

Design and Manufacturing of High Concentration Reflected Photovoltaic Module

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Abstract

The task of this study is to find the optimal condition of designed High Concentration Reflected Photovoltaic (HCRPV) module by simulation method whose concentration ratio is set to be 872 and 78.5. This simulated optimal condition was then utilized to fabricate HCRPV module. From simulation results, the light collective efficiency, the energy uniformity, the shape of light spot diagrams can be obtained. It was found that square based pyramid light guide tube can effectively improve the uniformity of light on model A structure. When the slope angle of square based pyramid shape of light guide tube is set to be 3 degree, the focal length of the first mirror is 60mm and the secondary mirror vertex distance is designed to be 93.1mm, the HCRPV module have the best performance. It was also found that the light collective efficiency can be reached to about 97.7% with these conditions. On model B structure, the size was reduced to 9 times without light guide comparing to model A structure. It was also found that the light collective efficiency can also be reached to about 97.1%. The Aluminum HCRPV module was then fabricated according to the optimal simulated conditions. When the HCRPV module was coated with silver material, the voltage on the multi-junction solar cell was measured to be 2.7V and 2.68V, the current

was measured to be 2.83A and 0.63A corresponding to model A and B structures, as the solar energy of illumination is 800 W/m². The power is measured to about 7.64W and 1.7W corresponding to model A and B structures.

Keyword : High Concentration Reflected Photovoltaic (HCRPV), Light Guide Tube, Multi-junction