بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأفلام قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأفلام بعيدا عن الغبار

في درجة حرارة من ١٥-٢٥ مئوية ورطوبة نسبية من ٢٠-٤٠%

To be Kept away from Dust in Dry Cool place of 15-25- c and relative humidity 20-40%

بعض الوثائق
الاصلية تالفة

بالرسالة صفحات

لم ترد بالاصل

South Valley University
Faculty of Science (Aswan)

CRYSTAL GROWTH AND STUDIES OF SOME TERNARY SEMICONDUCTOR COMPOUNDS

A THESIS

Submitted to the Faculty of Science (ASWAN)
South Valley University
In Partial Fulfillment of the requirements
For the Degree of Master of Science
(PHYSICS)

By

Badr Mohammed Ali
(B. Sc. Physics, Faculty of science1996)

Supervised by

Prof. Dr. G. A. Gamal
Prof. of Exp. Solid State Physics
Faculty of Science. Phys. Dept. (Qena)
South Valley Univ.

Dr. M. M. Abdel-Rahman
Asst. Prof of Physics
Head of Phys. Dept. (Aswan)
Faculty of Science
South Valley Univ.

Dr. I. M. Ashraf
Lect. of Phys.
Phys. Dept. (Aswan)
Faculty of Science
South Valley Univ.

1422 – 2001

بسم الله الرحمن الرحيم

« علم الإنسان ما لم يعلم »

صدق الله العظيم

(سورة العلق)

ACKNOWLDGMENT

First of all, it is my duty to bow my head in true gratitude to the **Almighty God**, whose guidance and help enabled me to take the first steps on the path of improving my knowledge through this humble effort.

The candidate is indebted to **Prof. Dr. G. A.Gamal**, Prof. of Exp. Solid State Physics, Phys. Dep., Faculty of Sciences (Qena) for his keen interest in the work, supervision, continuous discussion and fruitful advice throughout the progress of all stages of the work.

My thanks are also due to **Dr. M. M. Abdel- Rahman**, Asst. Prof. Physics and Head of Phys. Dept., Faculty of Sciences (Aswan) for his supervision, fruitful discussions, and continuous encouragement and the beneficial discussion throughout the course of this work.

I have great pleasure in expressing my deep gratitude to **Dr. A. M. Ashraf**, Lect. of Solid State Physics, Phys. Dept., Faculty of Sciences (Aswan) for suggesting the problem, supervising, providing the excellent research facilities and for his true efforts to facilitate all scientific problems.

I wish to express my deepest thanks to and gratitude to ***prof. Dr. M. T. El-Hatty***, the dean of the Aswan faculty of science, south valley university.

I wish to express my deepest thanks to and gratitude to ***prof. Dr. A. I. Koriem,*** the vice dean of the Aswan faculty of science, south valley university.

Thanks to **my Parents** and **my wife** for their kind help and encouragement.

CONTENTS

CHAPTER 1: INTRODUCTION

CHAPTER 2: THEORETICAL BACKGROUND

CHAPTER (1)

Introduction

(1-1) GENERAL INTRODUCTION.

We can broadly classify the solid state materials into two categories with respect to structure [1]:

One of them is called crystalline solids, with atomic building blocks occur more or less in regular pattern, and the other category is called amorphous solids in which there is no definite microscopic pattern to the atom arrays. As the electricity was discovered, it was found that there are two groups of solid state materials with respect to electrical conduction: good conductors (metals) with electrical conductivity between 10^4 to 10^6 $(\Omega\ cm)^{-1}$, and insulators (non metal) that have electrical conductivity less than 10^{-10} $(\Omega\ cm)^{-1}$. But it was found that there is another group of some solids has an electrical conductivity lies between 10^{-10} to 10^4 $(\Omega\ cm)^{-1}$. This last group was classified as semiconductor materials. Semiconduction can be specified as following [1]:

i. In pure semiconductors, electrical conductivity rises exponentially with temperature. At lower temperature a smaller concentration of impurities is required in order to ensure this behavior.

ii. In impure semiconductors, electrical conductivity depends strongly on the impurity concentration.

iii. The electrical conductivity in semiconducting materials changes (general rises) by irradiation with low or high-energy radiation or by injection of carriers from a suitable metallic contact. It also depends on the kind of doping, where the charge transport may be either by electrons or by so-called positive holes. These two kinds give two different kinds of the electrical behavior.

These semiconducting materials have been applied in the electrical technology to provide devices with non-linear current-voltage characteristics, also the sensitive elements in photocell [2].

The intensive work was not started on the industrial applications of semiconductors until the beginning of the forties [3]. In fifties there is a class of semiconductor devices were constructed such as tunel diodes, field-effect transistors, thyristors and many others. At the beginning of the sixties, the planerepitaxial technology came into practice which enabled serial production of high–frequency-diodes and transistors with a narrow spread of parameters, high stability, and broad range of operating powers acting up to hundred of wallets. This technology allowed for the production of complete radio circuits with hundreds of components grown from single crystal semiconductors.

Now the development of the solid state technology has rapid introduction of the scientific achievements into practice, for example the semiconductor devices formed the bases of modern radio-electronics and found extensive applications in computing technique, electrical engineering and various industries directly associated with the conservation of electrical energy.

(1-2) The pervious works and the crystal structure of $TlGaSe_2$ single crystal.

The Thallium chalcogenides $TlBX_2$ (B =AL, Ga; X = S, Se,Te) are comparatively new group of compounds in this general class are of interest because of their layered structure [4].

The melting point and the density of $TlGaSe_2$ were determined according to the electrical measurements by G.D. Guselnov. The $TlGaSe_2$ compound ranks among the new incompletely valet ternary layer–and-chain semiconductor [5].

An investigation of T-P phase diagram of $TlGaSe_2$ crystal between room temperature and 520K under hydrostatic pressure up to 1.2 Gpa was made by K. R. Allakhverdiev et al. [6]. P-type $TlGaSe_2$