Tomography-based determination of radiative properties of two phase media with a semitransparent phase

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Calculations of the radiative properties of a $CaCO_3$ backed bed based on measured geometry are presented. These results will be useful for several calculations and experiments where radiative properties of a $CaCO_3$ packed bed are needed.

Extinction, absorption, and scatteringcoefficient as well as the scattering phase function are determined. The 3D geometry is obtained by tomographic measurements of the medium. Characterization of the geometry is presented. A Monte Carlo ray tracing technique is implemented to determine the properties of the two phase medium composed of a transparent and semitransparent phase. Parameter uncertainties of the single $CaCO_3$ phase are studied. Also numerical independency studies are mentioned to show the accuracy of the proposed method. Results are applied to different averaging models to find the radiative properties for an equivalent averaged medium. Additional the technique is applied to artificially generated media made of either identical overlapping semitransparent spheres in a non-participating medium or spherical shaped non-participating medium surrounded of semitransparent medium. The purpose of this application is a better understanding of the medium structure's influences on the radiative properties. Further comparisons to earlier obtained results for two phase media composed of an opaque and transparent phase are made.