



EGUsphere, referee comment RC1  
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## Comment on egusphere-2022-913

Anonymous Referee #1

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Referee comment on "Reconsideration of surface tension and phase state effects on cloud condensation nuclei activity based on the atomic force microscopy measurement" by Chun Xiong et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-913-RC1>, 2022

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This manuscript investigated the CCN activity of the mixtures of inorganic salt and dicarboxylic acid and further determined their phase state and surface tension by using the atomic force microscopy. The results show that the bias between the  $k_{CCN}$  and  $k_{Chem}$  of inorganic salt/AA and inorganic salt/OA can be explained by the surface tension reduction. The study highlights the role of surface tension reduction in evaluating CCN activity. The study is interesting in several aspects. The topic is one that is currently undergoing debate in the atmospheric chemistry and aerosols science communities, and it is of interest to the readership of ACP. The study could be acceptable for publication if revisions are made with consideration of the issues listed below.

One of my major concern is that the measured size of collected particles in this study, which ranged from 0.4-1 $\mu$ m. But, as has been known that, surface tension lowering effect by the surfactants was more important or obvious for fine and ultrafine particles with diameters smaller than 100 nm (Ovadnevaite et al., 2017). As particles grows, the solution is diluted and the surface tension lowering effect becomes weak. So, it would be more meaningful and or with scientific significance if the authors could look at and measure the smaller size particles.

Moreover, in this study, the Kappa closure was conducted by measuring the pure and mixed inorganics and organics. However, the authors measured within the size range of ~50-260 nm as given in Table 2, which is different with the size range when they used for measuring surface tension. So, can the bias between  $k_{CCN}$  and  $k_{Chem}$  based on the larger size explain the effect of surface tension reduction? The surface tension should also dependent on particle size.

In addition, it is not very clear that how did the author get the Kappa values of each individual pure component, some more details are suggested to include in the Method.

Also, it is mentioned in the paper that the surface tension lowering is jointly determined by solubility, deliquescence RH and surface activity, and the influence of solubility is greater. This conclusion is based on the data results that the surface tension of the two dicarboxylic acids (AA and OA) with low solubility decreases significantly at most. At the same time, these two dicarboxylic acids also have the higher deliquescence point and the longer carbon chain. However, the influence of deliquescence point on surface tension has not been discussed in this paper. As mentioned earlier, the particles are already liquid when measuring, that is, fully deliquescence. Is there a causal relationship between the deliquescence point and the surface tension lowering? In addition, does the carbon chain length mean that the surface activity must be strong? The authors may refer some previous studies to further clarify this.