ABSTRACT

The solar energy conversion methods using non-conventional semiconductor materials were studied. Four systems were investigated in the frame work of this project; solid state photovoltaic system, photoelectrochemical system, photocatalytic system and dye sensitized solar cells. An attempt was also made to investigate the photoeffects at semiconductor interfaces, semiconductor-liquid junctions, and dye sensitized semiconductor interfaces by measuring various semiconducting and photophysical parameters.

The methods of preparation of p- and n-type film of β-CuCNS and their solid state properties were studied. p-Cu_xS/n-β-CuCNS junction solar cell was fabricated and the characteristics were determined.

Polycrystalline p-Cu_xS/n-CdS junction photocathode (where CdS film deposited on Cu_xS coated copper substrate) showed a photocurrent quantum efficiency which was several orders of magnitude higher than that of Cu_xS photocathode. The mechanism involved was studied.

Dye sensitized solid state and photoelectrochemical cells were prepared using β-CuCNS. Enhanced photocurrent quantum efficiency of a heterojunction CuS/CuCNS photocathode where CuCNS was sensitized with Rhodamine B was attributed to the presence of a strong space charge electric field that assist charge separation. A thin layer of dye sandwiched between p-CuCNS deposited on copper substrate and n-SnO_2 coated transparent glass was found to yield photocurrent resulting from light absorption in the dye. Furthermore stabilization and quantum efficiency were improved by varying surface properties of the devices.

Photocatalytic type cells, which can be used for photocleavage of water and produce energy rich compounds were studied. Silver phosphate and hydrous cuprous oxide were found to photocatalyse decomposition of water into oxygen and hydrogen. Again it was found that an aqueous suspension of hydrous cyprous oxide photoreduce carbonic acid selectivity to methanol with selfsacrification. The high yield and selectivity was attributed to strong chemisorption of CO_2 ; highly negative flat band potential and multi-electron transfer.