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Characteristics of quasi soild photoelectrochemical cells with SnO_2/ZnO and TiO_2 films

Dye sensitized photoelectrochemical cells (PEC) have been widely studied for developing inexpensive, low cost solar energy devices with high efficiency. However, the presence of a liquid electrolyte in these cells causes stability, encapsulation and performance limitations. As the absence of liquid reduces the encapsulation problem, the use of solvent free polymer electrolyte is an promising alternative.

Here we report the photoelectrochemical behaviour of quasi-solid polymeric dye sensitized PECs with nanaoporous TiO_2 and SnO_2/ ZnO films.in the preparation of Sn2/ZnO films, a solution of colloidal SnO_2, acetic acid triton X – 100, ZnO and methanol is sprayed on to CTO glass plates and sintered. TiO2 films are prepared by using a solution of TiO_2 (Degussa P25), nitric acid, triton x -100 and a few drops of water. The sintered films are coated with the dye (cis-dithiocyananto [N-bis (2,2'-bipyridyl -4 -4dicarboxylic acid] Ru [II]).

The viscous polymeric electrolyte (6.5% Polyacrilonitrile, 26% propylene carbonate, 4% ethylene carbonate, 16.5% acetonitrile, 6.65% CsI and 0.35% I_2) is placed on the dye-coated films and pressed onto the platinized CTO glass counter electrode. The open circuit voltages and the short circuit currents obtained under direct sun light illumination (1000 W m^{-2}) for the cells with SnO_2/ ZnO and TiO_2 as anodes are ~0.6 V, ~11.5 mA cm^{-2} and ~0.6 V, ~5.7 mA cm^{-2} respectively.

The energy conversion efficiencies obtained for the SnO_2/ ZnO and TiO_2 cells are ~ 9% at diffused day light (100 W m^{-2}) and ~5% under light intensity of 1000 W m^{-2}. For the cells with TiO_2 films these values are ~5% to ~2% respectively. Transient studies reveled that the photocurrent is reproducible with quick response and induced repeatedly under several on and off cycles. SnO_2/ ZnO cell configuration shows higher stability than that of the TiO_2 cell. Again the overall stability of these cells is very much higher than that of the reported liquid electrolytic cells.