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Atmospheric Measurement Techniques Discussions

Interactive comment on "Characterization of a Non-Thermal Plasma Source for the Use as a Mass Spec Calibration Tool and Non-Radioactive Aerosol Charger" *by* Christian Tauber et al.

Anonymous Referee #2

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This work describes the use of a plasma torch as an aerosol neutralizer. The work measures and compares the charging probability of the new source with commercial available other aerosol chargers. The charging probabilities were measured for positive and negative particles (Ag, and NaCl) and at different aerosol flow rates. In addition, the plasma torch has been evaluated at operation with different working fluids (He, Ar, N2). The mobility distributions and mass graphs of the charger ions were also measured in order to get an information on the properties of the charger ions. The work includes a very thorough investigation of the charger source and the charger ions. However, there are a few general concerns about the work, that should be addressed before publication:

1. The plasma torch itself, is not described at all in the current manuscript, a paragraph on the working principle should be added to the manuscript.

2. In the measurement with different gases, one would expect that using a DMA and CPC in a helium-air mixture would result into changes in the instrument performance. The voltage mobility relationship in the DMA is gas dependent, and in the CPC the flow calibration would change when adding helium to the system, also the supersaturation profile would change and the detection limit would shift to smaller particles (e.g. Thomas et al. 2018, Journal of Heat and Mass Transfer). These are points that should be addressed in this manuscript.

3. The charger ion mass and mobilities were measured, however, no qualitative thoughts were included in how and why that would result into the observed changes of charging probability. It has been stated correctly that the charger ion composition plays an important role to the final charge distribution. But what is missing is to apply the information found in this work to existing theories and see if the trend agrees with the observations. Simulation results of charge distributions considering different ion mass and mobility of charger ions have been performed in the past, see for example Maisser et al, 2015, Journal of Aerosol Science

4. The results of the optical emission spectroscopy seem very isolated from the rest of the publication. It is not clear how these experiments were performed. This is a bit confusing, is this supposed to be part of the experimental setup description, or already an experimental results section? If it is experimental results, then the procedure of how these measurements were done should be added in a bit more detail in the experimental section. Was this a completely separate measurement, or did you do that while aerosol generation and charging was happening as well? This would require also a description of the source itself, which was already mentioned above. Was the optical emission spectroscopy done only in pure helium environment, and how would that be relevant to the rest of the measurement?

Some more detailed comments:

Ad Section 2) Experimental Setup: No description, schematic or anything on the charger!

Page , Fig. 2: It seems like the mobility distributions were measured in an air Helium, Argon, or N2 mixture. But I don't see any discussion of the influence of this gas mixture on the mobility measurements. If the DMA has been operated in a closed loop this has to be considered. The mobility of THAB in a helium air mixture would not be the same, so how was the calibration done in this case? If this was considered and found to be negligible a discussion and reference has to be added. If it has not been considered, then this needs to be done.

Section 2.1. I think this should be numbered 3, not 2.1, since it does not seem to be part of the experimental setup

Page 5, line 94, 95: What is the copper antenna for?

Page 8, line 144 says that the different masses of charger ions created in the plasma torch and the other charger sources might result in the observed differences. Can this be quantified. Is the mean mass, and mobility higher or larger than in the other case. How does an increase or decrease of mass and mobility affect the final result. Why did you not apply the measured mass and mobility to the theory?

Page 9, line 163, why would it charge better in air than in helium? And how can the large difference of 50% be explained?

Page 10, line 185, polarities wrong, also, you should mention that it was the y-axis that was normalized

Page 11, Fig. 7, for negative mass graphs the chemical equations are mentioned but not the mass, while for the positive ions it's the other way around. Is there a reason for that? What are the rectangles in the positive Am-241?

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