NASA TECH BRIEF

NASA Pasadena Office

Facility for Testing Solar Cells

A test facility has been developed for evaluating the performance characteristics of solar cells over a temperature range of −180° to +200°C in vacuum or in a gas. Primary components of the facility are a test chamber and an external solar simulator. The test chamber is 33 cm high and 38 cm in diameter; light from the solar simulator passes through a 20-cm circular quartz window in a wall of the test chamber. Tests at temperatures below 10°C are conducted in a vacuum or in an atmosphere of dry nitrogen to prevent condensation of water vapor on the surfaces of the solar cells.

The solar cells are mounted within the chamber on a block of copper which acts as a heat sink; the block is bored to provide channels for the circulation of liquid nitrogen and to form compartments between the channels for cartridge-type heaters. Eight thermocouples are set in position on the block; six are situated so as to indicate temperature gradients within the block and two are used to indicate the temperature of the solar cells. Temperatures are monitored continuously to ensure proper control of the set-point temperature and to ensure that thermal changes do not exceed 5°C per minute.

A calibrated intensity-standard cell and a color ratio detector are located in the chamber over the copper block; these devices are isolated thermally and electrically from the copper block and are maintained at a constant temperature by a thermoelectric module which is mounted on a separate, water-cooled heat sink.

The solar simulator is a close-filtered xenon system; intensities in the range of 5 to 300 mW/cm² are obtained by interposing neutral density filters in the light path and by varying the distance from the source to the test chamber. The uniformity of light intensity over the test area is within ±2%. The color ratio detector assures that the spectral quality of the solar simulator is constant for all temperature tests of the electrical performance of solar cells.

The voltage–current performance characteristics of solar cells at various combinations of temperature and light intensity are plotted on an X-Y recorder. Data from the plots are fed into a computer for calculation of maximum power, curve shape factor, cell efficiency, and the averages of each of the parameters.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP74-10099

Patent status:

NASA has decided not to apply for a patent.

Source: Robert K. Yasui of
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under contract to
(NPO-11761)

Category 02