ABSTRACT

Photocurrent quantum efficiency of liquid photovoltaic cells (PECs) is largely limited by the rapid recombination of the photogenerated charge carriers at the solid defect as well as at the interface. In solid state photovoltaics, the problem is more serious with polycrystalline materials because of the rapid recombination of carriers before separation by the barrier field. In liquid photovoltaics, the minority carriers tunnelling into the medium are transferred more efficiently when charge transfer agents are present. Therefore this study was undertaken to look for the possibilities to enhancing the photocurrent quantum efficiency in PECs by suppression of recombination or other losses.

It is observed that when the p-type Cu_2O is coated with the cationic forms of different dyes(whereas the anionic ligand of the dye is salicylate ion), photocurrent generation in the bandgap region wavelength is also enhanced. The effect is explained as originating from the suppression of the recombination of the carriers generated by the photons captured directly by the semiconductor surface.

Deposition of thin films of polynuclear metal cyanide films of Prussian Blue(PB) on CdS photoelectrodes is found to increase the photocurrent in CdS. The efficient hole trapping in PB and an effective removal of holes from PB by adsorbed redox species suppress recombinations.

Photoelectrochemical cell based on microporous cuprous iodide(CuI) photoelectrode sensitized with natural pigment chlorophyll was studied. Characteristics of the

photocurrent spectra of the chlorophyll sensitized microporous cuprous iodide film under back wall mode and front wall mode illumination give evidences to the existence of diffusion controlled charge transfer process between colloidal particles of cuprous iodide.

It is observed that the treatment of microporous TiO_2 film with tannins and related polyphenolic substances produces Ti^{4+}-tannin or Ti^{4+}-phenol charge transfer complexes firmly affixed to the surface of TiO_2 crystallites. Efficient photosensitization originating from the surface chelated charge transfer complex generates high photocurrents in liquid photovoltaic cells.