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LIGHT SOAKING EFFECT ON THE PERFORMANCE OF Sb_2S_3 BASED SOLAR CELLS UNDER LOW LIGHT INTENSITY

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Antimony sulphide (Sb_2S_3) solar cells have achieved the highest efficiency of 7.69% in practice; however, it is lower than theoretical predictions. The main drawback of Sb_2S_3 solar cells is the defects in the bulk, grain boundaries, and at interfaces. The light soaking effect (LSE) was observed in FTO/TiO_2/Sb_2S_3/P3HT/carbon solar cells, which were fabricated via a modified solar cell configuration utilising a novel spin coating approach. The solar cells were then characterised to identify the reasons behind LSE because improving the stability of Sb_2S_3 solar cells requires the suppression of LSE. Overall, the initial measurements of these solar cells resulted in efficiency of 0.1 – 0.5%, short circuit current density (J_{SC}) of 1 – 4 mA cm^{-2}, open circuit voltage (V_{OC}) of 0.1 – 0.5 V and fill factor of 0.25 – 0.30; however, with illumination, J_{SC} enhanced while V_{OC} decreased slightly. Even though the rate of change in J_{SC} with illumination time was similar, it can be improved by passivating the bulk Sb_2S_3 layer, enhancing charge transfer, and decreasing its thickness. Additionally, when solar cells were evaluated temporarily, improvement of 4.14 – 17.65% in J_{SC} was observed without any illumination. Therefore, it was suspected that defects in fabricated solar cells generate heat. At low intensities, solar cells demonstrated higher performance in *I-V* plots. When V_{OC} versus intensity plot was elucidated, these solar cells had trap-assisted recombination at the lower intensity ($\approx$ 20 mW cm^{-2}) and bimolecular recombination at the higher intensity. If these recombination processes could be minimised, it would be possible to achieve better performing Sb_2S_3 solar cells with minimum LSE. Moreover, the major suspected locations of defects in these solar cells are found to be in the grain boundaries and interfaces of the Sb_2S_3 layer.

Keywords: Bimolecular recombination, Illumination time, Light soaking effect, Low intensity, Trap-assisted recombination