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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Absorbing aerosols at high relative humidity: closure between hygroscopic growth and optical properties" *by* J. M. Flores et al.

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We are grateful for the time and effort you have invested reviewing our work, and are pleased that you found our work interesting and appreciate all of the constructive comments you've given us. We understand the frustration of reviewing a manuscript with a 'mess involving table and figure captions'. Unfortunately, there was a mistake by the editorial office on the placements of the figure and table captions, and by us not realizing this mistake sooner. However, the mistake was noticed by the editor and a corrected version was implemented on the 26th of January, 2012.

Following are the responses to your comments. "The discussion of aerosol optical

parameters near clouds should not be part of this manuscript and cannot be based on the laboratory measurements presented in the first part. Strongly absorbing aerosols are generally black carbon based and nigrosin is not a good model of their complex behavior upon humidification. Black carbon aerosols are generally emitted as fractal-like chain aggregates which upon humidification may collapse, irreversibly changing their optical properties (for example, see Lewis et al., 2009). In general, the discussion of aerosol optical parameters near clouds seems to be somewhat of an afterthought as it is not mentioned in the title and only very briefly in the abstract."

Due to the responses from all three reviewers we've excluded this part from the manuscript.

p. 1026 l. 10-11: "If the final dry measurements differed more than 5% from the initial, the measurements of that substance were repeated." And I assume the original measurements were not used. This excludes, by definition, any irreversible changes of aerosol optics upon humidification, a very unscientific procedure. At the very least, the authors need to discuss how often this happened and what the excluded data show.

We respectfully disagree with the comment, what we are trying to attain is a 5% consistency/stability of the experimental procedure. While performing humidified CRD measurements the mirrors can get fogged and the empty cavity decay time (τo) can change which will in turn yield the wrong extinction coefficient. To obtain reliable results, a change of no more than 5% is desirable for the dry cross sections. A greater change indicates that something changed in the experimental system while performing the RH measurements making the measurements unreliable. To make this clearer in the manuscript we changed the phrase:" If the final dry measurement differed more than 5% from the initial, the measurements of that substance were repeated" to "To ensure experimental stability, the measurements were repeated if the final dry extinction cross section differed by more than 5% from the initial one."

p. 1030, l. 23-26: "Figure 3 shows, in general good qualitative agreement between

measurements and theoretical calculations". This is not what I see in Fig. 3! I see large, systematic looking discrepancies, especially for absorbing aerosols. These discrepancies need to be discussed!

We are not sure where does the reviewer see the systematic discrepancies. We added the following to explain the errors that are shown for the mixture of ammonium sulfate and nigrosine. "The measurements for all aerosols at both RHs and wavelengths are in good qualitative agreement with the calculations. While there are some values that lay outside the shaded area, all substances follow the theoretical trends. The greatest errors can be observed for the mixture of ammonium sulfate and nigrosine at a 1:1 molar ratio. These errors can result from the unknown structure and mixing state of the particles after atomization. Since the volume weighted mixing rule assumes homogenously mixed aerosols, the discrepancies can indicate that in our case the mixture of AS and nigrosine at 1:1 molar ratio is either not an entirely internal structure or homogenous mixture."

Error bars need to be included in all figures!

Error bars are included in all figures showing experimental results. The theoretical calculations of Figure 5 do not need error bars as what we are showing is the relative behavior between homogenously mixed and a core-shell structure.

The derivation of the imaginary part of the refractive index from extinction measurements is, at best, very challenging. Even the authors state (p. 1033, l. 22-23) "In Fig. 6, we observe that the extinction is practically independent from the imaginary component of the complex refractive index:". So, how can one retrieve the imaginary component from extinction measurements? At the very least, the authors need to include a detailed error analysis for the imaginary part and in table 1, a comparison of retrieved values with literature values. The error analysis also needs to extend to the calculation of the single scattering albedo, which is crucial for cloud effects

The discussion of Figure 6 has been removed from the manuscript following the recom-

mendations of the reviewers. On the other hand, to explain more clearly how the refractive index is retrieved from extinction measurements we've included in the Methodology section the following text:

"For homogeneous spheres, the extinction coefficient (αext) is described by: α_ext=Nσ_ext=1/4 πNDˆ2 Q_ext (2) where σext is the extinction cross section, N is the particle concentration, D the particle diameter, and Qext the extinction efficiency (which is the ratio of the optical extinction cross section to the geometric area of the particle). The extinction efficiency at a given wavelength and RI is only a function of the particle size. The particle size is normally expressed as a dimensionless size parameter (x), which is the ratio of the particle circumference to the wavelength (λ) of the incident light (x = πD/λ). The RI of aerosols can then be retrieved by using Mie theory and finding the theoretical Qext curve that best fits the measured Qext values for the different aerosol size parameters measured."

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 1019, 2012.