

# **Reply to comments on “Reconsideration of surface tension and phase state effects on CCN activity based on the AFM measurement” by Xiong et al.**

## **Reply to Anonymous Referee #2**

### **Minor comments:**

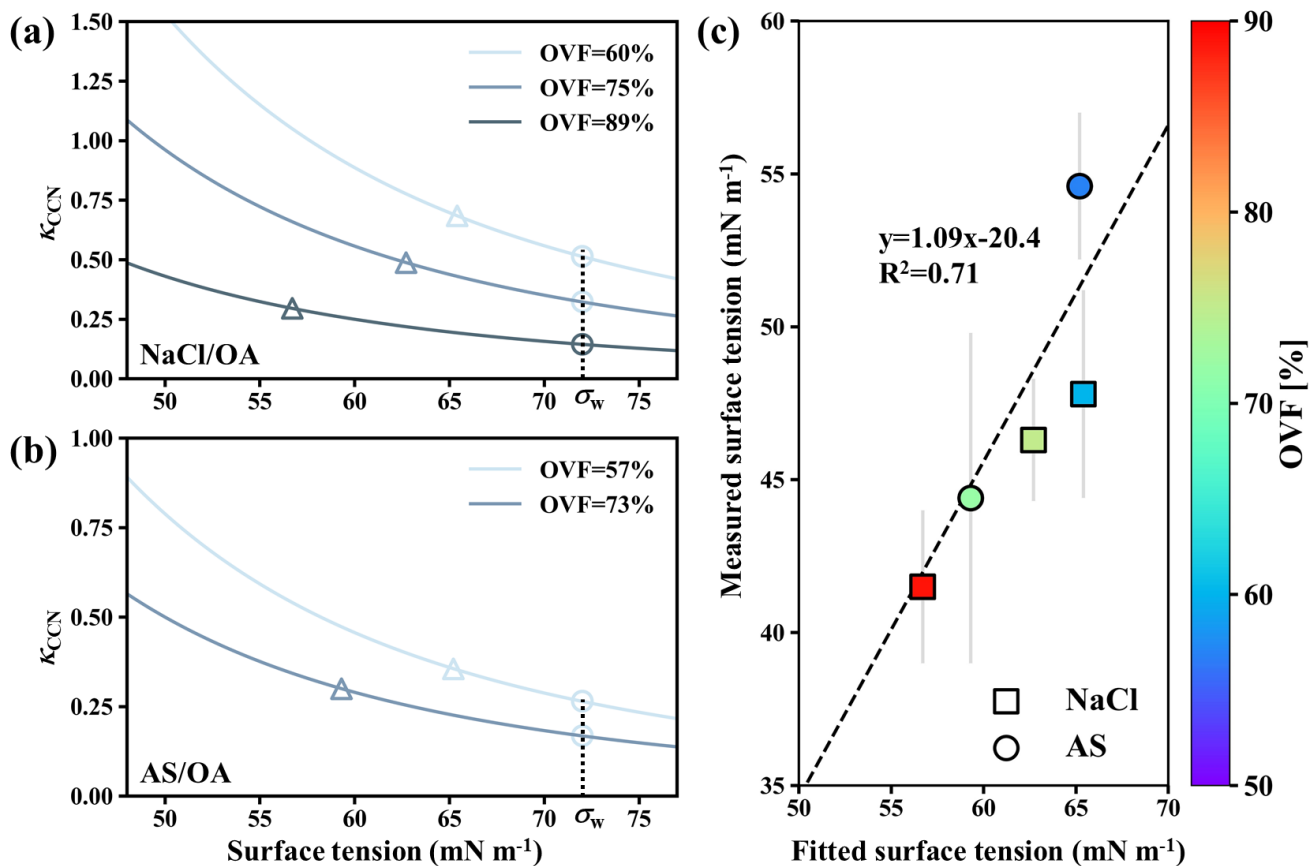
1) Authors revised the manuscript well by considering the most of the comments by the reviewers. The authors provided an excellent response to the major comment by reviewer #2. However, the content is not reflected to the revised manuscript. It should make sense to add the contents to the revised manuscript unless the authors have a significant concern about it. I believe that the revised manuscript will meet the criteria of the journal after adding the content to the manuscript.

**Response: We really appreciate the constructive comments and suggestions raised by the reviewer. As suggested, we have added the response of the major comment to our revised manuscript.**

### **Addition:**

**L273: In order to quantitatively connect surface tension and measured  $\kappa_{\text{CCN}}$ , we used the solubility-involved Köhler model which was introduced by Petters and Kreidenweis (2008), to investigate sensitivity of the measured  $\kappa_{\text{CCN}}$  values on the assumed value of surface tension for inorganic salts/OA systems. As shown in Fig. 7a,**

$\kappa_{\text{CCN}}$  of NaCl/OA with 60%, 75% and 89% OVF derived from solubility-involved Köhler model with water surface tension were 0.515, 0.324 and 0.145 (circles). These values underpredict measured  $\kappa_{\text{CCN}}$  (0.688, 0.485 and 0.296, triangles). However, if modeled  $\kappa_{\text{CCN}}$  values fit the measured values, the corresponding surface tensions should reduce to 65.4 mN m<sup>-1</sup> (60% OVF), 62.7 mN m<sup>-1</sup> (75% OVF), 56.7 mN m<sup>-1</sup> (89% OVF). Similar results were also found for AS/OA systems (Fig.7b). In Fig. 7c, fitted surface tension showed good linear relation with measured surface tensions (slope and R<sup>2</sup> were 1.09 and 0.71). Therefore, our results could provide a quantitative way to predict  $\kappa_{\text{CCN}}$  values of inorganic salts/OA based on solubility-involved Köhler model, by using their measured surface tensions results under high RH. This quantitative method should be tested for more chemical systems in the future.



**Fig. 7**  $\kappa_{CCN}$  vs. assumed surface tension for (a) NaCl/OA and (b) AS/OA systems according to solubility-involved Köhler model presented by Petters and Kreidenweis (2008). The triangles and circles in (a) and (b) represent the measured  $\kappa_{CCN}$  and predict  $\kappa_{CCN}$  by solubility-involved Köhler model. Closure between fitted surface tensions and measured surface tensions (c).  $\sigma_w$  represents water surface tension (72  $\text{mN m}^{-1}$ ).

## Reference

Petters, M. D., and Kreidenweis, S. M.: A single parameter representation of hygroscopic growth and cloud condensation nucleus activity - Part 2: Including solubility, *Atmos. Chem. Phys.*, 8, 6273-6279, 10.5194/acp-8-6273-2008, 2008.