EGU21-2115, updated on 05 Dec 2022
https://doi.org/10.5194/egusphere-egu21-2115
EGU General Assembly 2021

Optical properties of Gobi dust and its pure compounds: experimental extinction spectra and complex refractive indices determination.

Lise Deschutter[1,2], Hervé Herbin[2], and Denis Petitprez[1]
[1]Univ. Lille, CNRS, UMR 8522 - PC2A - Physicochimie des Processus de Combustion et de l'Atmosphère, F-59000 Lille, France (lise.deschutter@univ-lille.fr)
[2]Univ. Lille, CNRS, UMR 8518 - LOA - Laboratoire d'Optique Atmosphérique, F-59000 Lille, France

Spectrometers are powerful instruments to detect atmospheric aerosols, especially on satellites since they allow measurements at a global scale and over different spectral ranges with high spectral resolution. However, to fully exploit their capabilities and to link optical properties, chemical composition and mass concentration, it is essential to have reference optical properties of various particles and mainly the complex refractive indices (CRI). The CRI of a natural aerosol source can be determined from a real sample of it or applying the effective medium approximation using the CRI of the pure compounds present in the natural sample. But in that case, it is necessary to know the mass fraction of each individual compound and above all their CRI. Nevertheless, the literature and CRI databases provide only reflectance measurements on bulk materials or pressed pellets and over a limited wavelength range (Querry *et al.*, 1987).

In the present work, dust from the Gobi desert is studied as it is the second most active dust source, after the Sahara desert, in terms of mass emissions (Querol *et al.*, 2019). For that extinction spectra have been recorded for natural Gobi dust sample and for its major compounds (Illite, Calcite and Quartz). Particles as a powder in a vessel are generated thanks to a magnetic stirring and a flow of nitrogen (Hubert *et al.*, 2017). The continuous flow of aerosols is directed into a 10-meters multipass cell fitted to a Fourier transform infrared spectrometer and a 1-meter singlepass cell within a UV-Visible spectrometer which cover a continuous spectral range from 650 cm^{-1} to 40000 cm^{-1}. Moreover, at the exit of the spectrometers the size distribution is recorded by an aerodynamic particle sizer and a scanning mobility particle sizer which allow to measure size particles from 14 nm to 20 µm. An inversion algorithm is carried out using experimental extinction spectra and the size distribution as input data (Herbin *et al.*, 2017). Applying the Mie theory and the single subtractive Kramers-Kröning integral, the real and the imaginary part of the CRI are retrieved at each wavelength with an optimal estimation method.

For the first time, CRI of Illite has been retrieved with a high spectral resolution (1 cm^{-1}) and over a wide spectral range for suspended particles. For calcite and quartz particles, the crystalline phase has to be considered by introducing the ordinary and extraordinary indices. These pure compound sets of CRI will be used for testing effective medium approximation on Gobi dust for

which effective CRI have been also retrieved.