INFLUENCE OF A MICROSTRUCTURE OF VARIOUS METAL LAYERS ON PROPERTIES OF DIODES SHOTTKI MADE ON THE BASIS OF SILICON AT SMALL AND DIRECT PRESSURE

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ABSTRACT

In hereby work are investigated reception $N_{ix}Ti_{i\ 100-x}$ –n Si Shottky diodes (where x=0: 10: 25: 35: 58: 87: 100:) and Pb_xSb_{100-x}-n Si Shottky diodes, and influence of a microstructure of a film of metal on properties of Shottky diodes at small direct voltage.

It is found that heights of a barrier to both Shottky diodes there is a dependence from termoburn and from a percentage condition of a film of metal. With the help electrogramme and electron-microscopic research it is shown, that change of parameter of given Shottky diode is connected to change of a microstructure film of a metal alloy.

Keywords: microstructure, metal layers, Shottky barrier, semi-conductor, silicon.

I. INTRODUCTION

For the decision of a problem of influence of a microstructure of metal layers on properties of Shottky diodes at small pressure the material or with amorphous structure, or with monocrystal is perspective. Practically manufacturing of an integrated microcircuit with application of Shottky diodes on monocrystal layers is rather difficult technological problem.

In this respect more perspective is metal with amorphous structure.

During last 30 years the amorphous condition of firm bodies is intensively studied in connection with wide application amorphous semi-conductor and metal films in a number of areas of a science and technics.

Absence of borders of grains and granular structure, in the first, does these materials attractive from the point of view diffuzion barriers in manufacture of integrated circuits on film structures with many-tier metallization. In the second, similar a film allow to make termostable elements of microcircuits.

II. MAIN TEXT

The present work is devoted to reception $N_{ix}Ti_{i100-x}$ n Si Shottky diodes and Pb_xSb_{100-x}-n Si Shottky diodes to a basis of silicon at small direct pressure.

Influence of a microstructure of a film of metal on properties of contact the metal-semiconductor is considered in works [1-4]

For manufacturing Shottky diodes as the semiconductor it was used silicon plastic n-type with orientation (III) and specific resistance n of a layer 0,7 Ohm-cm.

As metal has been used the alloy Pb_xSb_{100-x} (where x=2:15:52:70:87:98) and $N_{ix}Ti_{i100-x}$ (where x=0:10:25:35:50:87:100). A film of alloys Pb_xSb_{100-x} and $N_{ix}Ti_{i100-x}$ have been received by a method of electron beam evaporation from two sources. Speed of evaporation of components got out so that the structure of a film corresponded to an alloy $N_{i35}T_{i65}$ and $Pb_{52}Sb_{48}$ as these alloys are inclined to Amorphous

Rentgenstructural analyses received films with the various maintenance of the components, lead on plant DRON-4 have shown that, $N_{i35}T_{i65}$ and $Pb_{52}Sb_{45}$ have amorphous structure and the rest film - polycrystalline [7]

For definition of parameters $N_{ix}Ti_{i\ 100-x}$ –n Si Shottky diodes and Pb_xSb_{100-x}-n Si Shottky diodes at small direct pressure $0 \prec V \prec kT/e$ for the description VAKH has been used the formula [8].

$$I = \frac{e}{k} SA^*T \exp\left(-\frac{\Phi_B}{kT}\right)V \quad (1)$$

Where S -is the contact area , A^* - an effective constant of Richardson, Φ_B - is the height of a barrier of contact. All other designations have usual sense. According to (1) VAKH is expressed by a direct line, corner which factor depends on value of height of a barrier.

Advantage of this method consists that it is especial sensible to spesific to properties of a microstructure of Shottky diodes, direct pressure.

Experimental VAKH $N_{ix}Ti_{i\ 100-x}$ –n Si Shottky diodes in the field of low direct pressure $V \prec kT/e$ are described by the formula (1). And also the height of barriers is calculated for $N_{ix}Ti_{i\ 100-x}$ –n Si Shottky diodes and Pb_xSb_{100-x}-n Si Shottky diodes. On fig.1 it is shown dependence of height of a barrier on percentage of components for $N_{ix}Ti_{i\ 100-x}$ –n Si Shottky diodes and Pb_xSb_{100-x}-n Si Shottky diodes accordingly in an alloy. The specified dependences have been received at room temperature for both diodes with the area $S = 1400 mnm^2$

Apparently from fig.1 the greatest heights of barriers concern to contact to amorphous alloys $N_{i35}T_{i65}$ and $Pb_{52}Sb_{48}$.

Comparing results of dependence of parameters of Shottky diodes from a percentage condition at small pressure to conclude that parameters of Shottky diodes are connected to change of a microstructure of a film of metal.

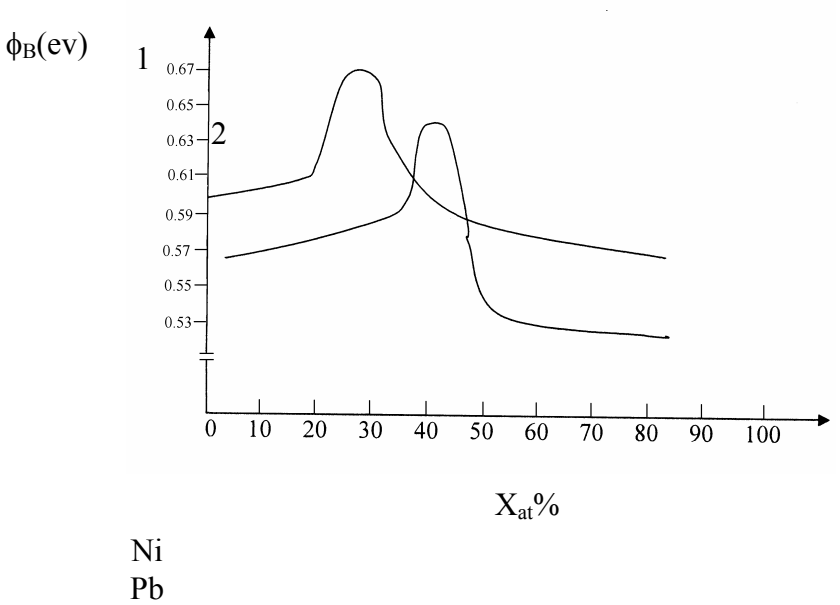

Fig 1. Dependence of height of a barrier of Shottky diodes on percentage of components in an alloy at low direct voltage.

III. CONCLUSION

It is found that heights of a barrier to both Shottky diodes there is a dependence from termoburn and from a percentage condition of a film of metal. With the help electrogramme and electron-microscopic research it is shown, that change of parameter of given Shottky diode is connected to change of a microstructure film of a metal alloy.

REFERENCES

1. *M.J. Kelly, A.G. Todd, M.J. Sisson, D.K. Wickenden.* Elect. Lett 1983 VI 9 № 13 p 474-476
2. Sh. G. Askerov, N.S. Baltovets, I. G. Pashaev, Sh. S. Aslanov, ET, series 10 microelectrodevices 1988, issue 2/68, p.39-41.(in Azeri)
3. D.K. Wickenden, M.J. Sisson, A.G. Todd, M.J. Kelly, Solid-State Elect. 1994 V27 №6 p. 515-518
4. I.G.Pashayev, BSU, News 1999, №3-4, pp.94-97(in Azeri)
4. R.T. Tung, J.V.S and Tech 1984 B 2 (3) p. 465-470
5. M. Finetti, E.T. Pan, I. Suni, M.A. Nicolit Appl. Phys lett 1983 43 (II) p. 987-989
6. I.G.Pashayev, Baku, Physics 197, v. III, №4, pp.64-66(in Azeri)
7. Zi S.M. Physics of semiconductors.(in Russian)
8. Sh.G. Askerov, I.G. Pashaev 2nd International Conference on Technical and Physical Problems in Power Engineering Tabriz-Iran 2004 p. 367-368