RADIATIVE PROPERTIES OF STATISTICALLY ANISOTROPIC NON BEERIAN POROUS MEDIA; GENERALIZED RADIATIVE TRANSFER EQUATION AND APPLICATIONS.

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ABSTRACT

The homogenized phases associated with statistically anisotropic porous media, often encountered in applications at high temperature, generally present two specific radiative properties: they do not follow Beer's laws, related to extinction, absorption and scattering and are characterized by an effective refractive index, depending on the propagation direction. Their radiative properties are also exhaustively characterized by an extinction cumulative distribution function, an absorption or a scattering cumulative probability and a general phase function, depending on both the incidence and scattering directions.

Consequently, a specific Generalized Radiative Transfer Equation (GRTE), expressed in function of the previous statistical functions, has been established. It can been solved by a Monte Carlo technique. The cases of porous media with two phases, transparent and opaque, semi transparent and opaque or semi transparent, at local scale, are considered.

The GRTE associated with a homogenized phase, optically thick at a local scale, degenerates into a classical RTE. A radiative conductivity tensor is then derived from the previous model, by a perturbation approach similar to the one of the Chapmann-Enskog's model. An accurate validity criterion of this radiative diffusion model has also been established.