar} and G_B methods affect the parameters of the diode.

Implantation of argon ions on the reverse side of the sample plate during the annealing process leads to the formation of high-density dislocations, which play the role of drains for metal impurities. At the same time, the nuclei of the OSFs, which are formed during the growth of silicon ingots and during epitaxy, are also being suppressed. This prevents the formation of OSFs during the process of thermal oxidation of plates (see Fig. 4), due to which the generation component of the reverse current (1) is significantly reduced. In addition, the getter area created in this way effectively absorbs uncontrolled impurities from the bulk and near-surface regions of the plate, which reduces reverse currents of diodes, since they are caused by both bulk and surface mechanisms.

A borosilicate glass layer formed during the boron diffusion on the surface of the protective SiO_2 film exhibits a gettering effect against impurity contaminants (usually impurities of Na, K, Fe, Ni, Cu, etc.), which usually get into the SiO_2 layer grown by thermal oxidation from walls of the quartz tube and from oxidizing environment. This allows to perform a deep cleaning of the protective oxide layer and the Si/SiO_2 interface from the impurities, which makes it possible to reduce the total charge in SiO_2, and this is equivalent to a decreasing of the density of surface states at the Si/SiO_2 interface. Improving the surface quality of structures, which is achieved by gettering, virtually eliminates the tunneling of current carriers through the potential barrier, which in turn provides a significant reduction in surface leakage currents at reverse connection of diodes. In addition, when conducting diffusion into the working side of the plate, the back side of the plate is not specifically protected, therefore, a high-alloyed gettering p^+-layer is formed on it. This allows for a significant reduction in the density of OSFs formed during thermal oxidation in active regions of the diode [22]. It should also be noted that another possible reason for decreasing the density of defects may be the effect of «post-oxidizing annealing» occurring in relation to the already formed OSFs during boron diffusion [23].

Conclusion

The creation of a getter formed by implantation of argon ions on the reverse side of the diode structure plate using the G_{Ar} technology prevents the formation of OSFs in the active region of the diode structure, and also provides a relatively high-quality cleaning of the near-surface diode area from uncontrolled impurities, which leads to a decrease in the charge carrier generation in the depletion region of semiconductor and to a reduction of the surface leakage currents.

The creation of a getter by diffusion of boron into the working side of the diode structure using the G_B technology prevents such undesirable surface effects as surface tunneling of electrons from the metal into the semiconductor and surface breakdown of diodes, and also makes it possible to reduce the density of OSFs on the working-side surface of the diode.

Thus, the first G_{Ar} method obviously prevents the generation of charge carriers in the depletion region of transition, but doesn't completely eliminate surface leakage currents. The second G_B method practically liquidates surface leakage current, but doesn't eliminate the generation component of the reverse current.

The diode breakdown voltage increases with the use of both technologies, however, the G_B method turned out to be more efficient than the G_{Ar} method.

When we used G_{Ar} and G_B technologies separately, the number of suitable diodes at the end of the production cycle increases by 5—6% compared with the basic technology, and by 11% when both of technologies G_{Ar+B} were used by applying double-sided gettering.

Thus, the developed technology for manufacturing Schottky diode structures prevents the formation of oxidative packing faults in the active region of the diode and improves the surface state of diode structures, which reduces the reverse current of diodes and, consequently, increases the percentage of product yield.

REFERENCES

1. Drozdov A.V., Danilov D.S., Yusupov I.V., Ghoshin G.G. [Simulation of diodes with Schottky barrier for applying in monolithic microwave integrated circuits]. *Doklady TUSUR*, 2018, vol. 21, no. 1, pp. 28-31. (Rus)

2. Kerimov E.A. Electrical properties of contacts with the IrSi-Si-based Schottky barrier. *Russian Microelectronics*, 2015, vol. 44, iss. 4. pp. 244-247.

3. Vikulin I.M., Stafeev V.I. *Fizika poluprovodnikovykh priborov* [Physics of semiconductor devices]. Moscow, Radio i Svyaz', 1990, 264 p. (Rus)

4. Khorosheva M.A., Kveder V.V., Seibt M. On the nature of defects produced by motion of dislocations in silicon. *Physica Status Solidi A*, 2015, vol. 212, iss. 8, pp. 1695-1703. https://doi.org/10.1002/pssa.201532153

5. Kveder V., Khorosheva M., Seibt M. Interplay of Ni and Au atoms with dislocations and vacancy defects generated by moving dislocations in Si. *Solid State Phenomena*, 2016, vol. 242. pp. 147-154. https://doi.org/10.4028/www.scientific.net/SSP.242.147

6. Loginov Yu.Yu., Mozsherin A.V., Brilikov A.V. [Effect of elastic stresses on the formation of structural defects in semiconductors]. *Vestnik SibGAU*, 2013, no. 2(48), pp. 198-200. (Rus)

7. Ravi K.V. *Imperfactions and impurities in semiconductor silicon*. New York, Wiley, 1981, 379 p.

8. Vikulin I.M., Litvinenko V.N., Shutov S.V. et al. Enhancing parameters of silicon varicaps using laser gettering. *Tekhnologiya i konstruirovanie v elektronnoi apparature*. 2018, no. 2, pp. 29-32. http://dx.doi. org/10.15222/TKEA2018.2.29

9. Rhoderick E. H. Metal-semiconductor contacts. Oxford, Clarendon Press, 1978, 201 p.

10. Solodukha V.A., Lanin V.L., Soloviev Ya.A. [Increasing the stability of the structures of the Schottky diodes with a guard ring to static electricity discharges]. *Bulletin of Polotsk State University. Serie C: Fundamental Sciences*. 2015, no.12. pp.72-81. (Rus)

11. Litvinenko V.N., Bohach N.V. [Defects and impurities in silicon and their gettering methods]. *Visnik KhNTU*, 2017, no. 1(60), pp. 32-42. (Rus)

12. Pilipenko V.A., Gorushko V.A., Petlitskiy A.N., Ponaryadov V.V., Turtsevich A.S., Shvedov S.V. Methods and mechanisms of gettering of silicon structures in the production of integrated circuits. *Tekhnologiya i Konstruirovanie v Elektronnoi Apparature*, 2013, no. 2-3, pp. 43-57.

13. Bokhan Yu.I., Kamenkov V.S., Tolochko N.K. Dominant factors of the laser gettering of silicon wafers. *Semiconductors*, 2015, vol. 49, iss. 2, pp. 270-273. https://doi.org/10.1134/S1063782615020050

14. Klimanov E.A. [Mechanism of gettering the generation-recombination centers in silicon at diffusion of phosphorus and boron]. *Uspekhi prikladnoi fiziki*, 2015, vol. 3, no. 2, pp. 121-125. (Rus)

15. Litvinenko V.M., Vikulin I.M. Influence of surface properties on the inverse characteristics of semiconductor devices. *Bulletin of KhNTU*, 2018, no. 1 (64), pp.46-56. (Rus)

16. Kruglov A.I., Krus A.P., Belyaev A.A. Optimization of the manufacturing technology of diode structures in order to reduce defect formation processes and improve the parameters of devices with a Schottky barrier. *Electronic equipment. Ser. 8. Quality management, standardization, metrology, testing*, 1989, iss. 2 (134). pp. 70-74. (Rus)

17. Anokhin V.Z. *Practikum po himii I technologii poluprovodnikov* [Practical work on chemistry and technology of semiconductors]. Ed. Ugai Ya.A, Moscow, Higher School, 1978, 264 p. (Rus)

18. Grafutin V.I., Prokop'ev E.P., Timoshenkov S.P. Gettering and synergetic approaches to the problem of silicon and silicon-based materials. Review. *Nanotechnology Research and Practice*, 2014, vol. 1, no. 1. pp. 4-26. http://dx.doi.org/10.13187/ejnr.2014.1.4п

19. Pat. UA 125518. *Sposib vigotovlennya dioda Shottki* [Method of manufacturing a Schottky diode] / Litvinenko V.M., 2018, Bull. № 9. (Ukr)

20. Pat. UA 55798 A. [Method of fabricating structures of a diode with a Schottky barrier] / V.M. Litvinenko, S.V. Litvinenko. 2003, Bull. № 4. (Ukr)

21. Litvinenko V.M., Bogach M.V. *Vplyv technologichnyh faktoriv na parametri diodiv Shottky* [Influence of technological factors on the parameters of Schottky diodes]. Kherson, publ. by PP Vyshemirsky V.S., 2017, 116 p. (Ukr)

22. Labunov V.A., Baranov I.L., Bondarenko V.P., Dorofeev A.M. *Sovremennye metody getterirovania v tehnologii poluprovodnikovoj electroniki.* [Modern methods of gettering in semiconductor electronics technology]. *Foreign electronics*. 1983, no. 11 (270), pp. 3-66. (Rus)

23. Nemtsev G.Z., Pekarev A.I., Chistyakov Yu.D., Burmistrov A.N. *Getterirovanie tochechnyh defectov v proizvodstve poluprovodnikovyh priborov*. [Gettering of point defects in the production of semiconductor devices]. *Foreign electronics*. 1981, no. 11 (245), pp. 3-63. (Rus)

Received 10.01 2018

DOI: 10.15222/TKEA2019.1-2.34
УДК 621.382

В. М. ЛИТВИНЕНКО[1], І. М. ВІКУЛІН[2], В. Е. ГОРБАЧОВ[2]

Україна, [1]Херсонський національний технічний університет;
[2]Одеська національна академія зв'язку ім. О. С. Попова
E-mail: hersonlvn@gmail.com

ПОЛІПШЕННЯ ЗВОРОТНИХ ХАРАКТЕРИСТИК ДІОДА ШОТТКІ ПРИ ВИКОРИСТАННІ ГЕТЕРУВАННЯ

Діоди Шотткі (ДШ) широко використовуються в багатьох областях електроніки як випрямні діоди невеликої та середньої потужності, а також як імпульсні діоди. При цьому вартість ДШ залишається порівняно високою через низький вихід придатних приладів, що пояснюється високим рівнем зворотних струмів і низькою, в порівнянні з p—n-переходами, пробивною напругою. Ці явища пов'язані з істотною залежністю зворотних струмів ДШ від якості поверхні діодних структур і впливом на них структурних дефектів і сторонніх домішок.

У даній роботі досліджено вплив структурних дефектів і домішкових забруднень поверхні на рівень зворотних струмів ДШ і ефективність застосування операцій гетерування для його зниження і підвищення виходу придатних приладів. Встановлено, що причинами низького відсотка виходу придатних структур ДШ при контролі рівня їх зворотних струмів є окислювальні дефекти упаковки, що утворюються в активних областях діодів в процесі проведення термічного окислення, і домішкові забруднення на поверхні діодних структур. Запропоновано технологію виготовлення структур ДШ з двома гетерними областями, одна з яких створена імплантацією аргону на зворотному боці пластини, друга — дифузією бору на робочій стороні пластини.

У порівнянні з базовою технологією виготовлення структур ДШ показано, що розроблена технологія із застосуванням гетерування структурно-домішкових дефектів дозволяє запобігти утворенню окислювальних дефектів упаковки в активних областях діодів і поліпшити стан поверхні діодних структур, що дає можливість знизити рівень зворотних струмів діодів і, як наслідок, істотно (до 10%) підвищити вихід придатних приладів.

Ключові слова: гетерування, зворотний струм, діод Шотткі, домішки, окислювальні дефекти упакування.

В. Н. ЛИТВИНЕНКО[1], И. М. ВИКУЛИН[2], В. Э. ГОРБАЧЕВ[2]

Украина, [1]Херсонский национальный технический университет;
[2]Одесская национальная академия связи им. А.С. Попова
E-mail: hersonlvn@gmail.com

УЛУЧШЕНИЕ ОБРАТНЫХ ХАРАКТЕРИСТИК ДИОДА ШОТТКИ ПРИ ИСПОЛЬЗОВАНИИ ГЕТТЕРИРОВАНИЯ

Диоды Шоттки (ДШ) широко используются во многих областях электроники в качестве выпрямительных диодов небольшой и средней мощности, а также в качестве импульсных диодов. При этом стоимость ДШ остается сравнительно высокой из-за низкого выхода годных приборов, что объясняется высоким уровнем обратных токов и низким, по сравнению с p—n-переходами, пробивным напряжением. Эти явления связаны с существенной зависимостью обратных токов ДШ от качества поверхности диодных структур и влиянием на них структурных дефектов и посторонних примесей.

В настоящей работе исследованы влияние структурных дефектов и примесных загрязнений поверхности на уровень обратных токов ДШ и эффективность применения операций геттерирования для его снижения и повышения выхода годных приборов. Установлено, что причинами низкого процента выхода годных структур ДШ при контроле уровня их обратных токов являются окислительные дефекты упаковки, образующиеся в активных областях диодов в процессе проведения термического окисления, и примесные загрязнения на поверхности диодных структур. Предложена технология изготовления структур ДШ с двумя геттерными областями, одна из которых создана имплантацией аргона на обратной стороне пластины, вторая — диффузией бора на рабочей стороне пластины.

В сравнении с базовой технологией изготовления структур ДШ показано, что разработанная технология с применением геттерирования структурно-примесных дефектов позволяет предотвратить образование окислительных дефектов упаковки в активных областях диодов и улучшить состояние поверхности диодных структур, что дает возможность снизить уровень обратных токов диодов и, как следствие, существенно (до 10%) повысить выход годных приборов.

Ключевые слова: геттерирование, обратный ток, диод Шоттки, примеси, окислительные дефекты упаковки.

Описание статьи для цитирования:
Litvinenko V. N., Vikulin I. M., Gorbachev V. E. Improvement of the reverse characteristics of Schottky diodes using gettering. Технология и конструирование в электронной аппаратуре, 2019, № 1, с. 34–39. http://dx.doi.org/10.15222/TKEA2019.1-2.34

Cite the article as:
Litvinenko V. N., Vikulin I. M., Gorbachev V. E. Improvement of the reverse characteristics of Schottky diodes using gettering. Tekhnologiya i Konstruirovanie v Elektronnoi Apparature, 2019, no. 1, pp. 34–39. http://dx.doi.org/10.15222/TKEA2019.1-2.34