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Atmospheric Chemistry and Physics Discussions

Interactive comment on "SO_2 oxidation products other than H_2SO_4 as a trigger of new particle formation – Part 1: Laboratory investigations" *by* T. Berndt et al.

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The paper by Berndt et al. presents interesting findings and an important new hypothesis is proposed. For aerosol nucleation occurring in the atmosphere it has been assumed for a long time that sulphuric acid is the most important substance driving the nucleation process (except for some special situations such as in some coastal areas where most likely iodine oxides are responsible for nucleation). It is now concluded from the experimental findings by Berndt et al. that sulphuric acid is actually not the substance responsible for nucleation, but another oxidized sulphur compound resulting from the SO2 oxidation.

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Interactive Discussion

Discussion Paper

The flow tube study presented in this paper is done with the necessary care and under very reproducible conditions. The differences in the nucleation rate between "H2SO4" and H2SO4 are demonstrated by convincing experiments. Although gaseous sulphuric acid is not measured directly in the experiments, it is demonstrated that the authors have a good understanding of the sulphuric acid concentration profile in their flow tube. In the revised version the questions and comments by the reviewers are addressed adequately by the authors. A direct measurement of gaseous sulphuric acid is of course highly desirable for future measurements with the laminar flow reactor.

The new hypothesis is able to explain the discrepancy between previous nucleation measurements in the laboratory for sulphuric acid produced from liquid reservoirs and observations in the atmosphere, where nucleation is observed at orders of magnitude lower concentrations of gaseous sulphuric acid. It could therefore solve an important open question in atmospheric sciences.

It is a highly surprising finding that sulphuric acid from the liquid reservoir does not participate substantially in the growth of the newly formed sub-3nm particles (Figure 3). This issue should be addressed by further investigations in the future.

As this new hypothesis needs to undergo in depth discussion and confirmation by other experiments it deserves publication in ACP. In the revised version, speculative statements are made with adequate caution and such statements are clearly marked. The work is highly original and well within the scope of ACP. The manuscript is clearly written and concise.

The laboratory findings and the hypothesis should be published on its own. There is a substantial amount of new and original information in this paper and the discussion of consequences for atmospheric measurements as presented in part 2 (Laaksonen et al.) should be treated separately from the laboratory findings.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9761, 2008.

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Interactive Comment