IAF SPACE POWER SYMPOSIUM (C3)
Space Power System for Ambitious Missions (4)

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DEVELOPMENT AND PROSPECTS FOR THE SPACE APPLICATION OF CDTE THIN FILM SOLAR CELL TECHNOLOGY

Abstract

The increasing power demands of spacecraft payloads, the prospect of space based solar photovoltaic power stations, and the renewed interest in lunar and planetary outposts, means that there is an emerging requirement for large area solar arrays that will provide far greater power (kWpeak) than is currently available. To be practical, such arrays will need to use solar cells which have a much higher specific power and a much lower cost per watt than current space-rated solar PV technologies. To this end, the Centre for Solar Energy Research (CSER) at Swansea University, the Surrey Space Centre (SSC) and the Department for Mechanical Sciences at the University of Surrey, have been working on a new solar cell technology, based on thin film cadmium telluride (CdTe), deposited directly onto ultra-thin

space-qualified cover glass. This offers a potentially high specific power, low-cost technology with the added benefit of allowing a high degree of solar array flexibility for improved stowage volume and novel deployment strategies. Cells based on this innovative solar cell architecture were manufactured and tested under a three year UK Engineering and Physical Science Research Council (EPSRC) funded project. An extensive programme of ground based testing showed that the cells were mechanically robust and consistent in performance. Radiation testing with proton and electron beams showed that the technology would be remarkably resilient to the effects of space radiation. In 2016, four test cells were flown on the joint Algerian Space Agency – UK Space Agency AlSat-1N Technology Demonstration CubeSat. Analysis of their in-flight performance, through automatic recording of their current-voltage (I-V) curves, shows that the cells are operating well in low-Earth orbit. This paper describes this new thin film solar cell technology, the results of ground testing, and the measured in-orbit performance of the test cells. It also describes the steps planned to move to production of large area cells, and how these would be applied to advanced space missions.