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Comment on acp-2022-74

Anonymous Referee #2

Referee comment on "Viscosity and physical state of sucrose mixed with ammonium sulfate droplets" by Rani Jeong et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-74-RC2, 2022

This manuscript details the viscosity measurement of organic-inorganic mixed droplets with varying RH at room temperature and shows better comparison results with AIOMFAC-VISC makes this a solid paper and provides important dataset. This manuscript is very appropriate for ACP and only minor revisions are needed. There are a few points I'd like to ask the authors to consider:

Starting in the Abstract, the physical state performance of organic-inorganic mixed droplets has not been highlighted as viscosity. It's better to show the main part of physical state from the results. In the Introduction, physical state is mentioned by describing the phase transition between liquid and solid state. Does the phase state equals to physical state? Aerosol particles are frequently internally mixed, but also shows phase separation with different state. The use of physical state needs to be clear in the paper.

Line 68: '…the ozone uptake coefficient of semi-solid particles was approximately one order of magnitude less than that of liquid particles…' Is the one order of magnitude very important and show much impact on the further reaction? This sentence did not highlight the importance of phase transition.

2.3 Optical observation of particles during dehydration: It should be notice why the optical observation is needed in the viscosity measurement experiment. It seems to provide direct evidence that when the droplets effloresce and the poke and flow test limitation occurs. This should be mentioned in the discussion part.

Line 215: '…A gradual increase in the viscosities of was observed…' "of" can be removed.

Figure 3: Optical images use different absolute length of white scale to indicate 20 μm among 4 subfigures. It seems that the viscosity measurement detect among 20 -100 μm droplets at random. Does the droplet size influence the measurement uncertainty between bead-mobility and poke-and-flow techniques?

Figure 4: As the author mentioned, the red dots do not cover the ~30 – 40% RH before the cracking RH (~25%) by using the poke and flow technique. Why does the bead mobility method cannot measure the droplets between 30 – 40% RH? It should be the large variation through liquid to semi-solid phase transition, and the bead mobility technique should be able to measure the viscosity up to 10^3 Pa s. It needs to explain here.

Figure 4: "…Mean viscosities shown are the result of bead-mobility experiment with the error along the x-axis direction representing standardization of 3 - 5 beads in one or two particles at given RH." "shown" can be removed.

Figure 4: Does the viscosity measurement of sucrose and AS mixed droplets have the literature results to compare. This organic-inorganic mixed system is common and usually been chosen for lab experiment. More comparison of the viscosity data obtained by different techniques are needed.