NUMERICAL INVESTIGATION OF THE EFFECT OF AGGREGATION ON THE PHASE FUNCTION AND SCATTERING COEFFICIENT OF SOOT IN THE INFRARED REGION

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ABSTRACT In the present study the effect of aggregation on soot radiative properties is investigated emphasizing the infrared region of the spectrum. The numerical study was performed quantitatively using an approximate, but powerful, theory (Rayleigh-Debye-Gans theory for fractal aggregates — RDG-FA). In order to use the RDG-FA theory for a wide range of aggregate sizes and wavelengths, an evaluation of its potentialities was performed. RDG-FA results concerning phase functions, scattering and absorption coefficients were compared with a more exact theory (integral equation formulation for scattering — IEFS). The results show that the scattering and aggregation of primary particles can be ignored for small aggregates formed with small primary particles. Aggregation becomes important for large aggregates with primary particle size parameters approaching 0.1, contributing to an increase in the scattering cross sections. The RDG-FA theory emerges as a good compromise between accuracy and modelling simplicity for large aggregates optical properties.