Effects of Space-Relevant Electron Radiation on Industry-Grade CdSeTe/CdTe Devices

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Abstract:

The potential for high specific power and defect tolerance in thin-film CdSeTe (CST) solar cells make them promising materials for space-based photovoltaics. CdTe-based modules hold the lowest degradation rate (0.3%/yr) among commercialized absorber technologies and are second only to silicon in global installed capacity. While CST is mature, robust, and industrialized, there have been few tests of its resilience to space stressors. In this work, we examine the effects of high-energy electrons on industry-grade CST cells at several space-relevant fluences. As-doped and Cu-doped CST devices were provided by First Solar, Inc. for irradiation. Utilizing an electron beam facility at the National Institute of Standards and Technology, several samples of each type were exposed to 1 MeV and 2.3 MeV electrons at total fluences of 10^{13}, 10^{14}, and 10^{15} e^-/cm^2. This variety of irradiation conditions closely follows the American Institute of Aeronautics and Astronautics (AIAA) S-111A-2014 standard for space solar cell testing and allows for remaining factor analysis by the displacement damage dose (DDD) method. Current density vs. voltage response, external quantum efficiency, and other key performance metrics will be discussed herein, along with end-of-life predictions from the DDD method. Overall, the standard CST:Cu cells proved more efficient and resistant to electron damage than the more experimental CST:As.

Conflicts of Interest

There are no conflicts of interest.

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