

A comparative study on ED-Cds and CBD-Cds thin films**M.R.M.B. Abeykoon¹, W.G.C.Kumarage^{1,2} and B.S. Dassanayake^{1,2*}**¹*Department of Physics, Faculty of Science, University of Peradeniya, Sri Lanka,*²*Postgraduate Institute of Science, University of Peradeniya, Sri Lanka***buddhid@gmail.com*

Among various deposition methods of CdS, chemical bath deposition (CBD) and electrochemical deposition (ED) stand out due to its simplicity, low cost along with uniformity of the fabricated samples. In this work CdS thin films are fabricated using CBD (CBD-CdS) and ED (ED-CdS) methods and compared using XRD, SEM, UV-visible spectroscopy and photoelectrochemical cell (PEC) measurements. All samples were deposited on thoroughly cleaned fluorine doped tin oxide (FTO) glasses. CBD-CdS was fabricated using, 0.001 M CdSO₄, 0.002 M CS(NH₂)₂ and 1.1 ml of NH₄OH at a bath temperature of 80 °C for one hour. ED-CdS was deposited by three electrode cathodic electrodeposition in an aqueous solution of 0.05 M CdCl₂, 0.05 M Na₂S₂O₃ at -600 mV against the Ag/AgCl electrode, at a bath temperature of 60 °C and a pH between 1-2. All fabricated films were air annealed at 200 °C for 1 hour. The XRD analysis shows that the fabricated ED-CdS and CBD-CdS are predominantly hexagonal. The SEM images of the ED-CdS samples indicate that the surfaces of the fabricated films containing spherical features with various sizes. ED-CdS indicate more uniform coagulates compared to that of CBD-CdS. Hence, it is expected that the electrochemical deposition gives better packing, higher uniformity and better contact with the FTO, resulting in higher I_{SC} for ED-CdS. The flat band potential value calculated from the Mott-Schottky plot was found to be -683 mV vs. Ag/AgCl for the ED-CdS and -533 mV vs. Ag/AgCl for the CBD-CdS, suggesting the existence of different electron affinity levels of CdS depending on the deposition method. The average transmittance of fabricated CBD-CdS and ED-CdS films were found to be 75% and 51% respectively. It can be concluded that the opto-electrical properties of CdS thin films are dependent on deposition method and ED-CdS show superior electrical properties compared to CBD-CdS.

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