TECHNOLOGY OF RECEIVING AND PRODUCTION OF FIELD TRANSISTORS WITH SHOTTKY'S LOCK ON THE BASIS OF PHOSPHIDE COMPOSITION INDIA

Kamolov I.R.[1], Kanatbayev S.S.[2], Kamalova D.I.[3], Mukhammadiyeva M.[4]
(Republic of Uzbekistan) Email: Kamolov510@scientifictext.ru

[1]Kamolov Ikhtiyor Ramazonovich - Candidate of the technical sciences, assistant professor;
[2]Kanatbayev Sagidat Saduovich – Assistant,
DEPARTMENT METHODS TEACHING PHYSICISTS AND ASTRONOMIES,
NAVOI STATE PEDAGOGICAL INSTITUTE,
NAVOI;
[3]Kamalova Dilnavoz Ikhtiyorovna - P.G. Student,
STATE UNITARY ENTERPRISE "FAN VA TARAQQIYOT",
TASHKENT STATE TECHNICAL UNIVERSITY, TASHKENT;
[4]Mukhammadiyeva Makhliyo – Master,
DEPARTMENT METHODS TEACHING PHYSICISTS AND ASTRONOMIES,
NAVOI STATE PEDAGOGICAL INSTITUTE, NAVOI,
REPUBLIC OF UZBEKISTAN

Abstract: *in this article the technology of receiving effective metal Shottky field effect transistors on the basis of phosphide composition India (InP) is considered and influence of chemical treatment on superficial properties of phosphide India is investigated. It is defined that chemical treatment really is an important factor of management of the superficial properties of phosphide India (InP) leading to change practically of all physical and chemical and mechanical parameters of contacts gold (metal) – India phosphide (Au – n – InP). Processing in solutions on the basis of inorganic acids gives InP surface with the minimum thickness of own oxide which nanometer d_{ok} = 0,45 ÷ 0,7 is equal. Solutions on the basis of alkalis, to H_2O_2 ÷ H_2O and Br_2 ÷ CH_2COOH leave on a surface after processing rather thick own InP oxide, nanometer d_{ok} =1,25 ÷ 2,5. InP surface before metal deposition needs to be processed in acid solutions on the basis of HF, HCl, H_2SO_4, H_3PO_4.*

In ours a research influence of chemical treatment on parameters of composition M – InP was estimated on VAC (volt-ampere characteristic) and VCC (volt – capacitive characteristic) contacts of Au – n – InP (100) (S = $4 \cdot 10^{-2}$ cm^2) created by method thermal dusting gold (Au) on n – InP substrates (N_a – N_α of 10^{18} cm^3) which are at a temperature of 403÷423 ºK. As chemical reagents which can have an impact on an initial condition of a surface solutions were used.

Keywords: *composition, India phosphide, surface, chemical treatment, acid, alkali, temperature, properties, radiation resistant.*

ТЕХНОЛОГИЯ ПОЛУЧЕНИЯ И ИЗГОТОВЛЕНИЯ ПОЛЕВЫХ ТРАНЗИСТОРОВ С ЗАТВОРОМ ШОТТКИ НА ОСНОВЕ КОМПОЗИЦИИ ФОСФИДА ИНДИЯ

Камолов И.Р.[1], Канатбаев С.С.[2], Камалова Д.И.[3], Мухаммадиева М.[4]
(Республика Узбекистан)

[1]Камолов Ихтиёр Рамазонович - кандидат технических наук, доцент;
[2]Канатбаев Сагидат Садуович – преподаватель,
кафедра методики преподавания физики и астрономии,
Навоийский государственный педагогический институт,
г. Навои;
[3]Камалова Дилнавоз Ихтиёровна – докторант,
Государственное унитарное предприятие "Фан ва тараккиёт" при Ташкентском государственном техническом университете, г. Ташкент;
[4]Мухаммадиева Махлиё – магистр,
кафедра методики преподавания физики и астрономии,
Навоийский государственный педагогический институт, г. Навои,
Республика Узбекистан

Аннотация: *в данной статье рассматривается технология получения эффективных полевых транзисторов с затвором Шоттки на основе композиции фосфида индия (InP) и исследовано влияние химической обработки на поверхностные свойства фосфида индия. Определено, что химическая обработка действительно является важным фактором управления поверхностными свойствами фосфида индия (InP), приводящими к изменению практически всех физико – химических и механических параметров контактов золото (металл) – фосфид индия (Au – n – InP). Обработка в растворах на основе неорганических кислот дает поверхность InP с минимальной толщиной собственного оксида, которая равна d_{ok} = 0,45 ÷ 0,7 нм. Растворы на основе щелочей, H_2O_2 ÷ H_2O и Br_2 ÷ CH_2COOH оставляют на поверхности после обработки достаточно толстый собственный оксид InP, d_{ok} = 1,25 ÷ 2,5 нм. Поверхность InP перед осаждением металла необходимо обрабатывать в кислотных растворах на основе HF, HCl, H_2SO_4, H_3PO_4.*

В нашем исследовании влияние химической обработки на параметры композиции M – InP оценивалось по ВАХ (вольт-амперная характеристика) и ВЕХ (вольт – ёмкостная характеристика) контактов Au – n – InP (100) (S = 4 · 10^{-2} $см^2$) сформированными методом термического напыление золота (Au) на подложки n – InP (N_a - N_α 10^{18} $см^{-3}$), находящиеся при температуре 403÷423 ºК. В качестве химических реагентов, которые могут оказывать влияние на первоначальное состояние поверхности, использовались растворы.

Ключевые слова: *композиция, фосфид индия, поверхность, химическая обработка, кислота, щелочь, температура, свойства, радиационно-стойким.*

Development and production of devices on the basis of phosphide india (InP) with high mechanical and operational properties forces to conduct large volume of preliminary technological researches on selection in relation to phosphide india, the modes of carrying out each technological operation of production of devices (field transistors). The researches on development of technology of the field transistors of Shottky (FTS) conducted by us with normally open channel on InP also belong to works of such plan. For production of transistors epitaxial and ion leghirovation layers of phosphide 0,1÷0,2 mcm thick with concentration of free electrons $0,8 \div 1 \cdot 10^{17}$ cm^{-3} were used. Substrates on the basis of InP it is received by Chokhralsk's method [1].

The choice and development of optimum methods of cleaning of a surface of materials, formations of necessary structure is one of the most current problems for the electronic and electro technical industry. If to consider manufacturing techniques of field transistors with Shottky's lock, then it is based on three main operations: chemical etching, photolithography and metallization. Operation of a photolithography and the modes of its carrying out practically do not depend on features of composition (metal - an oxide layer - the semiconductor). At the same time chemical etching and the modes of formation of metal coverings substantially are defined by physical and chemical properties of the composition.

Analyzing the results of researches and data of other authors [2] given earlier it is possible to come to conclusion that characteristics of contacts of composition metal - india phosphide (M-InP) depend on physical and chemical properties of a surface of composition on the basis of InP which substantially are defined by the modes of its preliminary processing influencing a surface stekhiometric, thickness and phase composition of own oxides. As chemical treatment belongs in the way of influence having the most expressed impact on a condition of a surface. The right choice of the modes of its carrying out is of particular importance when developing metals of formation of barriers of Shottky with the reproduced parameters.

In ours a research influence of chemical treatment on parameters of composition M-InP was estimated on VAC (volt-ampere characteristic) and VCC (volt - capacitive characteristic) contacts of Au-n-InP (100) ($S=4 \cdot 10^{-2}$ cm^2) created by method thermal dusting gold (Au) on n-InP substrates (N_a-N_α 10^{18} cm^3) which are at a temperature of 403÷423ºK. As chemical reagents which can have an impact on an initial condition of a surface solutions were used. All substrates before chemical treatment were exposed to deep chemical etching in $Br_2CHCOOH$ solution. After production contacts were exposed artificial aged by their endurance at T=363÷373ºK within 18 days.

The main results received during the conducted researches on their basis can be concluded:

1.Chemical treatment really is an important factor of management of the superficial InP properties leading to change practically of all parameters of contacts Au-n-InP. Apparently at variation of a type of chemical treatment ideality coefficient VAC, height of $\Phi_б^{эф}$ barrier and tension of breakdown can change respectively within 1,06÷1,8; 0,35÷0,68 eV and 3÷10 V [3].

2. Processing in solutions on the basis of inorganic acids gives InP surface with the minimum thickness of own oxide. In our case it is shown in proximity of n k 1,7 values; d_{ok}=0,45÷0,7 nm and small difference in the sizes $\Phi_б^{эф}$, determined by straight lines, the return VAC and VFC. At the same time solutions on the basis of alkalis, to H_2O_2-H_2O and Br_2-CH_2SOON leave on a surface after processing rather thick own InP oxide d_{ok}=1,25÷2,5 nm. InP composition surface before sedimentation of metal needs to be processed in acid solutions on the basis of HF, HCl, H_2SO_4, H_3PO_4. At the same time preference should be given to H_2O H_2SO_4 H_2O_2 solutions giving the minimum dispersion of parameters of contacts on the area of a plate.

3. The technology of formation of own oxides has the big functionality providing it broad prospects for application in the industries of modern electronics.

4. In chemically processed method, the produced field transistor with Shottky's lock has the improved operational and mechanical properties, will also become radiation resistant.

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