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Atmospheric Measurement Techniques Discussions

Interactive comment on "Collection efficiency of the Soot-Particle Aerosol Mass Spectrometer (SP-AMS) for internally mixed particulate black carbon" *by* M. D. Willis et.al.

Anonymous Referee #2

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General Comments:

Review of "Collection efficiency of the Soot-Particle Aerosol Mass Spectrometer (SP-AMS) for internally mixed particulate black carbon" by Willis et al. In this paper, the authors investigate the response of the SP-AMS to quantify the mass of refractory Black Carbon (rBC) and non-refractory particulate matter (NR-PM) for different thickness of organic coating on these particles. The authors find that coated particles have narrower beam widths, resulting in their improved sensitivity over "bare" particles. Accounting for the broader beam widths for bare particles, the authors find that the collection efficiency of these particles in the SP-AMS is higher than previously thought. Field

measurements of near-road aerosol with the SP-AMS are seen to exhibit particle beam width trends that are consistent with the expectation of fresh and aged rBC-containing particles.

The paper covers a topic of importance for researchers working with SP-AMS and presents results that are important for accurate quantification of rBC and NR-PM from atmospheric studies. The paper is well written and acceptable for publication after the below comments are addressed.

Specific comments:

1. Page 5227, Lines 13-25: There are several differences in the setups at the ARI and UofT facilities and it would be helpful to tabulate those (in addition to the quantities listed in the text currently, also include in this table the operating flowrates of the DMAs).

2. Page 5228, Lines 6-7: It is mentioned that contributions from doubly-charged particles were characterized using a SMPS. I'm assuming that the particles from the first DMA were neutralized in the SMPS and the size distributions were then measured. How was this data used to account for the contribution of doubly-charged particles in the subsequent analysis? Given that the measurements are mostly made in terms of particle mass and with particles in the size range of 200-400 nm, the contribution of doubly charged particles cannot be ignored here.

3. Figure 2: What are the "bare" particle sizes associated with the data shown in Figure 2?

4. Figure 2a: The one data point from ARI beyond Rorg/RB of 3 seems to suggest that RIErbc could be decreasing beyond Rorg/RB of 3 and there is significant uncertainty in the data of UofT. It is not clear that the sensitivity is saturated beyond Rorg/RB of 3.

5. Figure 2b: Why is the data from ARI not included for RIEorganics for Rorg/RB. $\sim$2.

6. Page 5232, Line 20: Homogeneously nucleated organic particles are mentioned as a possibility in these experiments. Do the CPC (and SMPS) measurements indicate

this possibility? Also, would there be sufficient mass in these particles to affect your measurements?

7. Figure 2: “The error bars are standard deviations of 2 or 3 measurements”. A standard deviation from two measurements is generally not acceptable. A more accurate representation of uncertainty should be estimated from error propagation analysis.

8. Page 5237, Lines 24-29: In comparing the fRB values obtained with the SP-AMS with the Mass-Analyzer, how are the SP-AMS measurements corrected at different core sizes for CE and sensitivity?

9. Page 5238, Lines 13-15: The correction of SP-AMS data requires knowledge of the RIEapp and CE with coating thickness. As coating thickness is usually an unknown, is it feasible to make these corrections for ambient/atmospheric measurements?

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 5223, 2014.