

## ***Interactive comment on “Sulfuric acid nucleation: power dependencies, variation with relative humidity, and effect of bases” by J. H. Zollner et al.***

### **Anonymous Referee #2**

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The subject of this paper is lab experiments on sulfuric acid nucleation. The topic is timely and well suited for ACP. However, in order to be publishable, there are some things that need clarification.

A number of experimental papers on sulfuric acid nucleation has been published in the literature. It has recently become clear that in the past, the experiments have suffered from 1) impurities and 2) imperfect particle measurements. For these reasons, the results from the various studies appear conflicting whereas in reality they probably are not. In terms of Fig. 6 of the present ms, if H<sub>2</sub>SO<sub>4</sub> is kept constant, impurities can cause the experimental curves to shift upward and have a gentler slope than is the case with pure sulfuric acid - water nucleation. On the other hand, imperfect particle detection (i.e. detector sees only particles clearly larger than the critical nuclei) can

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cause the experimental curves to shift downward and have a steeper slope than would be seen with a perfect particle detector (because a fraction of particles is lost to chamber walls before detection, and this fraction is larger when growth rate is smaller). Note that these two deficiencies - impurities and imperfect particle detection - can to some degree compensate.

In the present ms, the authors list a number of past experimental results and just note that the "discrepancies are based on experimental conditions or techniques, such as deficient particle counters or contaminant species). (Note that important results are missing from Fig. 6 that should be added: Sipilä et al., Metzger et al, Kirkby et al.) In order to reduce rather than increase confusion, they should discuss the seemingly conflicting results in more detail. What results might have been affected by contamination, what results might have been affected by insufficient particle detection, and to what degree? What is the additional information from the present experiments? In particular, a detailed comparison to the results of Kirkby et al. should be made.

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