E2-35 Improved photocurrent quantum efficiency from · Langmuir-Blodgett films

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Up to present time, the vast majority of photosensitization investigations on dye sensitized solar cells have been involved with disordered dye layers on wide band gap semiconductor. Recently, it was found that the properties of dye sensitized solar cells with ordered molecular arrangements are different from the properties observed from their disordered molecular arrangements. p-CuSCN(band gap 3.0 eV) is an excellent semiconductor material since it has the ability to operate stable sensitized photocurrents with disordered and ordered molecular arrangement. A remarkable sharp photocurrent enhancement can be observed when 4 Langmuir-Blodgett films (LB films) of Methylviolet-C_{18} deposit on p-CuSCN before deposition of Rhodamine-C_{18} 4 monolayers on Methylviolet-C_{18}.

It can be proved from the fluorescence measurements, absorption measurement and polarized absorption measurements that there exists an interaction between M-C_{18} and R-C_{18} molecular arrangements through their parallel vibration planes under the light effect.

This interaction causes a sharp photocurrent peak by sensitizing a p-CuSCN wide band gap semiconductor.

Excited electron of R-C_{18} molecular arrangement perturbed the ground state electrons of M-C_{18} through the parallel vibration planes to operate the interaction in order to generate the sharp photoresponse at $\lambda = 570$ nm.

Reactions involved can be summarised as follows:

$$R\text{-}C_{18} \longrightarrow R\text{-}C_{18}$$

$$R\text{-}C_{18}^{*} + M\text{-}C_{18} \longrightarrow R\text{-}C_{18} + M\text{-}C_{18}^{*}$$

$$M\text{-}C_{18}^{*} \longrightarrow M\text{-}C_{18}^{-} + h\ (VB\text{ - }pCuSCN)$$

$$M\text{-}C_{18}^{-} + A\ (\text{electron accepter}) \longrightarrow A - M\text{-}C_{18}$$

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