E1-10: Photovoltaic cell made from merocyanine – C_{18} Langmuir-Blodgett films on a plastic film

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If a thin - film phototvoltaic cell is prepared on a plastic plate, a flexible and large area solar cell can be produced. Merocyanine - C_{18} Langmuir-Blodgett (LB) films are used as the thin - film p-type semiconductor (band gap 1.9eV) deposited on plastic conductive substrate. The substrate is a polyester plastic plate (2mm thickness) coated with ITO (Indium Tin Oxide), which has an excellent transparency (86% for the average solar spectrum) and a low sheet resistivity (500Ω/m). Two types of configurations are examined, Al/Dye/ITO/Polyester ($I_{sc} \approx 350$ mA cm^{-2} and $V_{oc} \approx 250$ mV) and Al/Dye/ZnO/ITO Polyester ($I_{sc} \approx 750$ mA cm^{-2} and $V_{oc} \approx 450$ mV) irradiating through the plastic plate. Four monolayers of merocyanine-C_{18} LB films show the best photoelectrodes. Here, it is interesting that Ag/Dre/ZnO/ITO/Polyester solar cell shows good rectifying properties when compared to the system without ZnO layer. Here, merocyanine-C_{18} and ZnO make a hetero junction. Also the stability of the photocurrent is considerably high for the Al/Dye/ZnO/ITO/Polyester solar cell (decay rate of the photocurrent ≈0.3 μA cm^{-2}/min). However, photodegradation of the dye is a great problem to the conversion efficiency. Further, the series resistance in the ZnO layer whose resistivity is $10^5 - 10^6$ Ωcm, should be lowered and the rectifying characteristics of the dye/ZnO junction should be strong. This solar cell can be presented as a new approach since it has a flexible character for future solar energy conversion devices. The absorption properties of LB films exhibit 3 absorption peaks which are involved to generate sensitized photocurrent. Here the contribution from J aggregates is highly significant to the total current.

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