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Atmospheric Measurement Techniques Discussions

Interactive comment on "Counting on Chemistry: Laboratory Evaluation of Seed Material-Dependent Detection Efficiencies of Ultrafine Condensation Particle Counters" *by* Peter Josef Wlasits et al.

Anonymous Referee #2

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I have two deep points of conflict with the authors of this work. These points are about particles smaller than 2 nm. The first point is about the particles themselves and the second point is about they are produced and selected. 1°/ The authors argue that a 11 cm Vienna DMA at 30 lpm sheath air can select 1 nm particles with an acceptable resolution. I guess that they have used the DMA 1/40 introduced by Georg Reischl (Winklmayr et al. 1991). [redacted] 2°/ The colleagues are using an X ray charger (to produce ions) for the generated particles before the DMA. This point is critical in my opinion. In the sub 2 nm a charger should be useless and even forbidden when the purity (chemistry in fact) is important. Indeed the figure 2 b, 2 c, 3b, 3c and 4d show results with particles smaller than 2 nm of silver

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and sodium chloride for example. It is clear that these particles are not pure but dirt. Indeed if you add an ion to a particle to charge it in positive or in negative mode the result has nothing to do with the particle nor with the ion. Ag + Nitrate ion dimer (for example) from the charger is not pure silver particle anymore. Same thing with sodium chloride NaCl + lactic acid (for example) from has nothing to do with sodium chloride. See Maisser et al. (2015) JAS 90, 36-50; Steiner et al. (2014) AST 48,3 261-270 for the chemical composition of ions produced in chargers. I would suggest to the authors to be careful and warn the readers concerning the sub 2 nm results with a charger. High resolution DMAs, electrospray source atomization and evaporation condensation of vapors from hot wires are for the moment the cleanest methods for the generation of clean sub 2 nm. Clean means pure chemistry. Indeed the wire generator is much cleaner than an oven because the hottest point is the wire itself. It's not the case inside an oven. The particles from the wire generator are on the other hand self-charged. It's not the case when an oven is used.

I have few other small details about the work. 1°/ The following previous works should appear in the introduction of the paper to my opinion Seto et al (1997) https://doi.org/10.1063/1.474510 Gamero & Fernandez de la Mora https://doi.org/10.1016/S0021-8502(99)00555-8 Attoui 2018 : https://doi.org/10.1016/j.jaerosci.2018.08.005

2°/ I don't understand very well why the authors are using two identical set ups. What is the benefit of the DMA working at 19.5 lpm? Why not 20 lpm by the way? 3°/ It will be good to give the geometrical parameters of the DMAs. 4°/ The authors are giving the resolution of their DMA but nothing about the flowrate nor the size of the particles they have used for the measurement of the resolution. Was it done with a tandem DMA by the way? 5°/ The equation 2 is useless since the authors are talking about particles down to 1 nm (as small as !) where the diffusion is very active adversely to what Rick Flagan was telling in the cited paper. 6°/ In the figure 2 the diameter is given in standard number format. It's not the case in the figures 3 and 4. Please use

the same format. I would suggest standard format rather than scientific format. 7°/ Susan Hering and colleagues as published in a paper the experimental results of the versatile CPC commercialized by TSI. That paper is the most adequate reference to the instrument. The paper is cited on the TSI website. Susanne V. Hering, Gregory S. Lewis, Steven R. Spielman, Arantzazu Eiguren-Fernandez, Nathan M. Kreisberg, Chongai Kuang & Michel Attoui (2017) Detection near 1-nm with a laminar-flow, water-based condensation particle counter, Aerosol Science and Technology, 51:3, 354-362.

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