

## ***Interactive comment on “Temperature Effects on Sulfuric Acid Aerosol Nucleation and Growth: Initial Results from the TANGENT Study” by Lee Tiszenkel et al.***

### **Anonymous Referee #1**

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Review of Tiszenkel et al. Temperature effects on sulfuric acid aerosol nucleation and growth: Initial results from the TANGENT study.

The article is nicely written, relevant literature is cited and the shortcomings of the current study (mainly related to the experimental setup) are discussed appropriately.

However, I don't think the study brings anything new to the current scientific literature. The temperature effects on nucleation and early growth have already been discussed extensively in the previous study from partly the same author group (Yu et al. 2017), as well as in the studies from the CLOUD community. Given that the current study lacks crucial information about the cluster composition and measurements of base and

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organic contaminations in their system (thus relying on many assumptions based on comparison to the previous literature), there is little value in the few additional data points and speculations that are presented.

Given their high nucleation and growth rates for each sulfuric acid concentrations in the nucleation tube, I agree with the authors, that the nucleation mechanism is most probably ternary, i.e. involving ammonia and/or amines. However, the authors have not measured the cluster composition at the end of the nucleation tube, which, most probably, critically affects the survival of the nucleated clusters in warmer temperatures (what they intended to study and which is presented as one of the main conclusions). Also, only one pair of temperatures (FT-1, FT-2) is presented, so we don't actually get any information about the effect of temperature on the survival and further growth of these unknown clusters.

The measured GRs at FT-2 are high, 15-23nm/h, so it is very hard for me to believe that they could be caused by SO<sub>2</sub> and O<sub>3</sub> only, especially as the particles are smaller than 2nm when they exit the nucleation tube. Rather, it seems possible (as the authors also mention) that organic contaminants (which were not measured) could affect the growth either directly and/or by participating in forming sulfuric acid. This would also explain the observed nucleation in the growth tube. The possible effect of bases on growth of sub-3nm particles, found in several recent studies, is not discussed here at all. Therefore, I don't think that there is enough justification to speculate on unknown heterogeneous reactions causing the growth, as the authors claim in the abstract and conclusions.

I'm looking forward to the final results of the TANGENT study, as I think there is potential to do more and get interesting results with this setup, but I don't think the initial results as presented here should warrant publication in ACP.

More specific comments: -The authors should give realistic uncertainly estimations for their results and think about the accuracy of the values presented. Especially figure

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3 should have error bars, and it should be discussed what kind of error estimates this gives for the critical diameter and growth rates. -The calculation method of nucleation and growth rates should explained better, as well as the meaning of the growth rate factor. The variables used in the equations (and where the values for them come from) should be explained.

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