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The window layers effect on the hardness improvement of space solar cells exposed to the 1 MeV electron irradiations

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Abstract Because of their state of art technology, GaAs solar cells are generally preferred for spatial applications. Exposure to proton and electron irradiations, solar cells suffer significant degradation in their performance such as short circuit current and open circuit voltage. Adding a window layer helps in effectively reducing the surface recombination at the emitter surface of the solar cell without absorbing the useful light required for the device. It remains to study the physics of the window-emitter hetero-interface in order to understand how the window layer presence increases the minority carrier lifetime of the solar cell exposed to particles irradiation. In this work Numerical simulation has been used to study the AlxGa1-xAs window composition effect on the current–voltage characteristics of a GaAs solar cell under AM0 illumination and exposed to 1 MeV electron irradiation. To predict the effect of window layers on solar cells degradation, the current voltage characteristic are evaluated for different electron irradiation fluences. The findings are supported by experimental data. They lead us to get to know how the window layer improves resistance to electron irradiation through its own parameters.

Keywords Carrier lifetime · Window layer · Effective recombination velocity · Degradation · Electrons irradiation

1 Introduction

Window layers help in effectively reducing the surface recombination at the emitter surface of the solar cells, without absorbing the useful light required for the device, resulting in significant improvement in energy conversion efficiency (Jain 2003). Various window layer materials have been investigated for III–V compound semiconductor based solar cells. To

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