Section E1

501/E1

The spectral response broadening in dye sensitized devices due to the length of polymethine chain and the other ligands in cyanine dyes

P.K.D.D.P. Pitigala

Department of Physics, University of Sri Jayawardanapura, Gangodavila, Nugegoda

In dye sensitized (DS) devices, the excited dye molecules inject carriers to the energy bands of the attached semiconductor material, thereby separating the charges and driving a current in an external circuit. Although many initially encountered technical hurdles are overcome, the efficiency of DS solar cells remains low due to the narrower spectral response. Therefore, investigation of methods to broaden the spectral response of a DS solar cell is very important. In general, long carbonic chains are known to absorb infrared radiation. Alterations of a cyanine dye molecules with carbon chains can be used to extend the response spectra of the DS solar cell and other DS devices. The results of such an investigation are presented here. The investigation was carried out with four cyanine dye derivatives. These dyes were coated on TiO_2 electrodes. The TiO_2 electrodes were prepared by hydrolysis of titanium isopropoxide and depositing the slurry on fluorine doped conducting tin oxide (FTO) glass plates (1× 1.5 cm^2). CuSCN dissolved in propyl sulfide was used as the hole collecting (p-type) material, and was deposited on the dye coating, by keeping the dye coated electrode on a hot plate (~120 °C). The result shows broadening in the absorption and response spectra of the DS device as the length of the carbon chains in the dye molecules increases. The cyanine dyewith the longest central polymethine chain, has the largest red shift in the response spectra threshold, which extended into the near infrared region (~900nm). Additionally, the lengths of the other carbon ligands in the dye molecules also contributed to the broadening of the spectral response of DS devices. For the other three dyes, consisting of the same center polymethine chain length but with the CH_3-, the CH_3CH_2- and the $(CH_3)_2N(CH_2)_3$- ligands attached to pyrrolidinium ring had their response thresholds red shifted in the same consecutive order as the ligand length, implying a correlation among the chain length and the extension in the response threshold.

dpitigala@sjp.ac.lk 0112758104