CHAPTER VI

CHAPTER SIX

6. Summary and Conclusions.

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Summary and Conclusions:

In this investigation Bi_2O_3 films are prepared by spray pyrolysis technique and then converted to Bi_2S_3 films. The films are studied for their electrical and optical properties and then used in large area photovoltaic cell for conversion of solar energy. In the first chapter, subject of energy conversion is introduced in brief and summary of upto date literature on Bi_2O_3 and Bi_2S_3 is reported. In the light of this, the problem has been selected and stated therein. Theoretical back ground of ECPV cells is given in Chapter II. Out of different methods for the preparation of films, the spray pyrolysis technique employed in the present study is described at length in Chapter III. The optical absorption studies of Bi_2O_3 and Bi_2S_3 are investigated and presented in Chapter IV. These properties determine the behaviour of electrode in electrochemical photovoltaic cell. Electrical properties of electrochemical photovoltaic (ECPV) cells formed with Bi_2S_3 electrode are discussed in Chapter V. The dynamic characteristics and power output characteristics are studied and the results are discussed therein.

One of the most interesting investigations related to this study, is the preparation of Bi_2S_3 films from Bi_2O_3 ones, prepared by spray pyrolysis (S.P.) technique. The S.P. technique used is very simple, entirely reproducible and produces uniform Bi_2O_3 films of high stability and large area.

The optical absorption measurements show an absorption edge close to 825 nm. The absorption coefficient is high of the order of 10^4 - $10^5 cm^{-1}$ which confirms that absorption is due to inter band transitions. The intercepts of plots of $(\alpha h\nu)^2$ versus $h\nu$ give the values of optical bandgaps 1.62 eV and 2.8 eV, respectively, for Bi_2S_3 and Bi_2O_3 films. Resistivity measurements give activation energies 0.68 eV and 0.62 eV, respectively, for Bi_2O_3 and Bi_2S_3. These measurements also support that films are semiconductors. The measurement of thermoelectric power of films has confirmed the n-type character.

The nature of the dynamic I-V curves of the ECPV cell formed shows that junction has been formed between semiconducting Bi_2S_3 film and electrolyte. The behaviour of this junction can be explained on the basis of Schottley barrier type. The photovoltaic output characteristics of Bi_2S_3 / 0.1 M $NaOH, Na_2S$, S/C cell can be explained in terms of the series resistance, Rs and shunt resistance, Rsh of the cell. The fill factor (ff), maximum power (Pm) and efficiency of this ECPV cell, respectively, are 33.98%, 10.8 μW and .01 %. The study of photoresponse characteristics of ECPV cell is done. The open circuit voltage, Voc varies logarithmically with the intensity of irradiation. However, the photocurrent varies linearly with intensity of incident radiation, which is in agreement with the theory.

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