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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Novel method of generation of$Ca(HCO_3)_2$ and $CaCO_3$ aerosols and first determination of hygroscopic and cloud condensation nuclei activation properties" *by* D. F. Zhao et al.

D. F. Zhao et al.

t.mentel@fz-juelich.de

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We would like to thank the reviewer for the comments and suggestions, which contribute to improve the quality of our paper. We have made revisions and have replied to all comments and suggestions. Please, find a detailed point-by-point response to each comment.

Comment: 1. As the collection efficiency is discussed in another submitted manuscript it would be useful to give more details about possible gas phase contribution to m/z 18

and 44.

Response: The aerosol was generated with CO2 free synthetic air (Linde, quality 99.9999%). The particles were dried before entering the tube oven. Therefore, given the gas-phase suppression factor 107 of the AMS, we do not expect significant contribution on m/z 18 and 44 by gas-phase water and CO2 neither from air nor from evaporated H2O and CO2 from Ca(HCO3)2 in the furnace. Blank measurements with a HEPA filter in line were conducted before each experiment and the m/z 18 and 44 were lower than 0.3 ug m-3 and 0.04 ug m-3, respectively. During experiments the value of m/z 18 and 44 for aerosols was up to tens of ug m-3. We have given more detailed information about the measurement in the revised manuscript (p.7, line 3 and line 20):

Comment: 2. Plotting data of Sullivan et al. (2009b) in Fig.9 sets a good benchmark for comparison of CCN activation properties. Atmospheric relevance of this figure can be significantly enhanced by adding data from Fig.2 of Koehler et al. (2009) GRL. This will allow a reader to compare properties of chemically resolved particles and complex dust surrogates.

Response: Thank you, we followed this suggestions in the revised manuscript. See new Figure 9.

Comment: 3. Chan et al. (2005) ACP made a strong recommendation for reporting residence time for HTDMA systems. It would be desirable to give this detail for the system used here as the reference Buchholz et al. (2007) is not easy to access.

Response: We added a sentence on the contact time for particles with the final humidity (p. 8, line 11). "The particles remained for approximately 20 s in contact with the final humidity before they enter the SMPS which operated with sheath air of the same humidity."

Minor suggestions:

Comment: p. 8011, L. 2 specify what do you mean by fine mode

Response: Fine mode means fine particles with a size in the range of 0.1-2.5 um. In the revised manuscript, we have now specified it.

Comment: p. 8011, L. 17 CO2 formation has been also reported by Santschi and Rossi (2006) J.Phys.Chem A during trace gas uptake experiments with calcite

Response: In the revised manuscript, we have added this reference. We thank the reviewer for this suggestion.

Comment: p. 8013, L. 14 expand CO2 4.5, is 4.5 purity?

Response: 4.5 is the purity of the CO2 gas, which means purity is 99.995%. We have added this denotation in the revised manuscript.

Comment: p. 8013, L. 14 20 mbar is pressure difference, right?

Response: Yes, 20 mbar is the value of the pressure gauge. We use the now the terminus "gauge pressure" in the revised manuscript.

Comment: p. 8014, L. 7 change unstable to thermodynamically unstable

Response: Done.

Comment: p. 8017, L. 14 add reference Wiedensohler (1988) J.Aerosol Sci. when referring to natural charge distribution.

Response: Thanks for the reviewer's suggestion. We have added this reference in the revised manuscript.

Comment: p. 8018, L. 12 remove (Linde LiPur 6.0) as it was mentioned earlier

Response: We would prefer to keep it, since it is not a priori clear to the reader that the synthetic air for aerosol generation is the same as for flushing the 250 m3 chamber.

Comment: p. 8028, L. 6-8 the authors suggest a fast surface reaction and slow core

conversion. Surface to bulk kinetic constrains were also suggested earlier for dust surrogate ATD reaction with nitric acid by Vlasenko et al. (2009) PCCP

Response: Thanks for the reviewer's suggestion. We have referred to this paper in discussing the aging process of Ca(HCO3)2/CaCO3 in the revised manuscript.

Comment: p. 8028, L. 21 HNO3 origin (heterogeneous or photochemically produced in situ?) should be specified as it was not added directly

Response: HNO3 can originate from both background i.e.the evaporation of HNO3 absorbed on the chamber wall as mentioned in p. 8018 L.1-2 and the possible heterogeneous reaction of NO2 and traces of N2O5 with chamber wall and aerosol surfaces when NO2 was present. We specified now the origin of HNO3 in the revised manuscript. (p. 21, line 1) "In this mixture HNO3 was formed by heterogeneous reaction of NO2 and N2O5 on the particle surfaces and on the chamber walls."

Comment: p.8028, L. 28 specify major AMS peaks used for nitrate measurement

Response: As described in Allan et al. (2004), m/z 30, 46 are major peaks used for nitrate measurement. We have specified this in the revised manuscript.

Technical:

Comment: Fig.8 use more legend types and other colors

Response: More colors and different symbols were used.

Comment: Fig.11 specify in the caption green points. Different grades of blue are hard to distinguish. For example, middle blue curve is hard to find

Response: We now changed colors and used different symbols..

Comment: Fig.12 Y-axis, closing bracket for units is missing.

Response: Corrected.

We also removed some minor author errors in the manuscript, especially in the hygro-

scopic growth section 3.4 the RHs for onset of restructuring were 2-3% off in the text and in Figure 8. The numbers given in Fig. 8 were correct and this has been changed in the text accordingly.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 8009, 2010.