

Atmos. Meas. Tech. Discuss., referee comment RC1  
<https://doi.org/10.5194/amt-2021-35-RC1>, 2021  
© Author(s) 2021. This work is distributed under  
the Creative Commons Attribution 4.0 License.

## Comment on amt-2021-35

Anonymous Referee #1

---

Referee comment on "Utilizing an electrical low-pressure impactor to indirectly probe water uptake via particle bounce measurements" by Kevin B. Fischer and Giuseppe A. Petrucci, Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-35-RC1>, 2021

---

The authors presented a method to probe particle bounce behavior via water uptake/evaporation processes by using an electrical low pressure impactor (ELPI). Three model aerosol particles, including ammonium sulfate (AS), sucrose, and secondary organic aerosol (SOA) from  $\alpha$ -pinene ozonolysis, were used for investigation. This is an interesting method to study the phase behavior of various types of particles. However, I find it a bit confusing on the purpose of this method and also some interpretation of the data obtained. I recommend Major Revision with some comments as below.

General:

- It is not very clear to me whether this method is proposed to measure particle hygroscopicity or particle phase state. If it is the former, then more detailed comparison with hygroscopic growth behaviors (e.g., curves) for those well studied species should be made. If it is the latter, parameters that are more closely related to phase state (e.g., viscosity or water uptake/evaporation kinetics that is related to diffusivity of water molecules in viscous particles) should be provided.

- It is assumed that all particles that bounce from any preceding stage will end up in the last (filter) stage. How valid is this assumption? As seen from Fig. 1, the DRH and ERH of AS were not very sharp, as different from normally reported abrupt changes of either mass or diameter during deliquescence and efflorescence for this crystalline species. Does it reflect a possibility that some “residual” particles might end up in earlier stages even if the AS particles are known to be solid crystalline?
  
- The RH drop at the lower stages of ELPI was said to have a negligible effect on the drying of AS particles (P8/L188), but can lead to sufficiently fast drying of sucrose particles (P11/L239). This looks a bit contradicting to me. Please clarify.

Specific:

- I think Figures 4 and 5 can be combined into one figure for easy comparison of the same species of two diameters.
  
- Why 190-nm particles can reach equilibrium in water uptake and show much less particle bounce than 70-nm particles? The former should take a longer time to complete the water uptake than the latter. Furthermore, what is the residence time of those particles in the 775-L chamber?

- Table 2: why are the residence times for different stages differ so dramatically? Is it related to the physical distance between consecutive stages?
  
- Section 3.5: what new insights does this work, using atmospherically relevant small particles, contribute to the understanding of aerosol drying? Or alternatively, does aerosol drying process help explain some observations here (as stated in the last sentence in the abstract). For the latter point, I believe the interpretation is a little bit contradicting as stated in the last general comment above. Either way, I find Section 3.5 not fitting well in the manuscript.
  
- P3/L65: suggest to use "775-L" here and some other places.
  
- Figure 7: what can the inflection point RH for the SOA data set tell us?