Popular abstract

The conversion of sunlight suffers in a conventional solar cell suffers from a fundamental limitation to its efficiency, which is caused by the broad range of wavelengths (colours) contained in the light emitted by the sun. In the field of thermophotovoltaics (TPV), one aims to address this issue by replacing the sun with a hot, man-made surface, a so-called thermal emitter. Since the thermal emitter can be chosen freely, inefficiencies associated with the spectrum (colour content) of sunlight can now be overcome by appropriate design of the emitter. Moreover, TPV can be used to increase the efficiency of high-temperature processes when it is used to convert waste heat from e.g. a gas-fired water boiler.

However, for efficient TPV operation, it is necessary for the emitter to have excellent thermal stability as well as satisfy certain requirements to its optical properties. These requirements can be met with careful engineering of the optical properties of the emitter. This PhD project presents resonant surface structures fabricated with materials with high thermal stability, which can either absorb and retain heat from the efficiently, or give off radiation with wavelength suitable for the efficient illumination of a solar cell. Results obtained through the project are demonstrates results with a TPV prototype.