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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Viscosity controls humidity dependence of $N_2O_5$ uptake to citric acid aerosol" *by* G. Gržinić et al.

**Anonymous Referee #2**

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Review of "viscosity controls humidity dependence of N2O5 uptake to citric acid aerosol" by Grzinic et al.

This paper focuses on the reactive uptake of N2O5 into particles containing citric acid and water as a function of RH. By comparing the measurements of reactive uptake with predictions of reactive uptake, the authors make the case that slow diffusion in citric acid-water particles can limit the overall reactivity of the particles. This study is a nice addition to the literature and should improve the understanding of N2O5 uptake into atmospheric particles. I recommend publication in ACP after the following comments are addressed.

1. If known, please state the deliquescence and efflorescence relative humidities for



citric acid and malonic acid particles.

2. Abstract: Consider changing "since the viscosity of highly concentrated citric acid solutions is not well established..." to "since the diffusion rates of N2O5 in highly concentrated citric acid solutions is not well established,..."

3. Page 21987, line 22-24: Did Lienhard et al. measure viscosities of citric acid and water solutions? If not, consider adding a reference here to the recent measurements of viscosity of citric acid and water solutions by Reid and colleagues for clarify.

4. page 21989, line 4-6: The authors indicate that they used a relative humidity above 15-17% to avoid efflorescence. However, this will only avoid efflorescence if efflorescence occurs below 15% RH. Has anyone measured the efflorescence point of citric acid-water particles? If so, this information should be added. If not, the authors should add the caveat that this RH may not prevent efflorescence.

5. Page 21994, line 7-9: What physical properties may be affected by contamination? Please expand for clarity.

6. Page 21994, line 12-14: Again, I don't think equilibrating the solution droplets from the nebulizer to the lowest RH used in the experiments will necessarily avoid crystallization. Please restate for clarity. Also add the efflorescence point if known.

7. Page 21994, line 25-26: Please indicate the RH range over which citric acid-water particles remain supersaturated based on the previous studies.

8. Page 21998, line 26-27: In Figure 5, are all the malonic acid data determined with supersatured solutions or were some data determined with solid malonic acid particles? This information should be added to the document.

9. Page 21999, lines 12-14: Perhaps I am wrong, but to me it seems unlikely that decoupling can explain the leveling off, since the parameterization based on water diffusion (Lienhard) does not level off. Here I am assuming that water diffusion represents an upper limit to the possible decoupling for N2O5.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 21983, 2015.