The role of low light intensity: a cheap, stable and solidly efficient amorphous Sb_2S_3 powder/hypericin composite/ PVA matrix loaded with electrolyte solar cell

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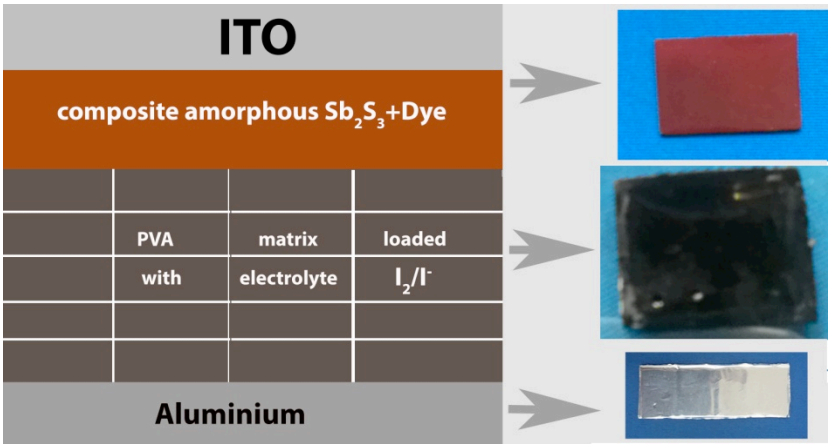
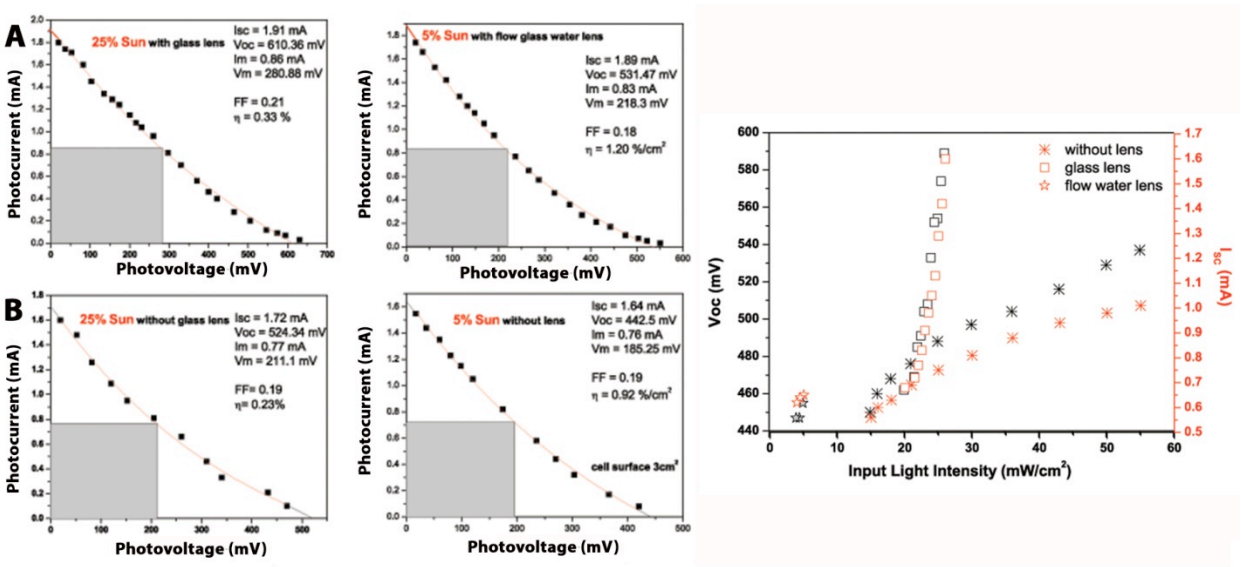
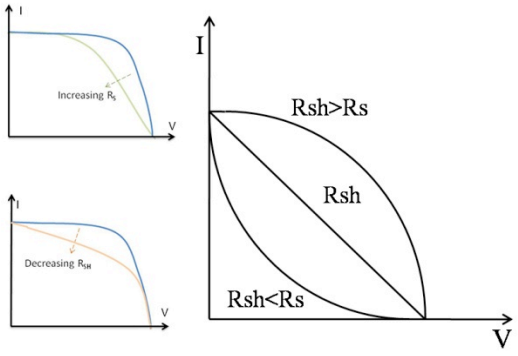
Abstract

We report here on an inexpensive, solid and stable solar cell designed and made entirely of synthesized materials, Sb_2S_3/hypericin (dye) thin film on ITO-coated glass (working electrode), aluminum (counter electrode), and PVA matrix (solid carrier) loaded with electrolyte (0.5M KI + 0.05MI_2). The fact that the cell is inexpensive but also stable and solid, with efficiency of around 1.3%/cm^2 at a very low light intensity of only 5% sun, makes it particularly suitable for indoor applications. At higher light intensities **of** 25 and 55% sun, however, the cell exhibits lower efficiency, around 0.3 and 0.07%/cm^2, respectively. Development of low-cost cell technology combined with understanding of low light utilization and setting of standard conditions should be some of the future directions the research in this area should follow. Therefore, in this work**,** we tried to give sufficient reasons for establishing standard conditions related to low light intensity.





Illuminated I–V curves for the solar cells (cells A and B are of the same configuration) made of ITO/amorphous Sb_2S_3/hypericin composite/ PVA matrix loaded with electrolyte (0.5M KI + 0.05MI2)/Al: plot of power output characteristics for two different low-light intensities 5% and 25% sun with glass/flow glass water lens (A) and without glass/flow glass water lens (B). The right side shows the variations in I_{SC} and V_{OC} with input light intensity for two different lenses, flow water lens at very low intensity (5% sun), glass lens (25% sun) and without lenses (55% sun) at medium intensity.



We have been trying to grasp the significance of low light and how it can be utilized, primarily for the purpose of fully understanding it and then making efficient PV devices. Standard low-light conditions have not yet been established but they are necessary to exist as a basis, which is to guide our research in the right direction. The efficiency of solar cells only cannot be our guide in something that is not yet fully understood. Development of low-cost technology combined with a better understanding of low-light utilization should be some of directions for the research in this area.