Paper ID: 17061
poster

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Poster Session (P)

Author: Dr. Xin Gao
Lanzhou Institute of Physics, China

Dr. Shengsheng Yang
Lanzhou Institute of Physics, China

# EVALUATION OF PREDICTION OF INGAP2/GAAS/GE SOLAR CELL PERFORMANCE IN SPACE RADIATION ENVIRONMENT

**Abstract**

The space radiation environment is mainly composed of electrons, protons or their combinations. Exposure to these charged particles typically degrades the electrical performance of semiconductor devices, especially less-shielded space solar array, thus limiting the lifetime of the solar array. Therefore, to be used in space, understanding the radiation response of solar cell is extremely important for accurate predictions of the expected mission lifetime. With the rapid development of new solar cell types, satellite designers need to continually qualify new cell technologies or new generations of existing technologies for the use of these solar cells in space. The effects of GEO (Altitude 35,870km, inclination 0), MEO (Altitude21,500km, inclination 55) and LEO (Altitude 799km, inclination 99) radiation environments on the degradation of a new type InGaP2/GaAs/Ge triple-junction GaAs cells (Manufactured in China) are investigated to provide the reference for solar array design. The on-ground irradiation experiments were performed to evaluate radiation effects of electrons and protons on these solar cells, and also to provide experimental data for predictions of the cell performances under the space radiation environments. For this cell type current-voltage (I-V) characteristics were obtained as a function of radiation fluence using electrons (1.0, 1.5 and 2.0 MeV) and protons (3.0, 5.0, 10.0 and 15 MeV). Illuminated I-V characteristics of each sample were measured both before and after irradiation using a Spectrolab X-25 solar simulator under AM0 condition (air mass zero, 1sun, 25C conditions). The prediction results of the performance degradations of the triple-junction GaAs cells are presented as a function of cell material, cover glass and backplane shielding, and the system orbit and lifetime in the space radiation environments, using the displacement damage dose methodology for analyzing and modeling. This study provides reference data for the design of the triple-junction GaAs solar cell in the typical space environments to ensure the security and reliability of on-orbit spacecrafts.