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Predicting, testing, and measuring the effects of the space environment on space missions (3)

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EFFECTS OF LONG-TERM STORAGE ON PROPERTIES OF PEROVSKITE SOLAR CELLS

Abstract

JAXA is developing the Space solar cell Demonstration instrument on HTV-X (SDX) to reveal the space environment tolerance of next-generation solar cells. One of the next-generation solar cells mounted on SDX is a perovskite solar cell (PSC), which has the potential of high specific power and radiation tolerance. To analyze the characteristics of PSCs on orbit, it is necessary to clarify the long-term stability because SDX will be stored in a nitrogen before launch and exposed to vacuum after launch for 6 months, respectively. Therefore, we conducted two types of storage tests using PSCs with encapsulant. One was in nitrogen, simulating the pre-launch environment, and the other was in a low-pressure atmosphere, simulating the post-launch environment. Light current-voltage (I-V) characteristics, dark I-V characteristics, and external quantum efficiency (EQE) were measured before and after storage. The short-circuit current (Isc) and open-circuit voltage (Voc) of PSCs did not change after storage. However, the maximum power point (Pmax) decreased slightly (less than 10 %) due to the decrease in the fill factor. Although the shunt resistance seems to decrease in the light I-V characteristics, it did not change in the dark I-V characteristics. Since the bias voltage dependence of the EQE changed before and after storage, it is thought that the voltage dependence of the photo-carrier collection efficiency changed due to the long-term storage. To analyze the SDX on-orbit data in detail, we need to understand the influences of storage.