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Author: Mr. AKASH DEEP K JAIN
SRM University, kattankulathur,chennai,INDIA, India, akashdeep.jn@gmail.com

Ms. divya agarwal
SRM University, kattankulathur,chennai, India, divyaagarwal2107@gmail.com

DESIGN OF EFFICIENT SOLAR CELLS FOR MAXIMUM POWER GENERATION

Abstract

Solar energy being the most convenient and effective source of energy available for the power generation in space, the solar cells finds a wide application in the spacecraft missions. The efficiency of the solar cell determines the effective power generated by capturing the incident sunlight. There are many types of solar cells available in the market. The efficiency of these solar cells is certainly low around 15%, thus more efficient solar cells are required to be considered. This thesis emphasizes for the design and development of the most efficient solar cells, which would increase the efficiency rate when compared to the conventional solar cells. Since 49% of sunlight lies in infrared range and about 7% in visible range hence use of materials, which effectively absorb these radiations, would increase the efficiency. Conventional triple junction solar cells are very effective to absorb the light in visible and near infrared region to generate electricity. Now by using 3dimensional projections of copper or manganese, which effectively absorb infrared radiation along with triple junction, cells would help to absorb almost 50% of incident sunlight range. Design of solar panel, which is divided to accommodate these solar cells and 3dimensional projections independently would help to absorb the more than half of the incident solar radiation and hence converting it into electricity. The 3 dimensional designs of these copper or manganese ejections provide wide angle as well as continuous light collection. This would also eliminate the requirement of sun tracking system. The 3dimensional design would also reduce the recombination loss providing more than one layer for the photons to get absorbed .The triple junction cells are made up of thin layer with variable band gaps such that the design spectrum will balance the current generation for the particular wavelength. Two independent connections are provided within these cells one corresponding to copper array and other to triple junction cells to avoid the complexity and are finally coupled at junction before the terminal of the battery to be charged. These would amplify the conversion mechanism of light energy in to electrical energy. Incorporating the existing maximum power point tracking (mppt) algorithm can further increase efficiency of solar cells giving rise to comparatively large and constant power output.