

Experimental determination of radiative properties for modelling radiation heat transfer in semi-transparent materials

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To be effective, models used in analysing radiation heat transfer of solar energy through layers of semi-transparent materials require knowledge of adequate radiative properties as input parameters. In this context, the work presented aims at experimentally determining the average extinction coefficient, scattering albedo and scattering phase function for quasi-homogeneous material behaviour. Therefore a beam of near monochromatic radiation is directed onto a sample and the distribution of radiative intensity exiting the sample measured with a detector. The radiative properties are then extracted by fitting a theoretical model to the experimental data. In a first step the setup was applied to determine the extinction coefficient of reticulate porous ceramics used in solar steam reforming of methane in the spectral range of 0.3 – 4 μm . The agreement of the resulting extinction coefficient of 230 m^{-1} with the value determined using a tomography based method was within 10%. In a second step the setup was extended to measurements on packed beds of CaCO_3 . As expected and shown by initial measurement results, the strong multiple scattering behaviour of this material poses a more complex mathematical problem. Data extraction will therefore be pursued with a Monte Carlo based modelling approach.