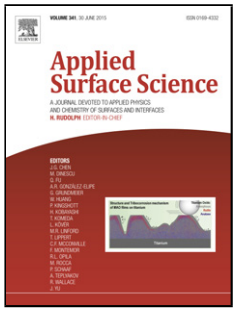

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Towards maximizing the haze effect of electrodes for high efficiency hybrid tandem solar cell

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Highlights

- - Current matching in tandem solar cells is required to maximize the efficiency of the tandem solar cell.
- - Haze effect helps in trapping the light within the active layer.
- - Scattering of light due to rough electrode surface helped in spectral tuning to aid in achieving current-matched condition.
- - Haze effect improved the ideal short-circuit current density obtained through optical simulation by 7.6 %.
- - Optimized structure was obtained when the active layer of the a-Si:H subcell thickness was 500 nm and that of the OPV subcell was 150 nm.

Abstract:

In this study, we executed optical simulations to compute the optimum power conversion efficiency (PCE) of a-Si:H/organic photovoltaic (OPV) hybrid tandem solar cell. The maximum ideal short circuit current density ($J_{sc,max}$) of the tandem solar cell is initially obtained by optimizing the thickness of the active layer of the OPV subcell for varying thickness of the a-Si:H bottom subcell. To investigate the effect of Haze parameter on the ideal short-circuit current density ($J_{sc,ideal}$) of the solar cells, we have varied the haze ratio for the TCO electrode of the a-Si:H subcell in the tandem structure. The haze ratio was obtained for various root mean square (RMS) roughness of the TCO of the front cell. The effect of haze ratio on the $J_{sc,ideal}$ on the tandem structured solar cell was studied, and the highest $J_{sc,ideal}$ was obtained at a haze of