

## ***Interactive comment on “Cloud Condensation Nuclei Activity of CaCO<sub>3</sub> Particles with Oleic Acid and Malonic Acid Coatings” by Mingjin Wang et al.***

### **Anonymous Referee #2**

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#### Overall assessment:

In this paper the effect of coating of oleic acid (low solubility in water) and malonic acid (water soluble) on the activation of particles to cloud drops is investigated. The CCNC experiments seem to be carried out according to present practice and the coating is done with great care.

It is thus disappointing that data evaluation does not meet the same standards. I have mainly identified two areas in which I would have liked to see a deeper analysis:

1) A full Köhler theory treatment based on the chemical composition of the particles would have been useful. A theoretical consideration of the expected changes in kappa values due to the reactions suggested and bilayer of oleic acid would improve the

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paper.

2) Focusing on the coating device temperature in the results section is a bit confusing and I am not convinced about the reproducibility of the experiment, given that the experimental cases are identified mainly by the temperature of the coating device. Focusing more on presenting the mass of organics coated on the particles would improve the paper significantly. Does the coating thickness depend on the original particle size? Can this give more information towards understanding the observations?

Also, there are several cases where the text is not very clear. I have indicated some of them below.

For these reasons I recommend that the paper is not published in its present state, but that it is considered again after major revision.

Detail comments:

In the motivation of the chosen substances: is oleic acid really a good choice for a surface-active compound, considering its low solubility?

On line 179, the residence time in the flow tube is given. However in a laminar flow, the residence time varies with the position, i.e. whether the air passes at the centre or near the walls. Is this effect considered and may it influence the results?

Lines 180 to 185: At first reading it sounds as if the relative humidities given are at 80C. However, in the case of 47% RH, the air would then be strongly supersaturated at 25C. Please clarify the temperature at which the RH is given.

Also, if 47% RH refers to 25C, the RH at 80C will still be very low, just a few percent. How does this influence the experiments?

In lines 228 to 231 proportionalities between AMS signals and organic particle mass and volume are described. Are they observations or assumptions?

Also, determination of the amount of organic coating: If I read the table 1 correctly, and

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make some calculation, the change in diameter and the change in organic mass, do not agree. Is this correct? Why is that?

Line 234 to 235. Have you tried to account for mode shift within the bin, by fitting a function to the distribution?

Line 293: You say “ and our kappa value is somewhat higher but still in this range”. Isn't it just in the range?

Line 298: You say “ The increased kappa value of 0.0008”. Shouldn't it be “The increase in kappa value of 0.0008”?

Line 323: What do you mean by a “significant amount” of coating? Is a coating of less than 2 nm insignificant? In all aspects?

Line 323-325: Unclear expression. Please specify that the sizing according to mobility diameter is referred to (if that is the case) and specify the temperature limit, instead of saying “ a certain value”.

Line 371: Why does the activated fraction level off at 83%? Did you make an intercalibration between numbers in the CCNC and CPC for other compounds?

In section 3.2 there is a lot of repetition, I think. Please see if the text can be made more efficient.

Line 413, the sentence starting with “This suggestion is supported by very low CCN activity of pure oleic acid. ...”. Is this based on some calculations? Please describe.

Line 421 to 423: But the low surface tension does not seem to help the pure oleic acid particles to activate, according to your measurements as well as Kumar et al. (2003) and Broekhuizen et al. (2004). Also, the first “of” on line 422 should be removed.

Figure 6: The fitted curves for 30-60C do not seem to follow the data very well. Why? Have you accounted for doubly charged particles? In my opinion there is a tendency to a two step-function, the first step reaching to CCN/CN of 0.15-0.2.

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