Electronographic Research of Supper Structural Phase $CuGaTe_2$ and Formation of Film Solutions on the Basis of Supper Lattices Structure $CuGa_{1-X}Ge_XTe_2$

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Abstract

With method of electronographical structural analysis, conditions of formation of films $CuCaTe_2$ with various substructures on substrates NaBr have been determined. The interaction reaction has been found and determined with which film solutions are formed, on the basis of over structured phase $CuGaTe_2$ with equal size to the initial phase. Germanium solutions enable recording and control of parameters of thin single crystallic films of over structured phases $CuGa_{1-x}Ge_xTe_2$.

Keywords: structural, phase, films, atoms, crystallization, electronogramm, lattice, diffractions

1. Introduction

Now this are the lines we reviews, and the devoted mechanisms, orderings and disordering of atoms in crystal lattice of alloys, and influences of various processing, on this process. The basic condition for providing formation of a film solution on the basis of super structural phase of any connection, according to the theory of ordering, which was stated by (Bethe, 1928), (Buerger, 1964), and (Kauly, 1979), etc. consists heteronymic atoms are drawn to each other more strongly, than same. As a result of ordering and disordering of already ordered phase free energy of alloy which should go down. This condition can be expressed through energy of interaction of atoms of two grades in the form of $E_{AB} <1/2\ (E_{AA}-E_{BB})$ it is satisfied for the given alloy stoichometric structure at any given temperature the structure becomes absolutely ordered, and the atoms in the system which is borrowed or strictly occupied, some certain units of a crystal lattice which is possibly designated to A and B.

At heating process energy is brought to thin films in the form of heat, this will now promote migration of atoms, which will now make some atoms to borrow or occupy another units B and on the contrary so that as a whole distribution of atoms in a lattice becomes more chaotic. The chaotic arrangement of atoms in film solutions on the basis of super lattices of that phase, in any given connections owing to distinction of the sizes of atoms, their charges and the other reasons, which leads to pushing repulsion or attraction of the dissolved atoms, allocation of superfluous phases or formations and reception, finally the ordered film solutions on the basis of super structural phases meet seldom. In the world there are only three methods of reception of super lattices. The first method is modulated spatial distribution of impurity in semiconductors. The second method consists of periodic combination physically and chemically compatible semiconductors layers. And the third method is focused on crystallization method, this is a process by which the present real work is revealed, which spasmodically increases in the periods of initial phase of $CuGaTe_2$ and formation of film solutions on the basis of a super structural phase of structure $CuGa_{1-x}GexTe_2$.

2. Experimental Procedure

As some of the atoms have to collide erroneous, understanding the fact that in crystal chemistry essence, such a physical structure is recognized and to find out that some represents similar structures, it is necessary to tell some words about necessity occurrence and creations of such super structural lattices and film solutions on that basis

The matter is like that, till fiftieth years of the last century, it was considered, that a limit of perfection of a crystal in its single crystal condition, after the occurrences of electronic microscopes with increases in hundreds, thousands and in millions times, it has been proven and appeared, that any single crystal – at its artificial state is created, a natural single crystals which contains numerous defects in the structures. The defects which are limiting cleanliness in crystals diamond have been visualized at various sorts. And diamond as it is known possesses coordination structure, the shortest junction which can exist in the nature, i.e it is always possible to find a way of the leading of one atom to another which takes place only on the shortest junction. By theoretical researches finally it was found out, that the crystal in the structure even in conditions of ideal thermodynamic balance can and should have various imperfections. Reasoning of theoretical works were reduced to that if phonon and electrons, which serve elementary excitation in phonon and electronics subsystem of a crystal existing imperfections, defects of a crystal lattice serve elementary excitation, in nuclear subsystem of a crystal.

And a unique way of disposal of these defects, it is necessary to go through in many cases, as many properties in that degree, a greater or lesser degree depends on the modification of these imperfections, to a basis of any defects should be created by other kinds, but with a condition however, that those or other properties of crystals will appear tolerant to them, and even insensitive to these defects created by already researchers

In search of new materials with the big mobility of carriers of a current it has been established, and confirmed, that by ordering of defects of a crystal lattice if they are in order, or disordering of imperfections that already ordered in a crystal structures with the extended periods of a crystal lattice in which reduction of the period of collisions of carriers of current electrons, electronic vacancies can be created or occur.

As mobility of current carrier depends on how often they test collisions at movement inside the crystal and then these collision are less often, and it is possible to reach or achieve in semi conductor with the advent of long periodic super lattices which will run freely above, as it was realized in all long periodic lattices. And also a state of affairs in semiconductors with initial structures into which for achieving a desirable concentration of carriers or bearers, it is necessary to enter impurity, and at introduction of impurity their mobility went down appeared bypassed thus creation of superstructural crystal lattices

As a result of the executed experimental researches thin films of $CuGaTe_2$ and films solutions on their basis with participation in them Ge as an impurity, it has been established and confirmed, that films of $CuGaTe_2$ have no trivial features which Germanium is supervised and both conditions of formation and dosed out injecting their atoms of a chemical element. Reaction of interaction at which there is a formation of films solutions on the basis of super lattices structures of $CuGaTe_2$ (Ge) is found out and experimentaly, researched by us rare in chemistry and in the physicist.

That film of $CuGaTe_2$ by thickness of 30 nanometers besieged by evaporation of synthesized substance in vacuum ~ 10^{-4} Pa on substrates NaBr being at room temperature formed a film of single crystal, conditions. Comparing diffraction and reflections it is possible to say on the basis of constants tetragonal crystal lattice, that 0.599; with = 1.190 nanometers; a spatial groups of symmetry - F42m-D^9_{2d}, resulted (Novoselev and Lazerev 1979), the heat of recrystallization of polycrystalline films at temperature 423K leads to formations and textured films (Figure 1).

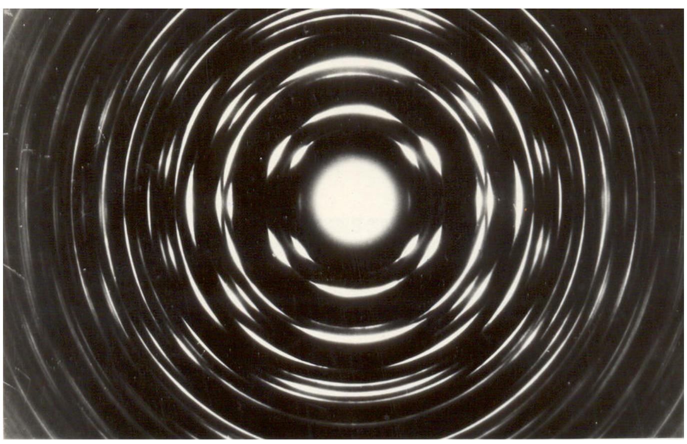

Figure 1. Electronogramm from structure $CuGaTe_2$

3. Results and Discussion

At sedimentation of $CuGaTe_2$ on preliminary heated substrates up to a temperature of 448 is created, a mixture of a polycrystal with a single crystal on electronogramm which appears additional, concerning the initial phase, which is formed. With increase in temperature of substrates and of intensity dot, diffracted and the reflexes corresponding meeting a single crystal, which increases the Intensity polycrystalline lines thus decreases the subsequent rise in temperature of substrates NaBr up to 473K which leads to formation of single crystal films of high perfection on electronogramm.

From a single crystal, (Figure 2) it show that under a right angle, strong electronogramm from a single crystal, under a right angle, a strong intensivity dot is diffracted, reflections are displayed on the basis of hk0 reflexes of known lattice $CuGaTe_2$. Comparing all reflexes diffracted fields, including rise on electronogramm the "satellite" reflexes surrounding normal reflexes, is possible with the parameter, a=1.202 nanometers. Established and confirmed on electrongramm, removed under corner j=300 which appeared equal to 2.661 nanometers. Between the periods of elementary cells of lattices, initially the extended cells of a super structural phases, there are simple parities: $a_{sup.st.}= 2a_0$; $c_{sup.st.} = \sqrt{5}\, c_0$ with, epitaxial growth $CuGaTe_2$ on NaBr. The extended cell of this superstructure turns out as a result of interface of two cells of a substrate which are NaBr. Thus relative Δ=(b - a / b) 100% and absolute ε = (1-c/2a) 100 % discrepancy between periods EL of a substrate and the super structural tetragonal lattice, belonging to space group 14 - S_4^2 or 14_1/amd-D^{19}_{4h} at formation of film solutions on the basis of a super structural phase makes about 2%. Thus, in our experiences for pair elements Ga and Ge in crystal structure $CuGaTe_2$ possessing the supper periods, which is confirmed, mutual solubility manual and the phenomenon of replacement of atoms with one another, formation of continuous numbers of lines of films solutions on the basis of a supper structural phase of $CuGaTe_2$. Thin films of superstructural phase compounds $CuGaTe_2$ have a perfect thermal equilibrium and stable physical property than the original single crystal conventional lattice periods.

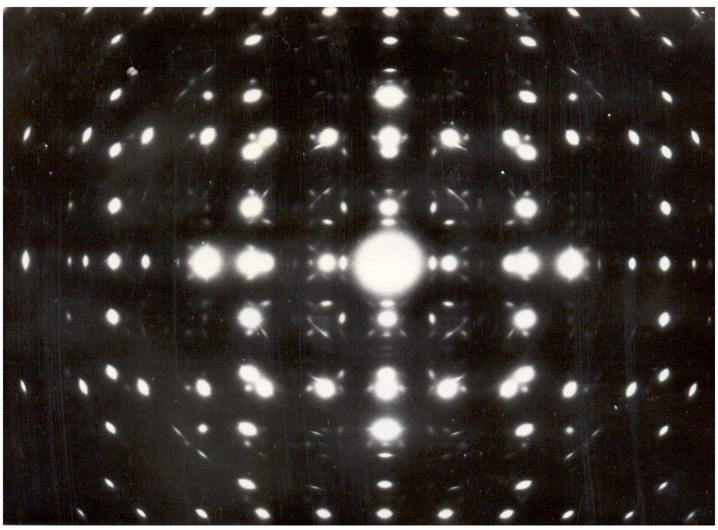

Figure 2. Electronogramm from a single crystal of supper structural phase $CuGaTe_2$

Reference

Bethe, H. A. (1928). Theorie der beugung von Elektronen an Kristallen. *Ann. Phys.,* Bd.87, s55. http://dx.doi.org/10.1002/andp.19283921704

Buerger, M. J. (1964). *The precession Method in X-ray Crystallography.* New-York-London: J. Wiley, 547.

Cowley. (1979) *Physics of diffraction*. Moskow.Mir, 431.

Novoseleva, A. V., & Lazarev, V. B. (1979). *Physical and chemical properties of semiconductor materials.* Moskow: Nauka, 340.