

Interactive comment on “Morphological transformation of soot: investigation of microphysical processes during the condensation of sulfuric acid and limonene ozonolysis product vapors” by Xiangyu Pei et al.

Anonymous Referee #2

Received and published: 20 February 2018

The authors present data on measurements on the mass equivalent and mobility size of fresh and coated soot particles, which is then interpreted using a framework that can explain the sequential transformations observed. The theoretical treatment is interesting and useful, and the conclusions are for the most part consistent with the data analysis. The subject is very suitable to ACP, and therefore I would suggest publication of the paper. There are some corrections and clarification that need to be made before publication, and I have also a few suggestions to improve readability.

Abstract (and conclusion): In the abstract, it is stated that the dynamic shape factor

C1

of fresh soot was in most cases ca. 1.1; this is also stated in the conclusions. This is clearly wrong, as none of the values reported e.g. in Table 1 are even close to 1.1. Please correct.

Abstract (p2, l11): I'm not sure that it is correct to say that this is the first study to track microphysical changes in situ, as e.g. observations of changes in soot effective density have been made for a long time.

p 4, l34: "(ii) volume equivalent inclusive of internal voids": just to clarify; are the internal voids assumed to be part of the particle volume, but external voids are not? If yes, this could be clarified in the explanation of the framework to make following it easier.

p7, eq. 8; when calculating the mass equivalent density of a particle, which density is used? Does this translate also to the mass equivalent coating thickness? This could be useful to indicate, because a person using the framework will not know which density (effective, sulfuric acid, SOA, etc...) to use.

p9, l9; I did not fully understand what the difference between the nominal and actual mobility diameters are. They are selected with the same instrumentation and if nothing is done to the aerosol in between, they should be the same? Please clarify.

p9, l17: I'm a little bothered by the use of 'preferentially' in the paper. If I understand the text correctly, the open voids are filled first (shown by horizontal lines in figs (4), and then the particles start to grow. Are the internal voids filled at all? To my understanding, the internal voids are assumed to be left open (in the framework at least). This could be stated more clearly.

p11, l 27: "The black, red, and green colors in each pie chart represent the mass fraction of black carbon, sulfuric acid, and organics, respectively". How were these mass fractions obtained? Also, this information should be in the caption.

page 12, l25: Move the part starting with 'We assume...' and ending with 'in this work'

C2

to the start of the explanation of the framework, as it will clarify the explanation better than here.

page 12, line 33: The phrase step-wise filling is often mentioned. I understood that there are basically two steps: void filling, and subsequent growth. Are there more? The collapse of the structure is also mentioned at some point, but this is not shown in Fig. 2. I would suggest that the actual steps are explicitly marked and named in at least one of Figs (4), preferentially all. Also, they should be explained in more detail in the captions.

Page 15, line 20-22: ...“ This may introduce some shift in the mapping of the mass and mobility size, leading to overestimation of Δr_{me} .” I don't really understand how the continuous growth causes a shift in the measured mobility or mass; please clarify this. Also, is there a reason why the soot differs so much in the internal/open void properties between the present and literature studies in Table 3?

Conclusions, p. 17, l21: '...this is the first study that considers the effect of of coatings with two chemical components'. Is there any conclusions drawn on the effect of the different components, and which properties cause these differences? I could not find these, and as this is not the main purpose of the paper, maybe this sentence could be changed.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-769>, 2017.