ELS-XV-2015 Abstracts
ELS-XV-2015-153
Electromagnetic & Light Scattering XV 2015, Leipzig

Transmission of dense layers of dielectric spheres

P. Born (1), K. Holldack (2), and M. Sperl (1)

(1) Institut für Materialphysik im Weltraum, Deutsches Zentrum für Luft- und Raumfahrt e.V., 51170 Cologne, Germany, (2) Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Albert-Einstein-Str. 15, 12489 Berlin, Germany

Media with dense packing of dielectric scatterers are common in nature. Sand heaps, regolith sediments, insect scales, bird feather barbs or colloidal photonic glasses are examples of densely packed particulate media. The influence of the arrangement of the particles as well as the near-field interactions in such media have to be described properly to predict the optical properties of such media or to characterize the primary particles and the packing by remote methods. Here we aim at validating present models relating packing structure and extinction by dense particulate media. We investigate the optical properties of dense layers of macroscopic polymeric particles in the THz spectral range. As such, we can investigate structural and near-field effects on the transmission spectra by controlling individual particle spacing and arrangements. Broad-band measurements allow for measurements from the Rayleigh-regime with size parameters below unity to the regime of the Mie-resonances and size parameters of 20.

Dense packings of hard spheres exhibit a high local correlation of particle packings. We find that the high local correlation produces additional resonances in the extinction spectra. We also compare our measurements to heuristic models, which predict that near-field interactions in dense particulate media are describable by a wavelength-dependent effective background medium, and to simulations of wave propagation in particulate media. Finally, we discuss the possibility to characterize the structure of particulate media from such measurements.