

Investigating effect of Carrier Lifetime and Concentration on performance of solar cells using Double Ag-ZnO/ZnO Layer Antireflection Coating

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The Ag-ZnO/ZnO double ARC layer on Silicon solar cells presented the average reflectance by 7.58% which was lowered to ZnO and Ag-ZnO single ARC layer. The simulation study demonstrated the reasonable electron and hole densities of $1.75 \times 10^{16} \text{ cm}^{-3}$ and $1.51 \times 10^{16} \text{ cm}^{-3}$ on Si solar cells with Ag-ZnO/ZnO double ARC layer. The simulated I-V characteristics exhibited that the efficiency of Ag-ZnO/ZnO double ARC layer based Si solar cells gradually increases with the increase of the minority carrier lifetimes. As compared to single ARC layer, the Ag-ZnO/ZnO double ARC layer based Si solar cell presented the highest conversion efficiency 14.32% with fill factor of 81.35% at minority carrier lifetime of 10 μs and carrier concentration of $1 \times 10^{17} \text{ cm}^{-3}$. The improved photovoltaic performance in Ag-ZnO/ZnO double ARC layer based Si solar cell might be suitable to the high generation of electron-hole pairs, improved minority lifetime and excellent carrier concentrations