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DEVELOPMENT AND TEST OF LOW COST SOLAR PANEL TECHNOLOGIES FOR SMALL
SATELLITES

Abstract

Solar panels for power generation in space are quite expensive and even small improvements in the development, production and qualification process may result in significant savings for low cost small satellites. This paper presents the activities carried out in collaboration between the University of Pisa and Alta SpA for the development, testing and integration of an efficient, yet unexpensive photovoltaic panel for microsatellite applications.

The approach adopted, aimed at reducing cost and developing “low tech” techniques to assembly and qualify solar panel for small satellite applications, uses a printed circuit board designed to optimize the use of surface partially occupied for power generation, where bare cells are installed by means of a double-sided insulating adhesive tape and each cell is covered with cerium doped borosilicate glass, using a controlled volatility silicone. Bonding was performed with a dedicated vacuum bag technique, developed in-house. This method achieves a significant cost reduction with respect to traditional techniques, while retaining high performance and reliable repeatability and avoiding complex technological procedures during the integration.

A prototype solar panel was manufactured, tested and integrated on the UniSat-5 small spacecraft by GAUSS Srl in preparation of a flight scheduled for early 2013. Thorough mechanical testing was performed as a part of the integration with UniSat-5. The panels manufactured during the development programme were subject to electrical characterization to evaluate the current-voltage characteristic curve and the efficiency of the array and to thermal vacuum tests according to ECSS standards to estimate the outgassing properties of the protoflight model. For both, a low cost experimental setup was developed on purpose. The recorded flight unit total mass loss (TML) is well under the acceptable limits, so that the panel was accepted for space flight. In-orbit validation of the panel is expected with the upcoming flight of UniSat-5 in space. The techniques and procedures developed under this programme allow for quick and inexpensive manufacture of reliable solar arrays, specially suited for micro-and nano-satellites.