RADIATIVE TRANSFER IN THERMOPHOTOVOLTAICS FILTERS

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ABSTRACT. A typical thermophotovolatics (TPV) system consists of a heat source, an emitter (radiator) and photovoltaic (PV) cells. The primary heat sources for TPV are chemical, solar (fusion), nuclear fission energy or waste heat from industry high-temperature processes. Some TPV systems use a spectrally selective filter between the emitter and the PV cells. This helps achieve higher efficiencies and electrical power density for TPV conversion when spectral control limitations are included. The filter may present other advantages such as protection of metal emitters from oxidation and PV cells from combustion products. In this paper we analyze radiative transfer and predict transmission of radiation through a spectral filter made of fused silica ($\mathrm{SiO_2}$). The effects of the spectral emission (i.e., emitter selectivity and temperature) and thickness of the filter are examined to suppress out-of-band radiation ($\lambda \geq 2\ \mu\mathrm{m}$) and to achieve improved TPV conversion efficiency. The TPV system (emitter, filter and diode) must be developed and designed from a system perspective.