Metal chalcogenide thin films

Deposition and characterization

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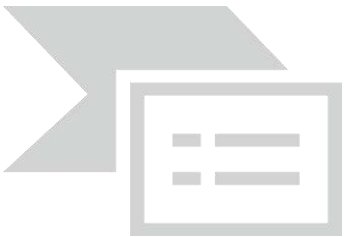

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METAL CHALCOGENIDE THIN FILMS: DEPOSITION AND CHARACTERIZATION ;

First Edition, by Dr. Ho Soon Min, Dr. Barun Ghosh, Dr. Chandra Shekhar Prajapati, Dr. Minnam Reddy Vasudeva Reddy

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Salient Features

USP is "METAL CHALCOGENIDE THIN FILMS: DEPOSITION AND CHARACTERIZATION"

✓ In this book, we have focused on the preparation and characterization of thin films. Definitely this book is different in all aspects starting from contents, as this book gives detailed information about the thin films which includes mainly:-

- Chemical bath deposition method has been emerged as a method for the deposition of metal chalcogenide thin films at low cost owing to short reaction time, low energy consumption, and extremely simple set up. It allows the deposition of thin films at relatively low temperatures.
- Spray pyrolysis is a chemical deposition technique. It is a simple and economic method having high growth rate, mass production capability and suitable for incorporating foreign impurities. It involves low cost equipment and raw materials.
- As the applications and usage of nano sized particles are increasing enormously in day to day technology, this book will explore the newer aspects of nano particles.
- Chemical vapour deposition has become the lead thin film deposition methods for the semiconductor industry due to its high throughput, high purity, and low cost operation.
- Raman spectroscopy is one of the most powerful tools for determining the crystalline structure and quality of semiconductor thin films (binary, ternary, quaternary and pen ternary). It provides a fingerprint by which the molecule can be identified. In this work, advantage and limitation of Raman technique were discussed.
- Metal oxide based thin films have gained enormous attention and are currently being widely used in modern technology. These semiconductor materials are used in variety applications in microelectronic, optical application, gas sensing application, energy storage application, photocatalyst, photoconductive, electrochromic, supercapacitor, protection layer and magnetic head recording. Therefore, in the present book, preparation of metal oxide films using several deposition methods will be discussed.

Foreword

I am extremely privileged to write foreword letter for the book entitled "**Metal Chalcogenide thin films: Deposition and Characterization**". This book emphasizes on the preparation of thin films using various methods such as chemical bath deposition, spray pyrolysis and chemical vapor deposition technique. Characterization of nanostructured thin films will be carried using different tools including scanning electron microscopy, X-ray diffraction, atomic force microscopy, energy dispersive x-ray spectroscopy, X-ray photoelectron spectroscopy, UV-visible spectrophotometer and Raman spectroscopy. Thin films play a vital role in the development of materials with unique properties. This book may be helpful for the scientists involving in the nanotechnology research.

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Acknowledgement

I am thankful to INTI International University that supported me on this book. Also, I am grateful to Dr. Barun Ghosh, Dr. Chandra Shekhar Prajapati, and Dr. Minnam Reddy Vasudeva Reddywho helped to complete this book directly. Finally, I would like to say thank you to Albert Science International Organization in the publishing of this book.

Dr. Ho Soon Min

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Background

Metal chalcogenide thin films with thickness ranging from nanometer to several micrometers were synthesized using various deposition methods such as chemical bath deposition method, spray pyrolysis and chemical vapor deposition. The term chalcogen includes all the elements of the group sixteen in the periodic table and the compounds that contain minimum one chalcogens are termed as chalcogenides. However, in view of technological importance, the term chalcogenide is frequently associated with the compounds containing considerable quantities of sulfur, selenium, tellurium. Nanostructured thin films are attracting considerable attention due to have wide applications in solar cells, sensor devices, optoelectronic device, photoconductor, optical imaging, optical mass memories, hologram recording and solar selective coatings. These semiconductor materials possess increased structural integrity as well as unique optical, chemical, and electrical properties. The unique function of these nanomaterials directly depends on their size, morphology, composition and structure dependent properties.

Chapter no. 1: Raman spectroscopy study of thin films: a review

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Summary

The research on the production of metal chalcogenide semiconductor (binary, ternary, quaternary and pen ternary) has been widely studied in the literature. Raman spectroscopy study was performed for identification of the phonon peaks in the spectra, crystalline structure and quality of semiconductor thin films.

Chapter no. 2: Preparation of thin films using chemical vapour deposition method

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Summary

Chemical vapor deposition method was used to prepare thin films. This method has many advantages including high throughput, high purity, and low cost operation. A large number of parameters must be accurately and reproducibly optimized to produce good films.

Chapter no. 3: Deposition of thin films using spray pyrolysis method

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[2]Department of Physics, Motilal Nehru National Institute of Technology, Allahabad, India

Summary

Zinc oxide thin films have been prepared using spray pyrolysis method. These films have hexagonal wurtzite structure and spherical-shaped grains without visible holes as shown in XRD and SEM studies. The band gap has been found to be 3.26 eV. Photoluminescence studies show that the ZnO film exhibits two emission peaks.

Chapter no. 4: Metal chalcogenide thin films: chemical bath deposition

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Summary

In chemical bath deposition method, the deposition of thin films strongly depends on growth conditions. Therefore, the physical properties of the deposited metal chalcogenide thin films can be easily engineered by controlling the bath parameters (nature of precursors and its concentration, type of complexing agent and its concentration).

Chapter no. 5: A review on metal oxide-based thin films

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Summary

Metal oxide based thin films (nickel oxide, copper oxide, tin oxide, aluminium oxide) are claimed to be one of the most interesting classes of materials science, exhibiting varieties of properties, applications and structures as well.The structure of the films was investigated using X-ray diffraction. The XRD data shows Al_2O_3 films have a cubic structure while tin oxide films have tetragonal structure. Further, XRD patterns indicate that these films are amorphous or polycrystalline, depending on the deposition conditions used. As the annealing temperature was increased, the crystalline quality of the thin films was enhanced.