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Comment

***Interactive comment on “Laboratory studies of  $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$  binary homogeneous nucleation from the  $\text{SO}_2+\text{OH}$  reaction: evaluation of the experimental setup and preliminary results” by L.-H. Young et al.***

**Anonymous Referee #3**

Received and published: 16 May 2008

Comments to Young et al. ACPD paper

The topic is very interesting and important one, and the MS can be published in ACP after major improvements.

- 1) In introduction the recent findings of atmospheric nucleation should be mentioned (e.g. Kulmala et al., 2007a). Particularly the finding of the size of recently formed clusters in atmospheric conditions should be compared with present laboratory findings.
- 2) The closure between sulphuric acid source and sink with corresponding concen-

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tration should be investigated. During this investigation also the initial sulphuric acid concentrations should be shown, not only the final (residual) ones. The assumption that  $[H_2SO_4] = [OH]$  should be verified.

3) What is the status of Benson et al. MS?

4) CPC detection efficiency is a key point to consider. There is a clear need to make a proper calibration and to show the results of the calibration. Water CPC and butanol CPC might give different values (see Kulmala et al., 2007b), and therefore proper calibrations are needed. Also the obtained data should be shown.

5) Although there are a lot of results, they are not shown in the proper way. All results should be given in tables. All results should also be given as a function of initial and residual  $[H_2SO_4]$  not only residual. It is also important to plot results in X-Y plots.

6) Since the same residual  $[H_2SO_4]$  gives different nucleation rates there are something unclear in the experiments. In my point of view the time for one experiment is probably too short. In several nucleation experiments (like in Viisanen et al., 1997) the time is much longer. Other possibility is that the detection efficiency of used CPCs and SMPS is not good enough to detect all nucleated particles.

7) It would be good to have some clear explanation why to use 4 and 19 s for nucleation time.

8) The argument that  $[H_2SO_4]$  cannot explain the observed growth seems not be valid. At least  $[H_2SO_4]$  can explain almost all the growth. However, proper calculations and comparison should be shown.

9) On removal of  $O_2$ : how it was determined? What was the concentration after removal?

10) The main result figure (14) shows that at the nucleation rate  $[H_2SO_4]$  varies more than factor of 10. It might also indicate the varying contribution of ions. It is important to comment that. The recent findings by Winkler et al. shows that ions are activating

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(nucleating) much more effectively than neutral clusters or homogeneous nucleation do occur (Winkler et al., 2008).

#### References:

Kulmala, M., Riipinen, I., Sipilä, M., Manninen, H.E., Petäjä, T., Junninen, H., Dal Maso, M., Mordas, G., Mirme, A., Vana, M., Hirsikko, A., Laakso, L., Harrison, R.M., Hanson, I., Leung, C., Lehtinen, K.E.J., Kerminen, V.-M. 2007a. Toward direct measurement of atmospheric nucleation. *Science* 318, 89-92. 10.1126/science.1144124.

Kulmala, M., Mordas, G., Petäjä, T., Grönholm, T., Aalto, P.P, Vehkamäki, H., Hienola, A.I., Herrmann, E., Sipilä, M., Riipinen, I., Manninen, H., Hämeri, K., Stratmann, F., Bilde, M., Winkler, P.M., Birmili, W., Wagner, P.E. 2007b The condensation particle counter battery (CPCB): A new tool to investigate the activation properties of nanoparticles. *J. Aerosol Sci.* 38, 289-304.

Viisanen, Y., Kulmala, M., Laaksonen, A. 1997. Experiments on gas-liquid nucleation of sulfuric acid and water. *J. Chem. Phys.* 107, 920-926.

Winkler et al., DOI: 10.1126/science.1149034, *Science* 319, 1374 (2008)

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 8, 6903, 2008.

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