

Analysis and optimization of $\text{In}_{1-x}\text{Ga}_x\text{As}_y\text{Sb}_{1-y}$ thermophotovoltaic cells under low radiator temperatures

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Abstract: In this paper, we investigated the heat to electricity conversion efficiency of $\text{In}_{1-x}\text{Ga}_x\text{As}_y\text{Sb}_{1-y}$ radioisotope thermophotovoltaic (RTPV) converter with $x=0.8$ and $y=0.18$, taking account of the photons with energy below the cells bandgap using a comprehensive analytical process. This was done with a computer program designed for this reason, which allowed the computation of the cell performance under a variety of specified incident radiation spectra as well as a variety of material parameters. The results show that for an emissivity value of 0.78, a cell thickness of about $7\mu\text{m}$ with low front recombination velocity (700cm/s), a conversion efficiency greater than 29% can be obtained for radiator's temperature of 1300°K at ambient temperature. This efficiency will decrease as the cell temperature increase.

Keywords : Radioisotope, Emissivity, Recombination Velocity, Efficiency, Temperature