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Investigation of Effect Ion Refocusing From the GaP(001)<110> Surface at the Grazing Incidence Ne+ Ions

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ABSTRACT

The effect ion refocusing at the small angle scattering Ne+ ions from the GaP(001)<110> surface have been studied by the computer simulation method. The characteristic trajectories refocusing ions have been studied.

Keywords: *computer simulation; ion refocusing; ion scattering*

I. INTRODUCTION

In the field of low and middle energy the collision of particles are defined in the first approximations power springy interaction atom. These power arise out of Kulons of power of the interaction nucleus and electronic atom and, consequently, act on any distance between interacting particle. Consequently, for calculation of the paths swooping ion necessary to consider his (its) interaction in crystalline lattice with all atom simultaneously that very it is difficult. But under not very low energy of the collision ion-atom can be considered as insulated fresh collisions of the particles. The acknowledgement that atoms of the lattice free at collisions i.e. behave as atoms of the thick gas, are a results of the study of time of the interaction and energy collision particles.

For the further development of mathematical modeling of the process of the scattering ion middle and low energy in broad grazing incidence angles and scattering is used regularities of the collision two heavy particles. The Ithaca, shall consider the dissipation of the bunch ion from surface monocrystal sample on base of the models fresh one-, two-, and etc frequentative collision.

The structure of the semiconductors AIIIBV type with the tetrahedral relationship is considered more complex, since these mono crystals had the special structure. In planes (001) atoms these semiconductor are situated layer by layer. The Ranked location surface atom of mono crystal can bring about origin inwardly hard body area with local density of the flow, in over and over again exceeding density of the primary ion bunch i.e. exists the effect ion refocusing [1-3]. At present, effect ion refocusing it is enough in detail studied for single monocrystals and there is analytical expression for calculation of the energy refocusing [5-6]. The effect refocusing is described within the framework of model surface semichannels. This effect begins to reveal itself, when transverse energy falling particles exceeds the limiting energy surface semichanneling under which incidence ions can overexexrt the potential barrier, created by floor of the most upper surface atomic rows.

The main goal presenting work is an analysis path refocusing particles in surface semichannels, formed on surfaces GaP(001)<110>.

II. COMPUTATIONAL METHOD AND DISCUSSION

Ion scattering spectroscopy (ISS) is a technique in which a beam of ions is scattered by a surface the geometry of the ion – atom collision and the effect of ion scattering are shown in Figure.1. One of the main parameters is a kinetic energy of scattering ions. The kinetic energy of scattered ions is measured; peaks are observed corresponding to elastic scattering of ions from atoms at the surface of the sample. Each element at the sample surface produces a peak at a different measured kinetic energy, caused by the momentum transfer between the incident ion and atom. The scattered ion and the scattering atom are normally of different masses, but the total momentum of the atom and ion is conserved. Therefore, as the initially "stationary" atom recoils, some kinetic energy is lost from the scattered ion, and the quantity of lost energy depends on the relative masses of the atom and ion.

In this project qualitative analysis and controller design of a TI-SEPIC converter for optimal utilization photovoltaic power is presented. This converter is essentially combination of conventional buck and SEPIC converters sharing common components. On the account of the integration load side only one inductor is sufficient enough for performing the power conversion in both Buck and SEPIC converters. Here the function of the lower SEPIC converter is to extract maximum power from the PV and feeds into the load, while the remaining load power demand is supplied by the dc source through a voltage-mode controlled buck converter. Proposed integrated Converter performance is verified through MAT/SIM software simulations and then verified with measurement results obtained the laboratory prototype converter system.

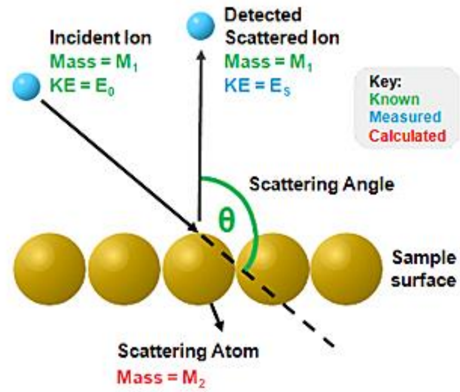

Figure1:.Experimental geometry for ion scattering spectroscopy

Used in persisting functioning program calculation, founded on approach the fresh collisions, on its structure is befitted broadly known program MARLOWE[7], but possesses big flexibility to change parameter interactions and combination interacting pairs ion-target. With use the universal potential of the interaction Ciglera-Birzaka-Littmarka [8] and with provision for integral of time were prototyped paths ion, feeling correlated slitherring dissipation on discrete chain atom and in semichannels on surfaces GaP(001) <110>. Elastic and non elastic energy losses were totalized along path diffused ion. Nonelastic energy losses calculated by formula Firsova,modified by L.M.Kishenevskim [9].

For study of the change the nature trajectories of ion is calculated dependencies of the corner of the scttaering from coordinate of the aiming point – φ(J) [10]. This dependency allows to separate on aiming platform of the group ion, diffused on surface chain, two chains on surfaces and semichannels

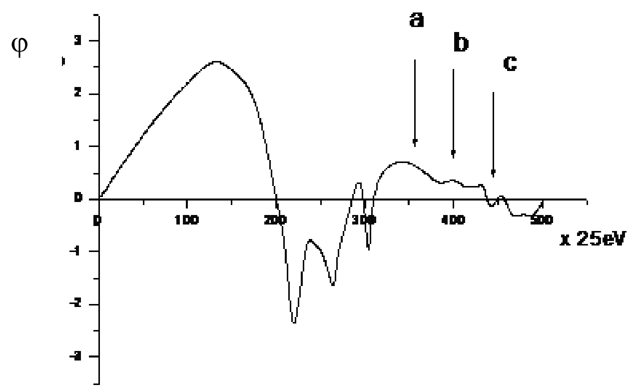

Figure 2: The dependence of φ(J) for incidence Ne^+ ions to the surface GaP(001) <110> at the incidence angle ψ=2.4^0 by E_0=5 κeV

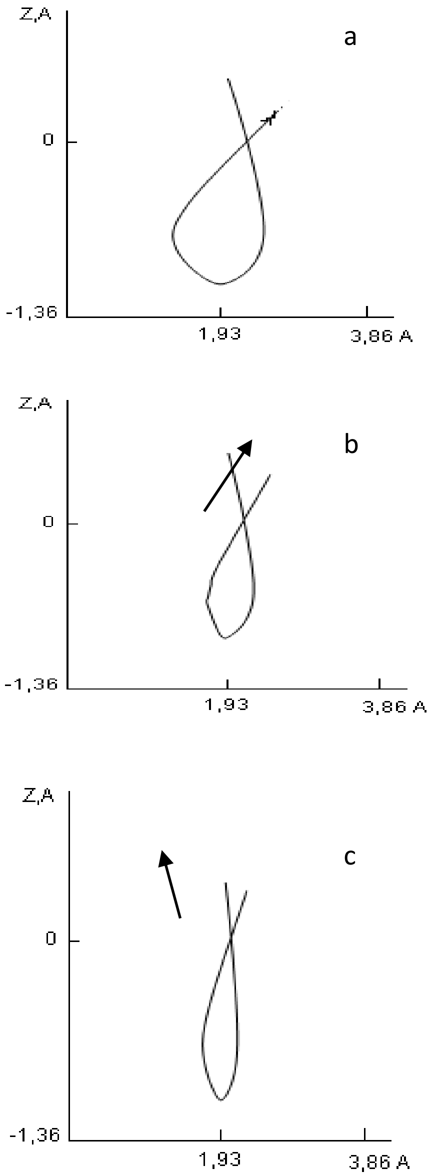

Figure 3: The characteristic trajectories Ne^+ ions on the points a, b, c

As it was noted in works [6, 11] for the incidence particles observed two focuses at effect ion refocusing: the first focus- nearby surfaces, but the second is a inside of semichannels.

On Fig.2 is presented dependency φ(J) for refocusing Ne^+ions with initial energy E_0=5 κeV at the bombardment the surfaces GaP(001)<110> under angle of incidence ψ=2.4^0, corresponding to condition of the effect refocusing. Follows to note that in this direction is formed broader and deep semichannel, consisting of three atomic rows Ga and P. The width semichannel 3.86 Å, depth of semichannel - 1.36 Å. It Is We can seen that φ does not exceed ±1^0 in broad interval of the change the coordinate of the point J.

On Figs.3 are presented the characteristic trajectories of refocusing ions at the points a, b and c which shown in the Figure.2. The points a, b and c especially chooses nearby middle point of surface semichannel for a observing the trajectories refocusing ions. Should be note, that the effect ion refocusing observed nearby middle of the surface semichannels. It is seen that in broad range of the change the coordinate of the aiming point -J, incoming and reflected part ions remain to be symmetrical for planes of the fall, getting through axis semichannel. Herewith bombarding ion, incidence field of the interaction of the first atomic row, changes its path of the motion aside nearby atomic row penetrated inside semichannel the ion interacts with atom second layer. Under influence atom, residing on the one third layer, ion rises upwards and reflected part of trajectories is symmetrical repeated comparatively falling part to paths. The analysis of trajectories refocusing ions has shown that their form and nature are defined by form semichannel, but change the sort of the atomic rows semichannels, are not defining. For brought trajectroies (Fig.2a) saved by ion energy is E=4723 eV, nonelastic loss of energy - E=462 eV. These results show that under such dissipations ion, loss to energy occur for count nonelastic processes.

CONCLUSIONS

By the method of computer simulation have been investigated the trajectories of refocusing ions reflected from GaP(001)<110>. The calculation has shown that form and nature trajectories of refocusing ions and this trajectories almost depend to the form of surface semichannels.

The effect ion refocusing can be used as a applicable method of the study of the modification characteristic of materials: way of the selection to geometries of the irradiation in focuses can be a put atoms, residing on different depth under surface, but in many component crystals - an atoms that or other sort.

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