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Cupric Oxide Thin Films for Optoelectronic Application

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Abstract : Copper oxide is a semiconductor that has been studied for several reasons such as the natural abundance of starting material copper (Cu); the easiness of production by Cu oxidation; their non-toxic nature and the reasonably good electrical and optical properties. Copper oxide is well-known as cuprite oxide. The cuprite is p-type semiconductors having band gap energy of 1.21 to 1.51 eV. As a p-type semiconductor, conduction arises from the presence of holes in the valence band (VB) due to doping/annealing. CuO is attractive as a selective solar absorber since it has high solar absorbency and a low thermal emittance. CuO is very promising candidate for solar cell applications as it is a suitable material for photovoltaic energy conversion. It has been demonstrated that the dip technique can be used to deposit CuO films in a simple manner using metallic chlorides ($CuCl_2.2H_2O$) as a starting material. Copper oxide films are prepared using a methanolic solution of cupric chloride ($CuCl_2.2H_2O$) at three baking temperatures. We made three samples, after heating which converts to black colour. XRD data confirm that the films are of CuO phases at a particular temperature. The optical band gap of the CuO films calculated from optical absorption measurements is 1.90 eV which is quite comparable to the reported value. Dip technique is a very simple and low-cost method, which requires no sophisticated specialized setup. Coating of the substrate with a large surface area can be easily obtained by this technique compared to that in physical evaporation techniques and spray pyrolysis. Another advantage of the dip technique is that it is very easy to coat both sides of the substrate instead of only one and to deposit otherwise inaccessible surfaces. This method is well suited for applying coating on the inner and outer surfaces of tubes of various diameters and shapes. The main advantage of the dip coating method lies in the fact that it is possible to deposit a variety of layers having good homogeneity and mechanical and chemical stability with a very simple setup. In this paper, the CuO thin films preparation by dip coating method and their characterization will be presented.

Keywords : absorber material, cupric oxide, dip coating, thin film
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