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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reduction in biomass burning aerosol light absorption upon humidification: roles of inorganically-induced hygroscopicity, particle collapse, and photoacoustic heat and mass transfer" *by* K. A. Lewis et al.

Anonymous Referee #2

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GENERAL REMARKS The manuscript investigates the impact of particle shape modification by hygroscopic growth and resulting particle collapse on the particle light absorption properties. As a second process, the effects of photoacoustic heat and mass transfer on particle absorption properties are studied. The study targets an important aspect of aerosol light absorption measurement. The authors performed a comprehensive study on these subjects combining the measurements of particle optical properties, morphological analysis and chemical analysis.

The results make an important contribution to the field of aerosol absorption measurement. The scientific objectives targeted in this study are in the focus of ACP and deserve publication. The authors present a lot of detailed results. However, these results may be presented in a more quantitative manner in order to increase the use of the paper. I am missing the whole picture the authors get out of this study. Furthermore, results are presented as figures only. I would expect a quantitative presentation of results in tables as well. At least the key findings should be given in tabulated form, because those quantitative data are of more practical use for the scientific community than graphical presentations only.

The proposed revisions are:

Section 3.3 HTDMA measurements:

I am wondering whether the authors can relate humidity growth factors from HTDMA data to the chemical composition presented in Figure 5. The presentation of results in a table is strongly recommended because humidity growth factors of biomass burning aerosol particles as a function of chemical composition are important data.

Sections 4.1 and 4.2 Hypotheses on reduction of absorption

1. On of the key issues addressed in this study is the collapse of particles after humidification and the resulting impact on particle absorption properties. The authors conducted a lot of SEM measurements of particle morphology. Why are the results not presented in a more quantitative manner? For the scientific community, the change in the particle fractal dimension from dry to humidified and again dried particles is a very important topic. I propose to add a table containing data on modification in particle morphology and resulting modifications of aerosol absorption properties, both measured and calculated. In the present form, the reader cannot assess magnitude and statistical significance of the expected effects.

2. Concerning the reduction in aerosol light absorption by morphological changes,

the authors cite two figures from other studies without relating their results explicitly to these findings. Referring to Section 4.2.1 it seems more appropriate to discuss the increase of knowledge on the reduction of the particle absorption coefficient as a function of relative humidity instead of discussing Figure 13 from Mikhailov et al. (2006). It would be interesting whether this effect is measured in the presented study with higher statistical significance than shown in Figure 13. Referring to Section 4.2.2 I propose to present own findings and relate them to the work of Liu et al. (2008) instead of discussing the already published work by Liu et al. (2008) with so much detail.

Section 4.3 on mass transfer

A model is used to calculate the expected mass transfer from absorbing particles in a photoacoustic resonator. The results are presented in Figure 15. This Figure, however, is difficult to interpret. Please include a quantitative description of the model-experiment intercomparison in the text, including the discussion of the statistical significance of the obtained results.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 15247, 2009.