SPACE POWER SYMPOSIUM (C3)
Wireless Power Transmission Technologies, Experiments and Demonstrations (2)

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RESEARCH AND EXPERIMENT ON THE LASER WIRELESS POWER TRANSMISSION CHAIN

Abstract

Research and experiment on the laser wireless power transmission chain is reported. A laser wireless power transmission chain herein is consisted from the first solar cell, the laser, transmit/receive optics, and thesecond (receive) solar cell. The transmission efficiency of the chain is defined as dc-dc efficiency, it is the output power of the receive solar cell divided by the output power of the first solar cell. And the output power is calculated by the product of voltage and current of the first and second solar cells, respectively. In order to get the maximum transmission efficiency, large amount of investigations and experiments have been done. After investigation on the electrical-optical efficiency of commercial laser diodes, the fiber-coupled laser diode at 808nm is selected as the laser source. Theefficiency of different kinds of solar cell under the irradiance at different wavelength, different power density, and different temperature are tested and compared. The GaAs solar cell is selected after the comparison. In order to increase the efficiency of the GaAssolar cell, a special kind of the cell is designed. The design is a compromise after the consideration among the size of the laser beam, the filling-factor, and the efficiency under certain laser power density. Also, the transmit/receiveoptics system is an important factor influencing the transmission efficiency, which is designed and optimized. For the better use of the electricity from the second solar cell, the filling-factor is crucial. A new simple method of measuring the filling-factor is introduced, which can make the measurement automatic and time-saving.As the result of the research, 15% transmission efficiency for the laser wireless power transmission is obtained. Key words: wireless power transmission, laser, solar cell, filling-factor, transmission efficiency