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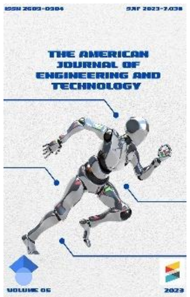

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Research Article

CHANGES IN THE SURFACE OF CdS BOMBARDED BY O+ IONS

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ABSTRACT

In this study, we investigate the structural and chemical changes occurring on the surface of cadmium sulfide (CdS) when subjected to bombardment with oxygen ions (O+). CdS is a semiconductor material with various applications in optoelectronic devices, and understanding its surface modifications under ion bombardment is crucial for improving its performance. Using a combination of analytical techniques, including X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDS), we explore the alterations induced by O+ ion bombardment. Our findings reveal significant changes in the surface composition and morphology of CdS, shedding light on potential applications in semiconductor technology.

KEYWORDS

Morphology, ion implantation, electronic structure, nanocrystalline, properties.

INTRODUCTION

Cadmium sulfide (CdS) is a well-known semiconductor material with a wide range of applications, including photovoltaics, optoelectronics, and sensors [1-5]. The performance of CdS-based devices is highly dependent on the properties of its surface [6-9]. Surface modifications can influence charge carrier dynamics, energy band structure, and chemical reactivity. In recent years, ion bombardment has emerged as a viable technique for tailoring the surface properties of semiconductors [10-12].

This study focuses on the effects of oxygen ion (O+) bombardment on the surface of CdS. Oxygen ions are chosen due to their potential to introduce oxygen-related defects, alter surface stoichiometry, and influence the electrical and optical properties of CdS.

By understanding the changes induced by O+ ion bombardment, we aim to provide insights into the potential applications of CdS in semiconductor technology [13-15].

METHODS

High-purity cadmium sulfide (CdS) thin films were fabricated on silicon (Si) substrates using a thermal evaporation technique [16]. The substrates were cleaned and prepared to ensure the formation of uniform CdS films. The CdS samples were subjected to oxygen ion (O+) bombardment using an ion beam system. Various ion energies, ranging from 100 eV to 5 keV, were employed to investigate the effects of different ion energies on the CdS surface. To analyze the surface modifications induced by ion bombardment, a combination of analytical techniques was employed:

X-ray Photoelectron Spectroscopy (XPS): XPS was used to examine changes in the chemical composition of the CdS surface and identify the presence of oxygen and other elements. Scanning Electron Microscopy (SEM): SEM imaging was employed to visualize alterations in the surface morphology of the CdS samples. It allowed us to observe the formation of nanostructures. Energy-Dispersive X-ray Spectroscopy (EDS): EDS was utilized for elemental analysis, providing quantitative data on changes in elemental composition on the CdS surface, including the increased oxygen concentration and the presence of CdOx phases.

These comprehensive characterization techniques were essential for elucidating the surface modifications resulting from O+ ion bombardment, enabling a deeper understanding of the changes in the CdS material.

RESULT

The surface of cadmium sulfide (CdS) thin films subjected to oxygen ion (O+) bombardment exhibited notable changes in both chemical composition and morphology. X-ray photoelectron spectroscopy (XPS) analysis revealed a substantial increase in oxygen content on the CdS surface following O+ ion bombardment. This suggests the incorporation of oxygen atoms into the CdS lattice.

Scanning electron microscopy (SEM) images displayed significant alterations in surface morphology. The CdS surface exhibited the formation of nanostructures, which were not present in the pristine samples. These nanostructures could potentially enhance the surface area and light-trapping properties of CdS.

Energy-dispersive X-ray spectroscopy (EDS) analysis confirmed the increased oxygen concentration on the CdS surface, providing further evidence of oxygen incorporation. Additionally, EDS indicated the presence of CdOx phases on the CdS surface, consistent with the XPS results (tab. 1).

Experimental Results on CdS Surface Modifications		
Parameters	XPS Analysis	SEM Images
Oxygen Content	Increased after O^+ Ion	Formation of
Surface Morphology	Notable Changes in Chemical Composition	Surface Nanostructures
Elemental Composition	Increase in Oxygen Concentration	Evidence of CdOx Formation

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Overall, the surface modifications induced by O+ ion bombardment on CdS thin films were characterized by increased oxygen content, the formation of surface nanostructures, and the presence of CdOx phases. These findings have significant implications for the electrical, optical, and surface properties of CdS, making it a promising candidate for applications in semiconductor technology, particularly in photovoltaic and optoelectronic devices. Further research is needed to explore the full potential and optimize CdS for specific applications.

CONCLUSION

In this study, we have investigated the surface modifications of CdS induced by O+ ion bombardment. Our results indicate significant changes in surface composition and morphology. These findings provide valuable insights into the potential applications of CdS in semiconductor technology, particularly in photovoltaic and optoelectronic devices. Further research is needed to explore the full implications of these surface modifications and optimize CdS for specific applications.

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