NOVATEUR PUBLICATIONS
INTERNATIONAL JOURNAL OF INNOVATIONS IN ENGINEERING RESEARCH AND TECHNOLOGY
[IJIERT] ISSN: 2394-3696 Website: ijiert.org
VOLUME 9, ISSUE 10, Nov. -2022

RESEARCH OF ELECTRICAL AND PHOTOELECTRIC PHENOMENA IN STRUCTURES BASED ON SILICON CONTACT WITH MANGANESE INTERLAYER WITH HIGH MANGANESE SILICIDE FILM

Xusanov Ahmadjon Jo'rayevich
Kokan State Pedagogical Institute
e-mail: ahmadjonxusanov31@gmail.com, tel: +99891-142-17-33

ABSTRACT
The physical properties of the manganese silicide layer formed on the silicon surface were studied. A layer of manganese silicides was deposited on the silicon surface by a solid-phase reaction method, in which ultrapure manganese metal was obtained on a chemically ultrapurified single crystal silicon surface. After the formation of manganese silicides on the surface of silicon, its crystal lattice structure, morphology and phase composition were studied using electronograph and electron microscope devices, JXA-840 type electronograph and XL 30SFED type electron microscope. It was shown that the dynamic process of the formation of a manganese silicide layer on silicon depends on steady and non-steady states.

Keywords: silicon, manganese supersilicide (MOS), gas phase, atoms, diffusion, structure, surface, morphology, phase composition.

MOS-Si<Mn>-M structures at low temperatures, in dark (no light) conditions, when certain voltages are applied, the device base has dielectric properties according to the value of the dark current Jk □ □□□□□□, and the structure looks like MOS-i-M confirmed[1]. The spectral photoconductivity of the structures at low temperatures was checked, and it was confirmed that the photocurrent increases by 9□10 orders of magnitude (at the applied voltage of 5V) in the special photoconductivity region, and that the relaxation of the photocurrent after the light is turned off consists of two stages only when the current passes through the MOS contact structures [1-4]. The photovolt-ampere characteristic (FVAX) in the structures was studied in a wide temperature range and the following conclusions were made: FVAX at home temperatures and VAX without light supply have a straight line character; in the low temperature (77 □ 270 K) region, FVAX is nonlinear, the photocurrent voltage dependence is J □ U2, J □ U(3-4), and the MOS contact has the characteristics of hole injection [5].

The formation of the i-transition layer in the structures during the formation of MOS on the silicon surface was determined by the method of structure research and electrical measurements, and the extremely high photosensitivity, long-term photoconductivity relaxations, residual photoconductivity, deep infrared and temperature quenching were confirmed only when the current passed through this layer, and the single model interval is explained [4-7].

On the basis of the advanced scientific worldviews of high-temperature mutual diffusion and reaction phenomena of substances in the case of manganese and silicon, in the process of diffusion of manganese into silicon with the help of high-tech modern devices [3], manganese supersilicide (MOS) MnSi1.71+ is formed on the silicon surface layer. 1.75 The main results obtained from the study of the electrical and photoelectric properties of phase curtain formation and curtain-compensated silicon contacts are as follows:

At high (1000-1200□C) temperatures, diffusion of manganese into silicon proceeds in a reaction process, as a result of which a manganese silicide film grows on the surface layer of silicon;

It was determined by calculating the chemical thermodynamic parameters: enthalpy, entropy and Gibbs free energies that the structure of the manganese silicide film, the element series of its phase depends on the temperature of the silicon (substrate) and the elastic vapor pressure of manganese;

As a result of the conducted research, a device and technology for the purposeful growth of manganese supersilicide (MOS) film was created.

The structures of grown manganese silicide films were studied by electron and X-ray diffraction, and at temperatures above 10,000C, the base (silicon) temperature is the first, and on the surface of silicon, MnSi1.71+1.75 phase manganese silicide film grows in the polycrystalline structure, and on the surface of polycrystal grains, as the second phase [1- 3], the formation of manganese monosilicide MnSi was confirmed;

The dependence of electrical conductivity and Hall coefficient on temperature was studied in the grown MOS screens, it was determined that they have metallic conductivity at low temperatures, and semiconductivity at high temperatures (T>300K), and it was determined that the concentration of holes in them is r□1019-1020cm-3.

In MnSi and MnSi1.71+1.75 phase curtains, the thermal coefficient □ measured in a wide temperature range has a positive sign □ = 100-180 μV/degree, and the proportion of MnSi1.71+1.75 phase compared to MnSi phase is □ □ 200 μV determined to be /grad[2-5];

The anisotropic thermoEUK (ATE) properties of manganese silicide curtains were studied by the method of heat radiation to the curtain surface, and the following results were obtained: if the MnSi1.71+1.75 phase in the grown polycrystalline curtains is more than the MnSi phase, the growth axes of the grains are oblique in relation to the base surface. and if the current-receiving contacts are taken in the direction perpendicular to these slopes, the conversion coefficient is around S = 500□1000 μV/W, and if the current-receiving contacts are taken in the direction parallel to the slope at the same light power, it was found that an ATE signal with S smaller than two orders of magnitude is generated. As a result of the research, it was found that it is possible to create measuring devices that quickly record the power and temperature of the light source on the basis of MOS curtains (Uzbekistan's patent was obtained for this device) [2];

MOS-Si<Mn>-M structures were modeled after studying the contact properties of the MOS film with the base silicon, and the temperature dependence of VAX and photo-VAX was studied in them. The MOS and Si<Mn> contact forming a heterophase transition was confirmed by structural investigations [1-5].

So, in conclusion, we can note that in compensated Si<Mn> samples, only when the current is through the MOS phase contact, anomalous photo-VAX and various photoconductivity phenomena arise as a result of it.

Адабиётлар

1. Баходирхонов М.К., Комилов Т.С., Хусанов А.Ж. “Поликристаллические неселективные приёмники излучения на основе плёнок высшего силицида марганца” письма а ЖТФ, 2002г, №22. С.11-16

2. М.К.Баходирхонов, Т.С.Камилов, А.Ж.Хусанов, Г.И.Иванкин, И.В.Занавескина «Исследование, влияния переходного слоя на фотоэлектрические свойства в структурах высшего силицида - марганеца (ВСМ) -Si<Mn>-M» // Поверхность. Рентгеновские, синхронные и нейтронные иследования. 2002, № 6. С.100-103 Т.С.Камилов, Ф.Кучкарова, М.М.Ахмедов, М.Т.Ботиров,

3.А.Ж.Хусанов «О механизме возникновения статической отрицательной дифференциальной фотопроводимости N-типа в структурах высшего силицида марганца (ВСМ) -Si<Mn>-M» // Известия ВУЗов Ўзбекистана, 2003, №2.

4 .Патент №IHDP9900594.1 РУз Комилов Т.С., Церфис Р.А., Хусанов А.Ж., Онаркулов К.Э., Хакимов Ш.К. «Способ изготовления анизотропного термодатчика на силицида марганеца»

5. Камилов Т.С., Хусанов А.Ж., Онаркулов К.Э. «Марганец силицид асосидаги поликристал ИК қабул қилгичлар» илмий мақолалар тўплами.-INFRA-2000 халқаро илмий анжуман. Тошкент, 2000, 198-199 бетлар.

6. Т.С.Камилов, А.Ж.Хусанов, А.А.Узоқов «Исследование, влияние переходного слоя на фотоэлектрические свойства в структурах высшего силицид – марганеца (ВСМ)- -Si<Mn>-M» IV-республика илмий – амалий анжумани. ТДАИ. Тошкент, 2002, 74-75 бетлар.

7. Kamilov T.S. and Khusanov A.Zh. “Policristalline non-selective Photodetectors based on films of higher manganese silicides” 14th International Simposium on Boron, Boredes and Ralated Compounds (ISSB’02), Saint Petersburg, Russia, June 9-14, 2002p 133

REFERENCES

1. Тохиров, У. О., & Турсунов, Ж. Э. (2012). Вопросы формирования методологических, когнитивных и креативных качеств учащихся. In *Педагогика: традиции и инновации* (pp. 112-113).
2. Турсунов, Ж. Э. (2021). ЭФФЕКТИВНЫЕ СПОСОБЫ ОПРЕДЕЛЕНИЯ КРЕАТИВНЫХ СПОСОБНОСТЕЙ УЧАЩИХСЯ НА УРОКАХ ТЕХНОЛОГИИ. In *СОВРЕМЕННЫЕ НАУЧНЫЕ ИССЛЕДОВАНИЯ: АКТУАЛЬНЫЕ ВОПРОСЫ, ДОСТИЖЕНИЯ И ИННОВАЦИИ* (pp. 153-157).
3. Турсунов, Ж. Э. (2018). V-VII синфлар меҳнат таълими машғулотларида ўқувчилар креативлик қобилиятларини шакллантириш модели. *Современное образование (Узбекистан)*, (1), 12-20.
4. Турсунов, Ж. (2011). Использование технологии эвристических обучающих ситуаций в развитии креативных способностей учащихся. *Молодой ученый*, (11-2), 177-178.
5. БАйБоБоЕВ, Н. Г., ХАМЗАЕВ, А. А., & РАХМоНоВ, Х. Т. (2014). Расчет кинетической энергии пруткового элеватора с центробежной сепарацией. *Вестник Рязанского государственного агротехнологического университета им. ПА Костычева*, (2), 19-21.
6. Байбобоев, Н. Г., Бышов, Н. В., Борычев, С. Н., Мухамедов, Ж. М., Рахмонов, Х. Т., Акбаров, Ш. Б., ... & Рембалович, Г. К. (2019). Навесная сепарирующая машина.
7. Raxmonov, X. T. (2018). SUBSTANTIATING THE PARAMETERS OF CLODS-DESTRUCTING BODY OF THE INTEGRATED ASSEMBLY. *Scientific-technical journal*, *1*(2), 127-130.
8. Sotvoldiyev, E., Khamdamova, V., Ibragimova, M., & Usmanova, M. (2020). PREPARING STUDENTS FOR BUSINESS ACTIVITY IN SCHOOL TECHNOLOGY CLASSES. *European Journal of Research and Reflection in Educational Sciences*, *8*(2), 1-4.
9. Ibragimova, M., Yusufkhodjaeva, F., Sattorova, D., & Sotvoldiyev, E. TECHNOLOGY OF USING INTERACTIVE METHODS IN SCHOOL EDUCATION.
10. Исакова, З. (2018). МЕЖПРЕДМЕТНАЯ ПРЕЕМСТВЕННОСТЬ СРЕДНЕ-СПЕЦИАЛЬНОГО И ВЫСШЕГО ОБРАЗОВАНИЯ. *Актуальные научные исследования в современном мире*, (12-4), 59-63.
11. Хонбобоев, Х. О., Икромова, М. Х., & Икромов, М. А. Х. (2016). Ta’limda axborot texnologiyalarni qollashning oziga xos xususiyatlari. Молодой ученый, (3-1), 21-22.
12. MUBINAKHON, I., & ANASKHON, I. M. The Importance of Using the Ict to Increase the Efficiency of Education. *JournalNX*, *7*(1), 106-108.
13. Юсуфходжаева, Ф. М. (2018). Тарбия усулларини тўғри танлашнинг таълим жараёнидаги аҳамияти. *Современное образование (Узбекистан)*, (1), 52-59.
14. Юсуфходжаева, Ф. (2018). ОСНОВЫ ОБРАЗОВАТЕЛЬНОЙ ПРАКТИКИ ПЯТИКЛАССНИКОВ ОБЩЕОБРАЗОВАТЕЛЬНЫХ ШКОЛ. *Актуальные научные исследования в современном мире*, (5-6), 44-46.
15. Юсуфходжаева, Ф. М. (2019). Касбий маҳорат ва компетентлиликни ривожлантириш жараёнида мотивлаштириш. *Современное образование (Узбекистан)*, (1 (74)), 11-17.

16. Sobirovna, U. M., & Irodaxon, T. (2022). TEXNOLOGIYA FANI MASHG'ULOTLARINI SAMARALI TASHKIL ETISH METODLARI. *PEDAGOGS jurnali*, *21*(1), 41-44.
17. Sobirovna, U. M. (2022). Improving the educational system for children with disabilities. *The Peerian Journal*, *4*, 20-22.
18. Yusufkhodjaeva, F., Usmanova, M., Sattorova, D., & Khamdamova, V. THE USE OF ICT IN SCHOOL EDUCATION. *computer*, *1*, 104.
19. Maryam, I., & Mukhlisa, U. The Use of Interactive Methods in the Orientation of Students to Entrepreneurial Activity. *JournalNX*, *7*(03), 223-226.
20. Ibragimova, M. G. (2022). METHODS OF INVENTING YOUNG PEOPLE TO ENTREPRENEURSHIP THROUGH INTERACTIVE METHODS. *Galaxy International Interdisciplinary Research Journal*, *10*(2), 45-48.
21. Ибрагимова, М. Ғ., Ҳамдамова, В. А., & Юсуфходжаева, Ф. М. (2020). ЁШЛАРНИ ИҚТИСОДИЙ ТАРБИЯЛАШДА ТЕЖАМКОРЛИКНИНГ ЎРНИ. *Интернаука*, (23-3), 61-62.
22. Ибрагимова, М. Г. (2019). НОВЫЕ ТЕХНОЛОГИИ ШИТЬЯ В ТРУДОВОМ ОБУЧЕНИИ. *Актуальные научные исследования в современном мире*, (2-5), 113-116.
23. Ибрагимова, М. Г. (2011). Факторы морально-нравственного ориентирования учащихся профессиональных колледжей на предпринимательскую деятельность. *Молодой ученый*, (12-2), 99-101.
24. Ибрагимова Мариям Ғуломовна (2019). Иқтисодии музокаралар жараенида танқидий фикрлашга йўналтирилган педагогик методлар аҳамияти. Современное образование (Узбекистан), (1 (74)), 18-24.
25. Tojiyevich, R. X., Juraevich, X. A., & Toshpo'latovich, Y. O. (2022). Theoretical Justification Of The Dimensions Of The Working Part Of The Combined Aggregate Cutting Grinder. *Journal of Positive School Psychology*, *6*(9), 3663-3667.
26. Toshpulatovich, Y. O. (2021). SCIENTIFIC AND TECHNOLOGICAL BASIS OF POTATO DEVELOPMENT. *Galaxy International Interdisciplinary Research Journal*, *9*(12), 296-300.
27. Юлдашев, О. Т. (2018). Умумий ўрта таълим, олий таълим тизимида меҳнат таълими дарсларини ташкил этишда интеграция жараёнининг ўрни. *Современное образование (Узбекистан)*, (1), 35-43.
28. Zaparov, A., Rakhmonov, K., & Isakova, Z. (2021). Modular Teaching Technology In Technical Sciences Application Methodology. *Oriental renaissance: Innovative, educational, natural and social sciences*, *1*(3),
29. Abdurahmonov, S. H., Bo'taev, A., & Zokirov, V. (2022). TECHNICAL CREATIVITY GEOMETRIC-GRAPHIC DESIGN IN STUDENTS DEVELOPMENT BASED ON EXERCISE. *Conferencea*, 140-145.
30. Butaev, A. A., Isakova, Z. R., & Zaparov, A. (2021). THE METHODS OF DEVELOPING MODERN TECHNOLOGY SKILLS AMONG GENERAL SECONDARY SCHOOL PUPILS. *Экономика и социум*, (2-1), 112-114.
31. Baratboyev, B., Butayev, A., & Mamadiyev, U. (2019). THE USE OF INTERACTIVE METHODS IN THE TEACHING OF FINE ARTS. *European Journal of Research and Reflection in Educational Sciences Vol*, *7*(12).
32. Бутаев, А., & Абдурахманов, Ш. (2011). Развитие критического мышления через пространственное представление и техническое рисование. *Молодой ученый*, (11-2), 151-154.
33. Farruxovna, B. G., & Ashirovich, B. A. Pedagogical and Psychological Factors in the Membership of Individual Interest in the System of Continuous Education. *JournalNX*, *7*(04), 388-391.
34. Ashirovich, B. A. To Develop The Ability of Thinking Creatively of Students in The Process of Drawing.

35. Zikrillaev, N. F., Saitov, E. B., Tursunov, O. B., Khusanov, A. J., & Kurbonaliev, K. K. (2021). Features Of Self-Oscillatory Processes In A Strongly Compensated Silicon With Nanoclusters Of Impurity Atoms. *European Journal of Molecular & Clinical Medicine*, *8*(1), 935-939.
36. Jurayevich, H. A. (2020). Some issues of directing students for independent scientific research. *ACADEMICIA: AN INTERNATIONAL MULTIDISCIPLINARY RESEARCH JOURNAL*, *10*(12), 1314-1317.
37. Kamilov, T. S., Kabilov, D. K., Samiev, I. S., Husanov, A. Z., & Dadamuhamedov, S. (2005, June). The thermoelectric radiation detector based on the multielement structures of the higher manganese silicide films. In *ICT 2005. 24th International Conference on Thermoelectrics, 2005.* (pp. 543-545). IEEE.
38. Камилов, Т. С., Хусанов, А. Ж., Бахадырханов, М. К., & Кобилов, Д. К. (2002). Поликристаллические неселективные приемники излучения на основе пленок высшего силицида марганца. *Письма в ЖТФ*, *28*(22).
39. Souma, T., Ohtaki, M., Zhang, Y., Bian, Z., Shakouri, A., Terasaki, I., ... & Dadamuhamedov, S. (2005). Том. 2005. Proceedings-ICT'05: 24th International Conference on Thermoelectrics.-Сер. Proceedings-ICT'05: 24th International Conference on Thermoelectrics. *Evaluation*, *387*, 390.
40. Usmonovich, O. B., & Qizi, O. D. B. (2021). FORMATION OF INFORMATION LITERACY IN PRIMARY SCHOOL STUDENTS. *World Bulletin of Social Sciences*, *2*, 122-123.
41. Olimov, B. U., & Olimova, D. B. Q. (2021). INNOVATSION TA'LIM MUHITIDA O'QUVCHILARNING KITOB O'QISHGA BO'LGAN QIZIQISHLARI YUZASIDAN UZVIYLIK VA UZLUKSIZLIKNI YO'LGA QO'YISH. *Academic research in educational sciences*, *2*(10), 321-325.
42. Olimov, B. U., & Olimova, D. B. (2020). ORGANIZATION OF MENTAL ARITHMETIC COURSES FOR PRIMARY SCHOOL STUDENTS. *Theoretical & Applied Science*, (4), 943-946.
43. Olimov, B. U., & Olimova, D. B. (2020). The effectiveness of mental arithmetic courses in pre-school education. *ISJ Theoretical & Applied Science, 02 (82)*, 525-527.
44. Olimov, B. U., & Olimova, D. B. (2020). ORGANIZATION OF MENTAL ARITHMETICS COURSES FOR EARLY CLASS STUDENTS IN SCHOOLS. *Theoretical & Applied Science*, (2), 522-524.
45. Eminjanovna, S. G. (2021). The role of national music in education of youth. ACADEMICIA: AN INTERNATIONAL MULTIDISCIPLINARY RESEARCH JOURNAL, 11(2), 1285-1288.
46. Ikramova, M. (2022). SPECIFIC CHARACTERISTICS OF USING MODERN EDUCATIONAL TECHNOLOGIES AND METHODS IN TRAINING FUTURE TEACHERS OF TECHNOLOGY. *Emergent: Journal of Educational Discoveries and Lifelong Learning*, *3*(9), 1-4.
47. Isaqova, Z., Ikramova, M., & Abdusamatova, M. (2021). TO EDUCATE STUDENTS TO BE SMART, POLITE, WELL-MANNERED, INTELLIGENT AND PHYSICALLY HEALTHY IN THE PROCESS OF LABOR EDUCATION. *Galaxy International Interdisciplinary Research Journal*, *9*(12), 868-870.
48. Usmonovich, O. B. (2021). ORGANIZATION OF TECHNOLOGY LESSONS IN SECONDARY SCHOOLS. *Galaxy International Interdisciplinary Research Journal*, *9*(6), 359-361.