

Investigation of GaSb solar cell with an AlGaAsSb window layer for applications as a bottom subcell of 4-junction solar cells

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GaSb provides great potential for the multijunction solar cells applications thanks to the low value of its bandgap (0.726 eV) - indispensable for a full solar spectrum harvesting. Nevertheless, most of the reported research indicates low J_{sc} and V_{oc} values of GaSb cells, leading to the poor conversion efficiencies.[1] Thus, increasing the values of those parameters is crucial for successful implementation of this subcell into the tandem structures without risking the degradation of overall performances. A promising approach to improve their efficiencies is the introduction of an optimized window layer providing a great surface passivation and reducing the contribution of the saturation current.[2]

In this work a GaSb solar cell comprising an $Al_{0.5}Ga_{0.5}As_{0.04}Sb_{0.96}$ window layer is studied. Its performance is investigated using dark current voltage, one sun current voltage and spectral response measurements. The interpretation of the results is carried out with a use of numerical simulations allowing to extract physical parameters such as minority carrier lifetimes. A significant increase in J_{sc} is observed, resulting in a final conversion efficiency of the cell estimated at 7.2%, which is to our best knowledge, the highest value reported on a GaSb solar cell so far. In order to evaluate the potential of this subcell for multijunction applications, numerical simulations are carried out using a filtered solar spectrum which corresponds to the convertible wavelengths range by a GaSb subcell implemented into 4- and 5-junction solar cells.

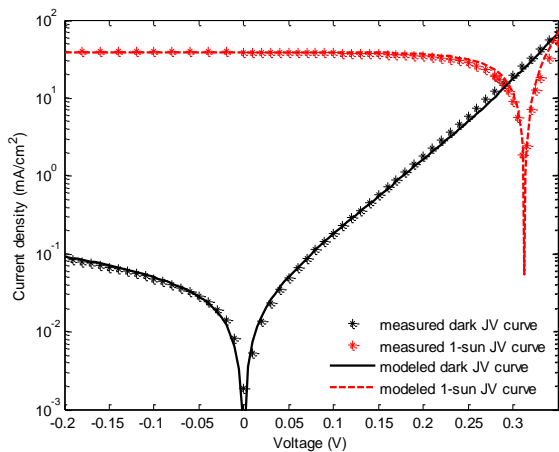


Fig. 1. Dark (black) and 1-sun J-V characteristics of studied GaSb cell.

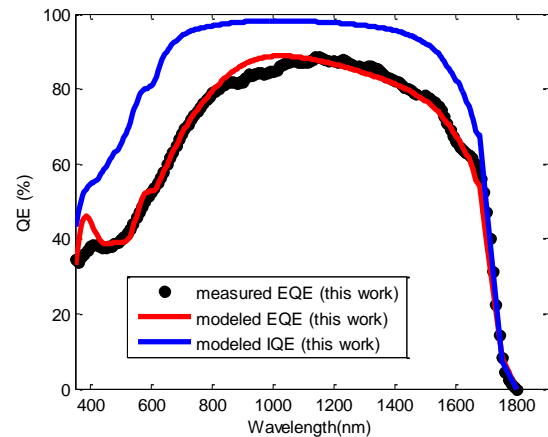


Fig. 2. Measured EQE and simulated EQE, IQE values of studied GaSb cell.

[1] *Four-Junction Wafer-Bonded Concentrator Solar Cells*. F. Dimroth, T.N.D Tibbits, M. Niemeyer, F. Predan, P. Beutel, C. Karcher, E. Oliva, G. Siefert, D. Lackner, P. Fuß-kailuweit, A. W. Bett, R. Krause, C. Drazek, E. Guiot, J. Wasselin, T. Signamarcheix. 1, s.l. : IEEE Journal of Photovoltaics, 6(1), 343–349., 2016, IEEE Journal of Photovoltaics, Vol. 6, pp. 343-349.

[2] C. Algora, I. Rey-Stolle. *Handbook of Concentrator Photovoltaic Technology*. s.l. : Wiley, 2016.