

## ***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 #1**

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The CCN activity of CaCO<sub>3</sub> particles with oleic acid and malonic acid coatings was investigated in this study. The results show that oleic acid coating and malonic acid coating have different impacts on the CCN activity of CaCO<sub>3</sub> particles. This can be attributed to the amphiphilic property of oleic acid in contrast to the high water solubility of malonic acid.

Indeed, malonic acid behaved as expected, with small amounts drastically impacting the CCN properties of CaCO<sub>3</sub> particles, with some impact of ageing processes involving water.

The behavior of oleic acid is more surprising, first suppressing or reducing the CCN properties for very thin coatings, and then enhancing them at multilayer coverages. This is tentatively explain by a kind of a bilayer being formed on top of the CaCO<sub>3</sub>

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particles, first exposing the hydrophobic tail to water (reducing effects) and then the carboxylic end groups (enhancing effects). This is a quite interesting effect, showing non-linear impacts of the coatings on the CCN properties.

This topic is therefore fully suitable for publication in ACP, and I would recommend its publication once the authors have dealt with the following points. I also underline that I'm not an expert in CCN properties measurements.

- Overall the paper is nicely illustrated but it contains some repetitive text blocs, especially in the result section, that could be avoided in order to ease the reading of this manuscript (and reinforcing also its content).

- While the argument of a bilayer of oleic acid does make sense, I'm still puzzled by the fact that the CCN properties are apparently higher for a coated particle compared to a pure oleic acid particle. I would have simply assumed that once thick enough, the water probing the surface does not see the core CaCO<sub>3</sub> particle (over the time scale of these experiments). In this situation, the pure oleic acid particle would exhibit a kind of upper limit for water adsorption and droplet activation. Maybe the authors could comment more on that, and maybe add the pure oleic acid data on their figures (this would ease the comparison with both systems).

- If my reading is correct, the CaCO<sub>3</sub> particles with a thick coatings do exhibit better CCN properties than the pure oleic acid particles (if my reading is incorrect, this would highlight that an in-depth editing would be beneficial for the reader). How can you explain such a fact? Is the CaCO<sub>3</sub> surface leading to some kind of ordering of the adsorbed organic acid (which might not be observed in the pure homogeneous organic particle) leading effectively to the above mentioned bilayer structure?

- Is the temperature in the coating device leading to some kind of ordering (for instance, by increase surface mobility before an ordering when cooling down)? Also, oleic acid has only a moderate thermal stability as it decomposes at higher temperature (typically at temperature at a factor 2 higher than those used here), potentially via an epoxide

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pathway in presence of air (and enhanced by light or metallic traces). Could traces of oxidized products nevertheless affect the composition of the coating at 80°C already? If so, then this effect should increase with time. Did the authors observed any variation with time of kappa at 80°C? Did the authors tried to have thicker coatings at lower temperature by changing the gas flow conditions in their coating device?

- Line 238. This sentence is unclear.
- Line 249: where a polydisperse
- Line 296: remained at

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