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IMPACT OF THE EXTINCTION BEHAVIOUR OF SIC LATTICES ON THEIR CONDUCTIVE-RADIATIVE HEAT TRANSFERS

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ABSTRACT

Refractory architected ceramics constitute a class of highly porous media which gains in importance for enginnering high-temperatures applications. From a thermal modelling viewpoint, one of the main challenges, is to finely describe the transport of thermal radiation which plays a major role in the dtermination of their thermal performances. Such a consideration is today crucial for developing topology optimization processes in order to define the best 3D geometries for a given set of objectives. To conduct these methodologies, it is important to quickly solve the radiative transfer equation at the continuous scale while taking into account as accurately as possible the meso-texture desbribing the 3D solid network. This goes back to assume that the physical statements governing this equation are valid, the porous architectures having to behave as an equivalent Beerian medium. However, when non Beerian behaviour is highlighted, the latter framework needs to be revised. To go one step further with this issue, numerical 3D geometries with a regular arrangement of cubic cells are generated with an homemade software. The analysis of their extinction cumulative distribution function curves obtained with the Radiative Distribution Function Identification method allows us to check whether or not the attenuated thermal radiation follows a Beerian behaviour. The effects of the textural parameters will then be discussed. Finally, preliminary practical considerations will be given for describing their conductive radiative behaviour when they are enclosed between a hot and a cold plate through both a continuous and the discrete scale methodologies, using a stabilized vectorial Finite Element Method solver.

KEY WORDS: Cellular lattices, Radiative Distribution Function Identification, non Beerian behaviour, conduction-radiation coupling.

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