STRUCTURAL AND ELECTRONIC STUDY OF Cu_2S THIN FILMS FOR THE POTENTIAL MANUFACTURE OF PHOTOVOLTAIC SOLAR CELLS

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INTRODUCTION

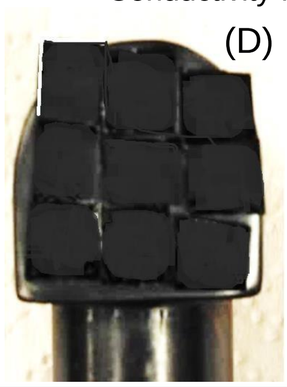
In the last decades, there have been a growing research in chalcogenide semiconductor thin films, due to its wide applications in various fields of science and technology[1]. Among different metal chalcogenides, copper sulfides have been extensively used due to their semiconducting and non-toxic nature, abundant in nature[2] making them useful in applications from the energy to the biomedical fields. In addition to being an important semiconductor with unique electronic, optical and chemical properties, Cu_2S thin films are of high interest due to its wide range of applications in the manufacture of photovoltaic solar cells[3], optoelectronic devices, gas sensor, photosensors and other.

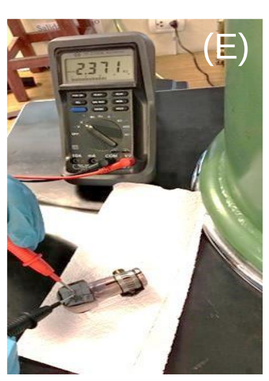
EXPERIMENTAL DETAILS

Figure 1: (A) Scheme of montage the electrodes for deposition by DC sputtering.

Fig.(B) Shows the image of the electrode with the substrates, and (C) the deposition of Cu_2S thin film

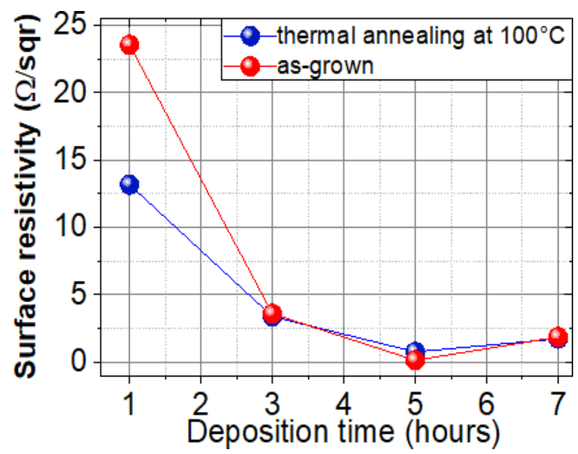
Fig. (D) Cu_2S thin film and Fig. (E) Conductivity measurement.

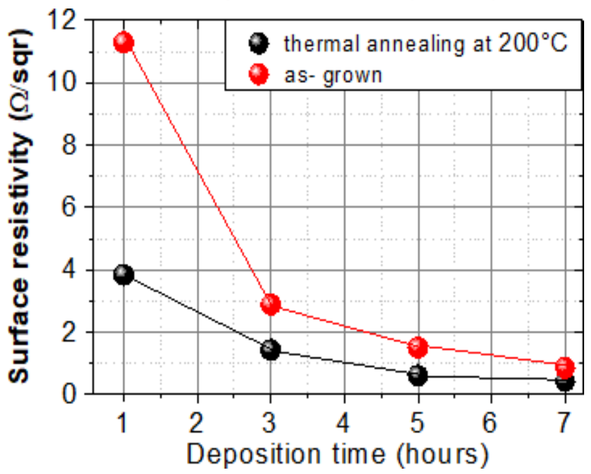


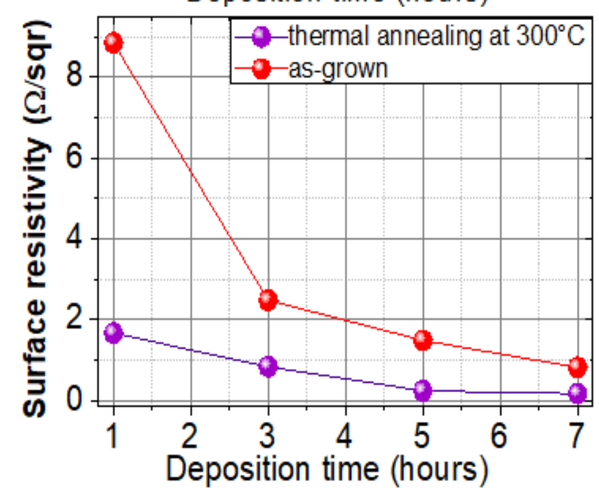


RESISTIVITY MEASUMENTS

Figure 2:Surface resistance as-grown and thermal annealing at 100 °C, 200°C, and 300°C.







X-RAY DIFFRACTION

Figure 3. (A) Samples 1,3,5 and 7 hours as-grown and (B) after thermal annealing at 200 ° C

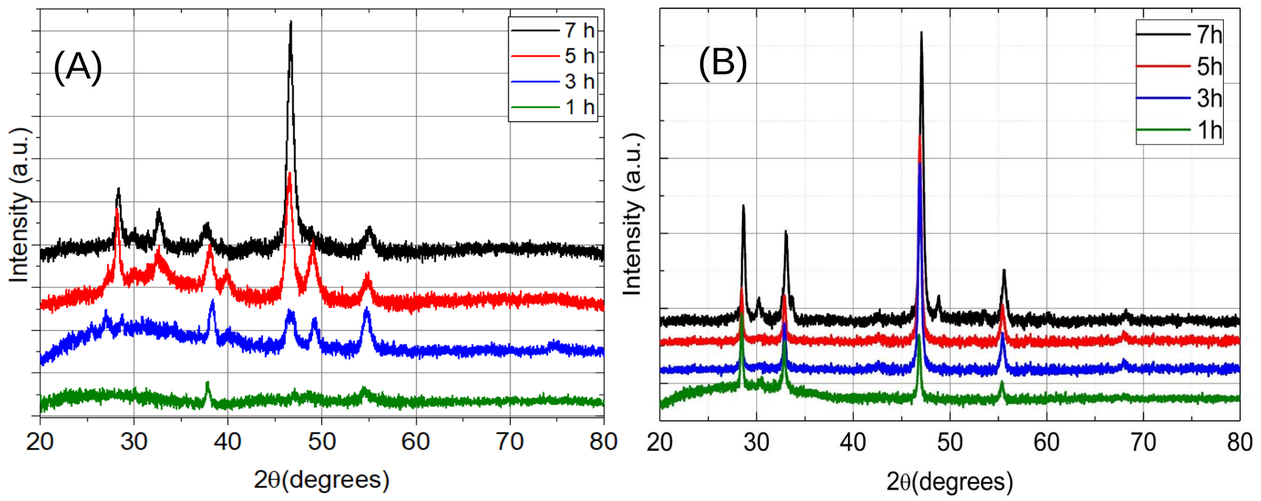
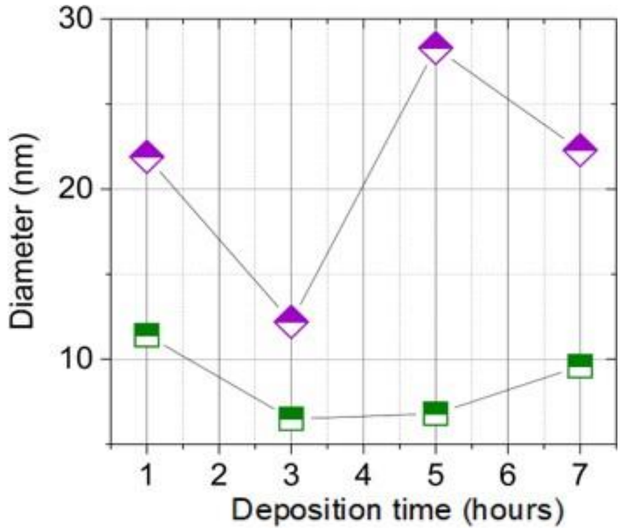


Figura 4. The average grain size as a function of deposition time (obtained by Rietveld refinement), as-grown and thermal annealing at 200 ° C



CONCLUSIONS

- According to the X-ray Diffraction patterns showed that the films as-grown have main peaks that correspond to Cu_2S phase, while the films annealed at 200°C present the CuS and cuprite phases and with a significant improvement in its crystallinity.
- Films grown with thermal annealing at 200 °C present a higher diameter than the pristine samples.
- The thermal treatment in a high vacuum improves the crystallinity and decreases the sheet resistance of the Copper Sulfide films, thus obtaining an improvement in conductivity.

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