EFFECT OF FLOATING $p-n$ JUNCTIONS ON THE EFFICIENCY OF SILICON BACK SIDE CONTACT SOLAR CELLS

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S u m m a r y

Characteristics of silicon back side contact solar cells are investigated theoretically and experimentally at low illumination levels in the presence of a floating $p^+ - n$ junction on the front surface. It is established that, under these conditions, the short-circuit current, open-circuit voltage, and internal quantum efficiency of photocurrent can significantly decrease due to the influence of recombination in the near-surface space charge region. The interval of irradiances, in which these reductions are essential enough, is determined. In particular, it is shown that the interval of light intensities corresponding to a decrease of the open-circuit voltage $V_{\rm OC}$ is significantly wider than that corresponding to a reduction of the short-circuit current $J_{\rm SC}$. The experimental results agree with those of calculations. The obtained results allow us to conclude that the floating $p^+ - n$ junctions on the front surface of silicon back side contact solar cells are appropriate for the use only at significantly large levels of illumination intensities (≥ 1000 W/m^2).