Atmos. Chem. Phys. Discuss., 11, C4132–C4134, 2011
www.atmos-chem-phys-discuss.net/11/C4132/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Studies of propane flame soot acting as heterogeneous ice nuclei in conjunction with single particle soot photometer measurements" *by* I. Crawford et al.

D Baumgardner (Referee)

darrel.baumgardner@gmail.com

Received and published: 31 May 2011

The study described in this paper is quite interesting and scientifically relevant. It is well written and should be published; however, there are several loose ends that I think need tying up, or at least tidied up. The one that puzzles me the most concerns the characterization of the particles produced by the CAST generator. In this paper, it is stated that "By varying the propane-air ratio, a range of soot containing of the order of a few percent organic carbon content to organic carbon contents of up to 80% can be generated in a repeatable fashion (Schnaiter et al., 2006)." So I went to read what Schnaiter et al. had done to characterize the properties of the CAST generator and

in looking at their Fig. 1, it seems that by varying the C/O ratios they get a very nice relationship of EC and OC to TC ratio but nowhere could I find where these EC and OC values came from so I don't really know how to interpret the 5% versus 30% OC discussed in the current paper. A number of questions arise:

1) Does OC5 and OC30 mean 5% and 30% by mass or by number?

2) Does 5% OC mean that 95% of the particles contain EC?

3) Were the OC5 and OC30 left in the coagulation chamber the same amount of time? If so, given the higher concentrations of OC5 with respect to OC30 and OC70, would that lead to a higher relative fraction of coagulated particles and hence more active as IN is related to size?

4) Evaluating the change in the aerosol population in the chamber involves six types of particles: pre-cloud no rBC (pcNBC), pre-cloud rBC (pcBC), cloud residual no BC (crNBC), cloud residual rBC (crBC), interstitial no BC (iNBC) and interstitial rBC (iBC). In order to compare the relative properties of the different types of OC with and without sulfate coating, these six types of particles need to be compared with respect to the OC content in order to assess what fraction of particles are being removed by nucleation and which ones are removed by inertial impact.

5) The size distributions should be shown, not only as normalized percent as a function of rBC mass, but also the concentrations normalized as a function of optical diameter measured with the SP-2, for particles with and without rBC.

Other observations:

Page 11010, line 6: What is the relevance here of mentioning the Baumgardner et al (2008) studies, other than that a CVI (not PCVI) was used? The analysis that was done in that study is somewhat different than done in the study described here.

Page 11012, line 17: ". . .left to coagulate. . .", There should be SMPS size distributions that show the before and after coagulation properties. Were all samples left for the

same time period?

Page 11013, line 15. It is never explained why two different CAST generators were used and the difference between the two is never quantified with size distributions from the two units.

Page 11014, line 8: “Aerosol residuals were analysed using a number of instruments but for this work we focus on measurements of the soot core mass and associated coating thickness made by a Single Particle Soot Photometer (SP2; DMT, Boulder, Colorado, USA, which was available for the first series of experiments examining the uncoated soot only)”. This sentence doesn’t seem to make any sense, i.e. the SP-2 was used for looking at coating thickness, but in parentheses it says it was used in experiments examining uncoated soot?

Page 11017, line 8, Shouldn’t the BC core size be rBC core size? Also, in previous papers using SP2 data, this diameter is often referred to at mass equivalent diameter, or MED. I think the same units should be used throughout for size, either nm or um.

Page 11017, line 19. The interpretation of the fraction of rBC to scattering only particles has to be done cautiously as this ratio is affected by the different size ranges of light scattering detection versus incandescent detection. I think that these ratios should be constrained within the same size range of light scattering and incandescence for the different conditions.

Page 11023, final sentence of the summary: “. . . however this poor IN behaviour may be compensated for if they exceed concentrations >10 L^{-1}.” This seems an odd note to end the paper and I found it also rather cryptic as I didn’t know what it means.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 11007, 2011.