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Effect of Stirring Rate of the Electrolyte on Properties of Electrodeposited CdS Layers

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Among the thin film polycrystalline solar energy materials, CdS is a well matching window material with CdTe absorber layer in order to form CdS/CdTe high efficiency solar cells. Amid wide variety of CdS fabrication methods, the electro-deposition(ED) is one of the promising production methods due to its simplicity, low cost, scalability and manufacturability. Since there are numerous experimentally controlled ED parameters, it is essential to find a set of best parameters in order to produce a high quality CdS window layer. Here the attention was driven on the ED parameter 'stirring rate of the electrolyte' which has not been discussed in detail earlier. As the stirring rate directly affected on the ion transportation process in the electrolytic bath, it should also be optimized up to a certain level and this study was carried out to investigate the influence of the stirring rate on the electrical, optical and morphological properties of the CdS thin films.

Here the CdS thin films were electrodeposited on FTO glass substrates (1 x 3 cm^2)using 100 ml of electrolyte which was a mixture of0.1 M$CdCl_2$ and 0.01 M$Na_2S_2O_3$.While all the other main ED parameters such as deposition potential, temperature of the bath, deposition time and pH of the bath were kept at previously identified constant conditions, the stirring rate was varied in the range 0-350 rpm. The electrical, optical and morphological properties of the CdS thin films deposited under different stirring rates were analyzed using photo electro chemical cell study, optical absorption spectroscopy and scanning electron microscopy respectively. Moreover the current profile during the deposition clearly shows how the stirring rate effects on the ion transportation and this study reveals that a stirring rate between 60-125 rpm is the best working stirring rate range for the fabrication of good quality CdS thin films using an electrolyte in a 100 ml beaker.

Key-words: Electro-deposition; electrochemistry; cadmium sulfide; semiconductors; solar energy materials