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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 38190-2019

Test method for electron irradiation of aerospace solar cells

航天用太阳电池电子辐照试验方法

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009. This standard is proposed and managed by the National Aerospace Technology and its Application Standardization Technical Committee (SAC/TC425). This standard was drafted. Shanghai Space Power Research Institute, Xinjiang Institute of Physics and Technology. The main drafters of this standard. Yang Hongdong, Yang Guang, Jiang Depeng, Lei Gang, Lu Jianfeng, Guo Qi, Chen Guoling, Yan, Wang Zhibin, Fan Wei, Maria Henny, Tan Xueyan. Aerospace solar cell electron irradiation test method

1 Scope

China's national test method for ground simulated electron beam irradiation of aerospace solar cells. It specifies the equipment, the test and inspection items, and the procedure. A solar array in orbit degrades, and the dominant cause is radiation: electrons and protons trapped in the Earth's radiation belts pass through the cells and displace atoms in the semiconductor lattice, creating defects that shorten the carrier lifetime and reduce the current the cell delivers. That degradation determines the end-of-life power of the spacecraft, which is what the whole power budget and therefore the mission duration is designed around. Since nobody can wait fifteen years to find out, the cells are irradiated on the ground with an electron beam that delivers in hours the fluence they would receive in orbit over their life, and the resulting loss is measured. The method has to fix the energy, the fluence and the measurement conditions, because the answer depends on all three.

This standard specifies the equipment, test and test items, test and test for ground-based simulated electron beam irradiation test for aerospace solar cells. Procedures, trial interruptions and processing, reporting and recording. This standard applies to aerospace solar cells, including monocrystalline silicon solar cells, germanium-based single-junction gallium arsenide solar cells, germanium-based triple-junction gallium arsenide Electron irradiation of solar cells, flip-chip triple-arsenide solar cells, flip-chip four-junction gallium arsenide solar cells, and other types of space solar cells test.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only dated versions apply to this article. Pieces. For undated references, the latest edition (including all amendments) applies to this document.

GB/T 2297-1989 Solar photovoltaic energy system terminology

GB/T 6494 Aerospace solar cell electrical performance test method

GB/T 6495.4 Temperature and irradiance correction method for IV measured characteristics of crystalline silicon photovoltaic devices

GB/T 6495.9-2006 Photovoltaic devices - Part 9. Performance requirements for solar simulators

GB/T 6496-2017 Aerospace solar cell calibration method

ISO 15387 Space System Single Junction Solar Cell Measurement and Calibration Procedure (Spacesystems-Single-junctionsolar cels-Measurementsandcalibrationprocedures)

3 Terms and definitions

The following terms and definitions as defined in GB/T 2297-1989 apply to this document.

3.1 Flux rate The number of particles passing through the unit area per unit time.

Note. The unit is electrons per square centimeter second [e/(cm2·s)].

3.2 Fluence The number of particles injected per unit area over a period of time.

Note 1. The unit is electron per square centimeter (e/cm2).

Note 2. It can also be regarded as the integral of the fluence rate with time.

4 Test purposes

Through the electronic radiation test of aerospace solar cells, the ground unit simulation test data is provided for the user unit, and the aerospace solar cell is evaluated. Adaptability in a space-charged particle irradiation environment.