RADIATIVE COOLING OF A SILICA FIBERS NETWORK

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ABSTRACT. Radiative cooling makes it possible to cool a surface to a temperature which is lower than the ambient temperature under direct solar incidence. This is achieved by high reflectance at solar spectrum and high emittance at transparent window spectrum of the atmosphere. In the literature, there are various numerical and experimental studies about radiative cooling in which the surfaces that are designed in various ways such as layered, structured and pigmented coatings. Current study incorporates fibers of amorphous SiO_2 as the radiative cooling material which are also commonly used for thermal insulation. Fibers modeled as cylinder, their absorbing and scattering behavior is calculated using Mie Theory and corresponding parameters are used to solve Radiative Transfer Equation by Monte Carlo method. Using fiber network removes the necessity to use binder, which results an increase in scattering due to increasing difference of refractive indices of medium and SiO_2. Results show that the cost-effective coating performs efficiently for both reflecting at solar spectrum and emitting at infrared spectrum as it could be seen from Fig-1. The presented spectral emittance of the coating is for 300nm radius fibers at 4% volumetric concentration and 1 cm coating thickness applied on ideal black substrate.

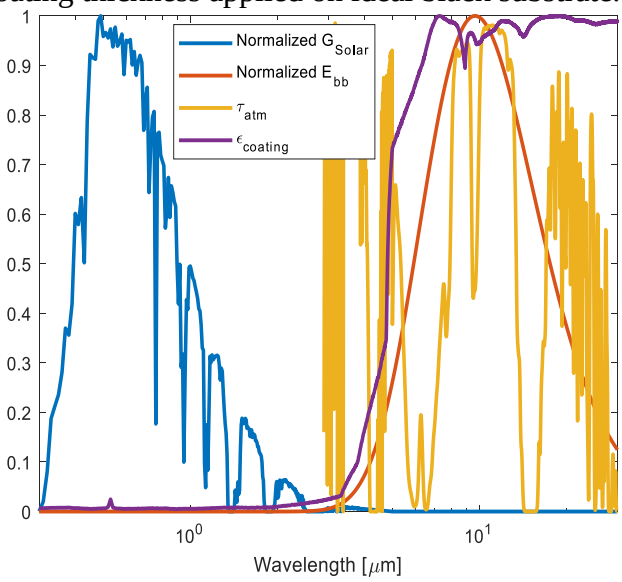

Figure 1 – Spectral emittance, atmospheric transmittance, normalized solar and blackbody intensities.

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