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ANALYSIS OF FLEXIBLE SOLAR ARRAY INTEGRATION TECHNOLOGY

Abstract

Photovoltaic (PV) arrays are the primary sources of electrical power for satellites and spacecrafts. Globally, rigid solar arrays are widely used in the space shuttles and satellites. While, limited by the huge volume and heavy weight, traditional rigid solar arrays could not meet the ever-increasing demand for higher power generation capacity. On the contrary, lightweight flexible solar array technology could, for some missions, provide higher specific power than traditional solar arrays. Therefore, flexible solar array technology has gradually become a mainstream trend of space station development and application. In China, the rigid solar arrays technology has maturely used in aircraft and satellites, however, the research of flexible solar arrays technology is just at the beginning. Thus, the developing of flexible solar array integration technology was high on the agenda which brooks no delay. The development of flexible solar array integration technology was closely related to the circuit designing of high voltage flexible solar array and its assembly technology. In order to meet higher specific power circuit demanding, multi-layers flexible solar panel is designed with the thickness of less than 0.5mm. The total weight of power generating system is significantly reduced than that of rigid solar arrays. The tensile strength and stiffness of solar panel are key elements to be considered in designing. Carbon fiber is an ideal material to solve the problem of low tensile strengths among most flexible materials. The multi-layer carbon fiber structure provides enough stiffness to protect the solar cell. A high voltage circuit is designed, which is beneficial to high power translation. Another core difficulty is solar array assembly technology, especially for the circuit welding and mounting solar cells to the panels. On the one hand, the circuit welding quality and reliability directly bear on the success or failure of satellite or space shuttle. The application of welding module will increase the stability and consistency of solar array system, this module could make the average intensity of the welded spot up to 0.83N/mm². On the other hand, thinner solar circuit improves layout flatness and bending adaptation. Above research on the core technologies of flexible solar array integration will fill in the blanks and make positive contribution to the development of China's aerospace industry.