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Investigation of n-type Cu_2O layers prepared by a low cost chemical method for use in photo-voltaic thin film solar cells

This investigation reports the simple method of preparation of Cu_2O and the properties of this layer as determined by XRD, GDOES and SEM techniques. The amount of Cu_2O grown on the copper plate and the variation of the pH value of the solution as a function of boiling time in the $CuSO_4$ solution are investigated. The oxide layer grows rapidly at the beginning and slow down after about first 40 minutes. The variation of pH value shows similar trend showing a rapid reduction at the beginning and the saturating a value close to3.8.

During the growth of Cu2O layer, the acidity of the solution increased rapidly and settles down at a constant value. At this equilibrium, the growth rate Cu2O must have been equal to rate of dissolution of the oxide layer due to increased acidity of the solution. The formation of CU2O on copper surface can be explained by the following reaction ie

$$CU^{2+} + Cu + H_2O \rightarrow Cu2O + 2H^+$$

The XRD patterns were obtained for there different layers with boiling times of 20, 40 and 60 minutes. The XRD pattern is dominated by there peaks (111), (200), (220) and from the copper substrate. The 20 minutes boiling in $CuSO_4$ solution forms a polycrystalline becomes stronger and Cu2O (200) peak also appears next to Cu (111) increases with prolonged boiling time of Cu plates in $CuSO_4$ solution. From SEM data the liner arrangements of grains observed must have been originated from the scratches found on the Cu surface during surface preparation. Further annealing in air at temperature in excess of 400 ^oC does not show any major changes of grain sizer or the improvement of XRD patterns. Glow discharge optical emission spectroscopy (GDOES) profiling experiment have been carried out on these Cu_2O / Cu systems and the presence of Cu_2O layer is indicated by the presence of more Oxygen and less Cu on the surface when compared to the bulk Cu plate.