$Cd_xZn_{1-x}S$ films deposited by laser ablation technique

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Abstract

$Cd_xZn_{1-x}S$ films were deposited on glass, quartz, and silicon (111) substrates by pulsed laser deposition. We investigated their structural and optical properties by X-Ray diffraction and UV-Vis Spectroscopy. The structural analysis showed that the principal diffraction plane is (002), it corresponds mainly to the hexagonal structure and there are traces of the cubic structure too. The crystallite size varies from 7.31 to 18.53 nm and the interplanar distance between 3.1 to 3.4 Å. The optical band gap energy was on the range 2.37 to 3.55 eV, showing a dependence on the concentration in the ternary.

Introduction

The zinc sulfide (ZnS) and cadmium sulfide (CdS) are semiconductors of the groups II/VI used in photovoltaic devices.

The synthesis of films by laser ablation it's done by using a short-pulse high intensity laser that removes the material from the target's surface.

Fig. 1 Laser lab arrangement of 30 and 50 Hz and synthesis of CdS films.

Growth conditions

We used a short-pulse laser with 1064 nm wavelength, 50 Hz frequency with a 2.8 W intensity, the substrates were at 400 °C. The deposition time was 30 minutes and a vacuum pressure of 10^{-6} torrs. The substrates used were glass, quartz and silicon (111).

UV-Vis absorption spectrum.

We used a spectrophotometer Perkin-Elmer lambda 65.

We determined the band gap and optical thickness see ref. [1].

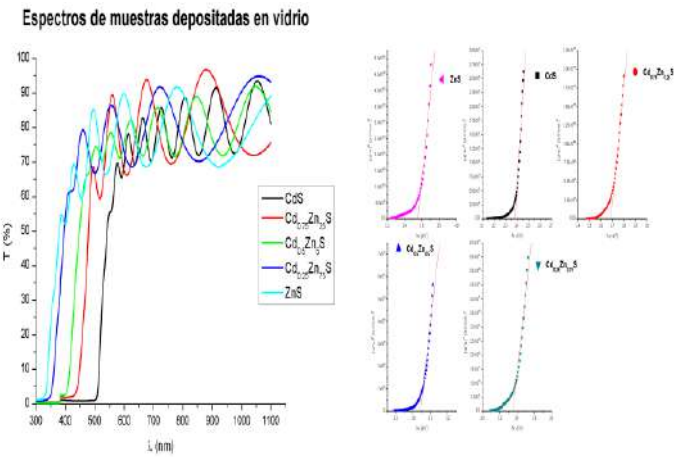

Fig. 2 Absorption spectrums of $Cd_xZn_{1-x}S$ on glass substrates and $Cd_xZn_{1-x}S$ absorption coefficient vs energy graphs.

Diffraction x-rays

We used an x-ray diffractometer bruker D8 with the K_α line of cupper (1.54Å), We analyze the data with profex software.

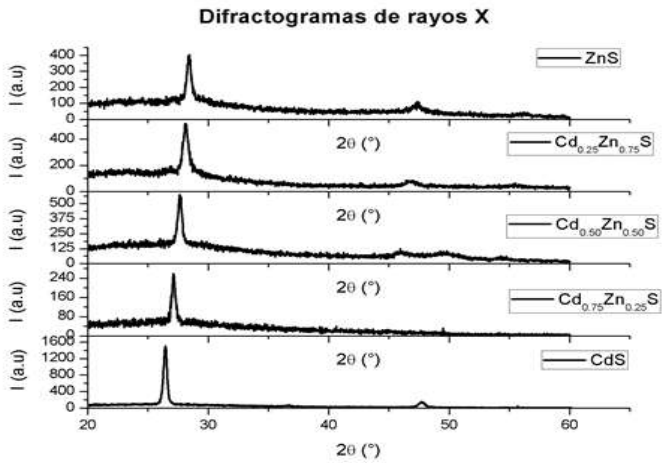

Fig. 3 X-ray diffractograms of $Cd_xZn_{1-x}S$.films.

Conclusion

The $Cd_xZn_{1-x}S$ films were deposited successfully on glass substrates, on quartz only in 0.5 concentration presented delamination this could be by a defect on the substrate used.

The UV-Vis absorption spectra showed us that the energy gap increased with zinc concentration.

The X-ray diffractograms showed us that the highest intensity peak moved from the (002) plane to the (111) plane, a transition between the hexagonal crystallite structure of CdS to the cubic structure of ZnS.

References

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