Thermophotovoltaic cell structure

What is a thermophotovoltaic system?

A basic thermophotovoltaic system consists of a hot object emitting thermal radiation and a photovoltaic cell similar to a solar cell but tuned to the spectrum being emitted from the hot object. As TPV systems generally work at lower temperatures than solar cells, their efficiencies tend to be low.

What is a thermophotovoltaic (TPV) cell?

Fig. 1. (A) Schematic diagram of a thermophotovoltaic (TPV) device,where the radiator is made of a high temperature resistant material,and the cell is made of a p-n junction diode. Heat is added to the radiator from an external source,and a cooling loop keep the cell at near room temperature.

What is thermophotovoltaic energy conversion?

Thermophotovoltaic (TPV) energy conversion is a direct conversion process from heat to electricity via photons. A basic thermophotovoltaic system consists of a hot object emitting thermal radiation and a photovoltaic cell similar to a solar cell but tuned to the spectrum being emitted from the hot object.

How do Thermophotovoltaic cells generate electricity?

Thermophotovoltaic (TPV) cells generate electricity by converting infrared radiation emitted by a hot thermal source. Air-bridge TPVs have demonstrated enhanced power conversion efficiencies by recuperating a large amount of power carried by below-band-gap (out-of-band) photons.

Are thermophotovoltaics the future of energy storage?

Thermophotovoltaics (TPVs) have the potential to enable a wide array of critical energy technologies,including a new generation of power-to-heat-to-power systems for inexpensive multi-day energy storage known as thermal batteries.

What is a solar/thermophotovoltaic device?

The solar/thermophotovoltaic approach can be a single solution for many problems arising from direct exposure of semiconductor components. In a solar-thermophotovoltaic device,a perfect absorber designed for broad absorption of solar radiationcan be used to heat an intermediate layer to elevated temperatures.

The influence of angle of incidence on performance of GaSb TPV cell with the three structures was studied comparatively, for two polarization modes, TE and TM. For DLARC and MLARC configurations, the obtained results show that the incidence angle of strongly affects the antireflection properties beyond 30º. Thus, the incidence angle was fixed at 30°, value for ...

performance and scalable cell designs. Here, we demonstrate record-efficiency single-junction thermophotovoltaic cells with large areas and a relatively simple structure that can be readily transferred to commercial epitaxial manufacturing processes. By optimizing the electrical and optical characteristics of our

cells, the cells can operate ...

Une cellule thermophotovoltaïque est une cellule photovoltaïque optimisée pour la conversion en électricité d"un rayonnement électromagnétique infrarouge.

The current study aims to address this challenge by constructing an optical-thermal-electric coupled conversion model of a single thermophotovoltaic (TPV) cell under high-intensity laser beam radiation. The primary connection parameter in the coupling model is a spectral response (SR). Therefore, the SR experimental platform has been ...

The mechanism and structure of a TPV cell are similar to that of a solar PV cell, except for the requirement of a much lower energy bandgap. The solar irradiation, approximated as a blackbody at 5800 K, has 75% of its spectrum above the energy threshold of 1.1 eV, which is the bandgap of a typical silicon-based PV cell [8, 15].

A Review on Thermophotovoltaic Cell and Its Applications in Energy Conversion: Issues and Recommendations ... The early GaSb photovoltaic cell structure that is sensitive to the photons in the infrared region up to 1.8 µm was invented and patented in 1988 by McLeod et al. (see US 4,776,893 patent) and Fraas et al. (see US 5096505 and US 5091,018 ...

This work demonstrates >40% thermophotovoltaic (TPV) efficiency over a wide range of heat source temperatures using single-junction TPV cells. The improved performance is achieved using an air-bridge design to recover below-band-gap photons along with high-quality materials and an optimized band gap to maximize carrier utilization. The versatility of the heat ...

Thermophotovoltaic (TPV) technology harvests electricity from a source of thermal radiation and at current, TPV cells can achieve conversion efficiency of more than 40%. The construct of the TPV system is relatively complex than the conventional solar cell in which the TPV has two critical components, specifically the absorber-emitter and ...

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