

## ***Interactive comment on “Optical properties and mineralogical composition of different Saharan mineral dust samples: a laboratory study” by C. Linke et al.***

**C. Linke et al.**

Received and published: 7 July 2006

Answer to the comments of Referee 1:

We acknowledge the comments and suggestions for an improvement of the paper.

Specific comments

1. Section 2.1: We agree with the reviewer, that this section may be improved by an extended description of sample dispersion and the size ranges investigated in the chamber. We will also add a figure (Figure 2) showing the measured APS size distributions of the four dispersed dust samples (sampled from the chamber). From the figure it becomes clear that our APS measurements only cover particles behind the impactor

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with a cut-off of 1.2  $\mu\text{m}$  aerodynamic diameter. We added the following paragraph to Section 2.1:

“Both the brush disperser and the dispersion nozzle were operated with dry and particle-free synthetic air. The dispersion pressure of the nozzle was 1.5 bar. The impactor stages with a cut-off  $d_{(50)}$  of 1.2  $\mu\text{m}$  (aerodynamic diameter) limited the size range of particles entering the NAUA chamber. Thus particle losses by sedimentation in the horizontal sampling lines and the long horizontal flow tube of LOPES were minimised resulting in a low systematic error of less than 5 % in the deduced specific optical cross sections.”

2. The uncertainties of the PA measurements were inserted in section 2.1 at the passage:

“Taking this Angström exponent the absorption at  $\lambda=1064$  nm was calculated by extrapolation. The uncertainty in the calibration was determined to be  $\pm 2$  % for all three wavelengths.”

and, at the end of the subsequent paragraph:

“The detection limit of the PA system was determined to be  $10^{-5}$  ( $\text{m}^{-1}$ ). The overall uncertainty of the PA measurements is about 5 % for our aerosol concentrations.”

3. This question is likely motivated by the laser-induced incandescence technique. In this technique soot particles are exposed to high laser fluences of more than  $0.1 \text{ J/cm}^2$  which indeed lead to a strong heating of the particles of up to 4000 K. Vander Wal et al. (1998) investigated the fluence-dependent structural changes and fragmentation of soot particles by electron microscopy. They observed changes for fluences above  $0.1 \text{ J/cm}^2$  which corresponds to peak soot temperatures above 3000 K (De Iuliis et al., 2006). In our set-up the IR cell has a fluence of about  $0.005 \text{ J/cm}^2$  - 20 times less than the fluence required to initiate an observable structural change. We estimated the soot temperature after the absorption of one IR laser pulse to be a few hundred  $^{\circ}\text{C}$ , a temperature increase which is far to low to initiate any structural changes or fragmentations.

Vander Wal et al., Optical and microscopy investigations of soot structure alterations by laser-induced incandescence, Appl. Phys. B, 67, 115-123, 1998

De Iuliis et al, Peak soot temperature in laser-induced incandescence measurements, Appl. Phys. B, 83, 397-402, 2006

4. Yes, we think that uncertainties exist for the hematite and goethite contents of the samples analysed by XRD. Especially an enrichment of hematite in the fine aerosol fraction is possible as already mentioned by the referee. Therefore, we added the following sentence to the end of section 4:

“However, due to a possible enrichment of hematite in the fine aerosol fraction the hematite concentration in the chamber aerosol could be significantly higher than the concentrations found in the XRD analysis of the granular samples.”

Since we applied non-single particle methods to analyse the mineralogical composition, it is not possible to draw any conclusions about the mixing state of the components.

5. All calculations of specific cross sections include the uncertainty in mass determination of 20 % due to the errors in the determination of total number concentrations and dust densities. We added the following sentence to section 5:

“The total uncertainty in mass determination of 20 % resulted from errors of the total number concentration, density and shape factor of the dust. By error propagation these uncertainties were considered in the calculation of the specific optical cross sections given in Table 1 and Table 2.”

Since the SSA is not dependent on the aerosol mass, but can be calculated from the scattering and extinction coefficients alone, the above uncertainties in the mass determination have no effect on the SSA values given in Table 2.

6. The intention of Figure 11 and the discussion in section 5 is to present the general difference between mineral dust and hematite. In contrast to the mineral dusts, the extinction spectrum of hematite has a significant absorption component for wavelengths

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below 600 nm. Therefore, the flat spectral behaviour in this wavelength region is a specific feature of hematite. We agree with the referee that the resonance structure in the wavelength range above 600 nm is due to the monodisperse nature of our hematite sample. We modified the discussion in section 5 and inserted:

“The hematite sample consists of a narrow size distribution of pseudo-cubic hematite particles (Sugimoto et al., 1993). The hematite spectrum shows a Mie-type resonance structure around 600 nm, but this does not affect the general absorption-induced flat spectral behaviour in the wavelength range below 600 nm, which is obviously a specific spectral feature of hematite.”

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 2897, 2006.

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