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Atmospheric Measurement Techniques Discussions

Interactive comment on "Effective density of Aquadag and fullerene soot black carbon reference materials used for SP2 calibration" *by* M. Gysel et al.

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The manuscript provides results from an investigation of the effective density of two materials (Aquadag and fullerene soot) commonly used for calibrating the response of the single particle soot photometer (SP2) to the mass of black carbon (BC) in individual particles. Two different research groups measured mass distributions of electrical mobility-selected BC particles using different aerosol mass analyzers (the APM and CPMA) coupled to condensation particle counters and in one case, an SP2. They then determined effective densities relating particle mass to particle "volume" as defined by

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the mobility diameter for a range of sizes and provide coefficients for a polynomial fit relating effective density to mobility diameter for both materials. As shown previously by Moteki and Kondo (2010), the effective densities deviate strongly and non-linearly from the bulk values. The results can be applied by groups operating SP2 instruments that do not have access to aerosol mass analyzers for calibration of the SP2.

The relationship between effective density and electrical mobility has been described previously, but the manuscripts makes several valuable contributions that merit publication. First, they examined the reproducibility of the behavior reported by Moteki and Kondo (2010) by repeating experiments for different batches of Aquadag and tested how varying the particle generation methods and concentrations affected the results. Second, they provide coefficients needed by other investigators to correct mobility-based calibrations using these materials adding utility. Third, they also report a new finding that Aquadag is not 100% BC as is normally assumed. For these reasons and also because the manuscript is within the scope of AMT, well written and will be useful to the SP2 community, I recommend its publication if the following minor comments can be addressed.

General comments

The results from the thermal-optical analysis should be described in more detail. At minimum the sampling method and analysis protocol should be provided. Was the Aquadag size selected before being sampled on the filter or is this a bulk measurement? Were the thermally denuded particles also sampled onto filters for OC/EC analysis? If so it would be worth presenting how the EC fraction changed in addition to the higher BC mass fraction observed by the SP2. If any information regarding the size-dependence of the contamination is available it would be valuable.

Some specific attributes of the mass analyzer systems are referred to in the paper (e.g., voltage, RPM, mass-voltage relationship), but the basic approach used by these instruments is not given. It would help readers unfamiliar with these instruments if

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the manuscript had a sentence or two describing the instruments. On a related note, Figure 2 would be easier to interpret if the concentrations were reported with respect to mass rather than voltage in the APM.

The summary section could benefit from a paragraph discussing some of the implications of these results for other products of the SP2 commonly reported, such as total mass concentration, mass size distributions, and coating thicknesses. Are these likely to result in minor changes in these parameters, or larger differences that merit a re-visiting of previously published results?

Finally, it would be helpful to solicit a comment for the manuscript's interactive discussion from an investigator involved in the Moteki and Kondo (2010) or related studies regarding the discrepancy observed at larger mobility diameters.

Specific comments

Page 4945, line 9: "...which shows that a DMA combined with an SP2 can be used for fast effective density measurements of pure BC particles, if an accurate calibration of the SP2 has been done..." Moteki and Kondo (2010) found that it is likely that the refractive index of the BC particles can affect the SP2 response, which has implications for effective density measurements made using only a DMA and SP2 that should be addressed here.

Page 4948, line 11: in reference for Laborde et al. in prep omit "Which journal"

References

Moteki, N. and Y. Kondo, Dependence of laser-induced incandescence on physical properties of black carbon aerosols: Measurements and theoretical interpretation, Aerosol Science and Technology, 44, 663-675, 2010.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 4937, 2011.