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MULTI-JUNCTION SOLAR CELLS PERFORMANCE ANALYSIS AND DEGRADATION
PREDICTIONS IN SPACE

Abstract

At the present, multi-junction solar cells are the main of primary power sources for satellites with the efficiency greater than 30 percent. The rise of the part of spacecrafts power makes the problems of solar cells degradation prediction in space environment conditions to be actual. Multi-junction solar cells performance degradations come from initial degradations due to tolerances and imperfections of manufacturing at the beginning of life BOL, and accumulated degradation of solar cells due to space environment effects over time up to the end of mission life EOL of satellite. The main type damaging particles on the geosynchronous orbits are the high energy electrons, the GaAs sub-cell degrades faster under such type of radiation treatment. Many different particles with same energy have different damaging effect on I_{sc} and V_{oc} results in a transition of current limiting cell from the top to the middle cell which induces a rapid degradation in the short-circuit current. The radiation degradation behaviour and performance analysis of multi-junction solar cells in space has not same understood as single junction solar cells because of their degradation phenomena and complicated circuit. In this research work, an analytical approach of degradation predictions of multi-junctions GaInP/GaAs/Ge solar cells for a small satellite in LEO space environment has been proposed, incorporated and validated to investigate the performance, power generated, and the electrical behaviour of multi-junction solar cells.