

Tj.tie: DEVELOPMENT OF THERMOPHOTOVOLTAIC ARRAY TESTING  
CAPABILITIES

Authors: James J. Lin Phone: (818) 354-2190  
Dale R. Burger FAX : (818) 393-4172  
Robert L. Mueller Mail. Stn: 303-308

Jet Propulsion Laboratory  
California Institute of Technology  
4800 Oak Grove Dr.  
Pasadena, CA 91109

ABSTRACT

The present Jet Propulsion Laboratory (JPL) characterization test method for a single thermophotovoltaic (TPV) cell is to illuminate the cell with black body emission. However, this method is inadequate for the performance testing of a string or an array of cells. This is simply because the black body aperture is too small to uniformly illuminate much more than a single, small cell.

Alternative light sources for TPV string or array testing would be to use a large area grey body, a diffused high power laser, a high power lamp array, or the Large Area Pulsed Solar Simulator (LAPSS). These methods are analyzed and compared. Conclusions are drawn concerning the needs and methods of TPV string and array testing.

The large area grey body source was found to need more development toward larger sizes. The color temperature of this source is limited and a cooling system is required for the test devices. The diffused high power laser source was found to be expensive and power limited. This source would require a special optical system to achieve uniform illumination and also requires a cooling system for the test devices. The high power lamp array source was found to need some development, and it would require cooling systems for the lamps and the test devices. The LAPSS was found to be a feasible light source. It required very little development funds and did not heat the test article. In the near term it was decided to use the LAPSS as the TPV light source.

A preliminary technique using the LAPSS with an infrared bandpass filter was developed for high power ( $8 \text{ W/cm}^2$ ) TPV testing purposes. Initial results indicate that this system is applicable to single cell, string and array testing of TPV cells because of its high emission power density and well matched emission spectrum. Tests and analyses were performed to establish test plane intensity and uniformity versus test device distance from the lamps. In addition, tests and analyses were performed to determine the spectral transmission characteristics of various infrared bandpass filter combinations. The LAPSS, with the infrared bandpass filter, is now operational. at JPL for TE'V cell, string and array testing.