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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Reactive uptake of N_2O_5 to internally mixed inorganic and organic particles: the role of organic carbon oxidation state and inferred organic phase separations" *by* C. J. Gaston et al.

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Interactive comment on "Reactive uptake of N2O5 to internally mixed inorganic and organic particles: the role of organic carbon oxidation state and inferred organic phase separations" by C. J. Gaston et al. Anonymous Referee #2 Received and published: 4 February 2014

The authors have systematically investigated the validity of the Anttila (2006) model for predicting the reduction of N2O5 uptake to ammonium bisulfate caused by organic

components. They have tuned the model to the results of new experimental datasets by adjusting the rate coefficient of N2O5 reaction and its diffusion rate coefficient in the organic phase, as well as a scaling factor for relative solubility/diffusion in the organic layer and aqueous core. Finally they make predictions for the suppression of the uptake coefficient of N2O5 for various O:C ratios and organic mass fractions in atmospheric particles. The presence of certain organics (low O:C ratio) significantly changes the response of N2O5 uptake to changes in RH. This is an interesting study, which advances or knowledge of N2O5 heterogeneous kinetics in the troposphere and may in the future lead to an improved approach to modelling this very important parameter. The authors may wish to consider the following points in revising their manuscript.

Author responses follow each comment and are denoted with **.

1. Please reduce the unnecessary use of acronyms. Ammonium bisulfate has a chemical formula not much longer than the acronym ABS. Also the structural formula of PEG should be given at one point.

**"ABS" has been replaced with "ammonium bisulfate" throughout the manuscript. The structural formula for PEG is now reported in the manuscript.

2. P32059 L5. The surface areas are derived from mobility diameters. Please state the accuracy of the areas thus derived.

**The ability of the mobility diameter to accurately represent the actual particle diameter mainly depends on the shape factor of the particle. Because the aerosol particles generated in this study were mixtures of ammonium bisulfate, the particles are assumed to contain high liquid water contents and therefore to be spherical. Shape factors for spherical particles are unity and thus we expect the mobility diameter accurately describes the true particle diameter in this case.

3. P32059 L24. Laminar flow. Please give the Re number.

**The Reynolds number is now stated in the manuscript.

4. P32060 Eq1. This assumes exponential dependence between "top" and "bottom". Was this observed ? What was the fractional loss of N2O5 ? Please show raw data, at the very least as supporting information if not in the manuscript.

**Figure S1 has been added to the supporting information of this manuscript showing decays of N2O5 as a function of injector position in the presence and absence of ammonium bisulfate particles. Both decays show linear behavior on a log scale indicating an exponential dependence on the N2O5 signal when the injector is at the top and bottom of the aerosol flow tube. The fractional loss of N2O5 was approximately 80%.

5. P32061 L5. Please list the corresponding RH values for each uptake coefficient.

**The RH values are now listed for each uptake coefficient.

6. P32062 L24. Please move the description of F to the manuscript. The reader should have optimal access to important features of the data analysis.

**The equation for parameter F is now in the manuscript.

7. P32065 L22. This observation(s)

**The word “observations” has been changed to “observation”.

8. P32065 L28. : : :possibilities exist for why: : :. There are several possible ways to explain why..?

**The sentence has been reworded as suggested.

9. P32072 L5: : :potentially: : :..

**“Potential” has been changed to “potentially”.

10. The dataset presented in Figure 7 looks convincing, with 1:1 agreement. However, if I have correctly understood the procedure used, this agreement has been achieved by the tuning of the model parameters such as korg for each individual condition. The model does not, a priori, predict these uptake coefficients. Perhaps the use of the word

predict in the y-axis is inappropriate here. The authors should clarify this.

**The reviewer is correct in his/her assessment that the model requires tuning for each condition and does not a priori predict uptake coefficients. We have, therefore, changed the word “predicted” to “parameterized” in Figure 7 (now Figure 8) of the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 32053, 2013.