Impact of Anti-Reflection (AR) Layer on the Performance CIGS Solar Cell

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Efficiency of solar cells was mainly restricted by optical losses, majorly from high surface reflection of the incident light beam [1]. Anti-reflection coating (ARC) with an appropriate refractive index is the best option to reduce reflection losses about 3 to 10% than the surface texturing. Most of AR coatings are very durable, with resistance to both physical and environmental damage. Among them, the simplest AR coating is MgF_2 which is ideal for broadband use though it gives varied results. In the present work, in order to understand the optical properties of MgF_2, single layers were grown on glass substrate by electron beam evaporator and were analyzed by UV-Vis-NIR Spectrophotometer. Further, the optimized layer MgF_2 anti reflection layer was coated on CIGS based solar cell at room temperature and studied the performance of cell by illuminated current density-voltage (J-V) measurements with a light source of 100 $mWcm^{-2}$ at AM 1.5 conditions. The optimized MgF_2 anti reflection layer showed an average transmittance of ~ 97 % with a thickness (t) of 100 nm and refractive index (n) of 1.38 [2]. The J-V curves of CIGS solar cell before and after coating of MgF_2 anti reflection layer, was shown in Fig. 1. The J-V analysis indicated that the CIGS cell without MgF_2 anti reflection layer, showed characteristic parameters such as, an open circuit voltage (V_{oc}) of 0.634 V, short circuit current density (J_{sc}) of 32.5 $mAcm^{-2}$, a fill factor (FF) of 66.46, giving a conversion efficiency of 13.7 %, whereas the cell with MgF_2 anti reflection layer, showed an open circuit voltage (V_{oc}) of 0.638 V, short circuit current density (J_{sc}) of 33.9 $mAcm^{-2}$, a fill factor (FF) of 67.19, giving a conversion efficiency of 14.6 %. Hence the results suggested that the MgF_2 anti reflection layer was improved the performance of CIGS solar cell [3].

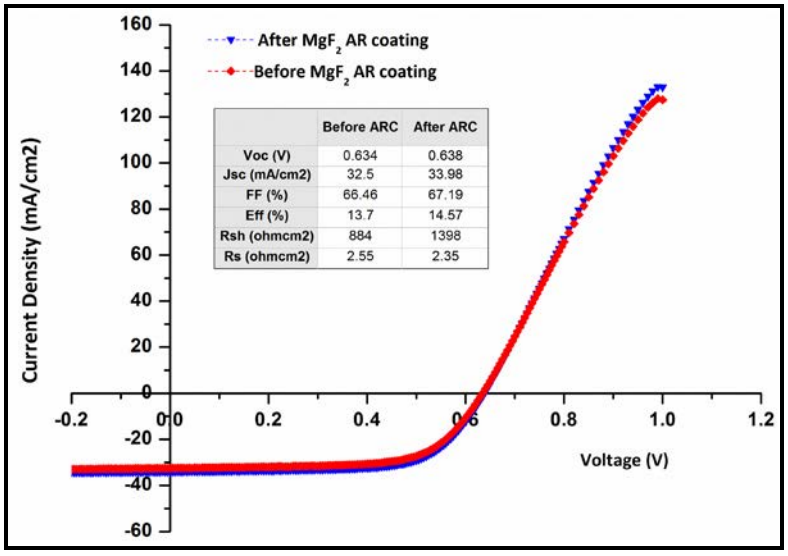

Fig. 1. Illuminated J–V curves of CIGS solar cell before and after coating of MgF_2 AR layer.

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