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## ***Interactive comment on “Internally mixed soot, sulfates, and organic matter in aerosol particles from Mexico City” by K. Adachi and P. R. Buseck***

**Anonymous Referee #2**

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General comments:

This paper discusses observations of internally mixed soot, sulfates and organic matters in and around Mexico city, indicating single particles come from multiple sources; the organic coating can change the light absorption property of soot particles and the attachment of sulfate to soot particles makes them hydrophilic, these results contribute to the properties of Mexico city aerosols and are useful for model calculation. However, some results need more analysis and some concerns need to be addressed. The paper also includes a large amount of speculation about sources, lifetimes, and impacts, that is probably beyond the scope of its findings. Furthermore, much of the language is very casual and lacks clear definitions in the literature.

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- 1) Does the paper address relevant scientific questions within the scope of ACP? Yes.
- 2) Does the paper present novel concepts, ideas, tools, or data? Yes, this paper presents novel data.
- 3) Are substantial conclusions reached? Yes, but some conclusions may need more analysis or proofs, see specific comments.
- 4) Are the scientific methods and assumptions valid and clearly outlined? Yes.
- 5) Are the results sufficient to support the interpretations and conclusions? Some conclusions may need more interpretations, see specific comments.
- 6) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes.
- 7) Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Most of them yes. See specific comments.
- 8) Does the title clearly reflect the contents of the paper? Yes.
- 9) Does the abstract provide a concise and complete summary? No. Some parts of the abstract should be put into introduction section.
- 10) Is the overall presentation well structured and clear? Yes.
- 11) Is the language fluent and precise? Yes.
- 12) Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes.
- 13) Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? No.
- 14) Are the number and quality of references appropriate? Yes.
- 15) Is the amount and quality of supplementary material appropriate? Yes.

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Specific comments:

Page 3: OM should be defined.

Page 3, line 13-22: This discussion is a throwback to 10 years ago, before our field progressed to the current clear consensus that atmospheric particles are not represented by either a "simple external mixture of pure components" or a "single internal mixture in all particles." A review of recent literature would show this, and the authors clearly need to incorporate those references here. Their argument here needs to account for the realities of multiple types of different internal mixtures using clear and precise language on this topic. The current discussion obfuscates the issue with vague and overly simplistic terminology that ignores 5 years of published, peer-reviewed progress by models and measurements (by groups that include their own). The continuing failure of models to reflect this complexity is not their lack of knowledge of its existence, but the limitations associated with computing power for large models.

1 Page 5, line 23, for sample #14, the distance from MC of is 286 km, why is it considered an "MC" sample while the criteria is that "MC samples are from within 80 km of the city center"?

2 Page 6, line 26, it says "OM commonly coats the surface of soot, sulfates"; Figure 5 shows soot with coating accounts for 55% of all particles studies; in the conclusion section, line 23, "sulfate commonly attaches to OM and soot particles"; coating and attachment mean the components are not really mixed, are coating and attachment equivalent to internally mixed?

3 Page 7, line 3, the authors identifies tar balls, is "spherical shape"; the only criteria of identifying tar balls? This may not be enough.

4 Page 9, line 24-25, "the peak of the distribution for internally mixed OM-S coatings from the MC samples is smaller than that from particles collected outside of

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MC&#8221;, what is the reason of this?

5 Page 9, Line 26, &#8220;Where OM-S coats soot, the particle sizes are larger than those without soot.&#8221;, but from Figure 4 (upper panel), the particle sizes of &#8220;coating in internal mixture&#8221; is smaller than soot in internal mixture.

6 Page 10, &#8220;particles become more compact during aging,&#8221; is not appropriate, since the aspect ratios are very close, and the standard deviations are big. Also, the author mentioned the liquid particles spread on the grid, how much error does this cause in calculating particle diameter?

7 Page 11, line 11, &#8220;we conclude that the rate of coating was rapid&#8221;: the life time of the particles of diameter 300 nm can be as long as several days, so the particles collect are not necessarily fresh, this conclusion is not appropriate.

8 Page 11, line 19-20, &#8220;A possible explanation is&#8230;&#8221;, is this observed from TEM images?

9 Page 11, line 21, &#8220;Light absorption of soot is enhanced when it is coated by OM-S.&#8221; why is that? Should cite some references here.

10 Page 12, line 12-13, &#8220;K occurs in more than 60% of the particles, most of which are sulfates.&#8221; How is this conclusion reached? Is there other measurements? Since on Page 7, line 10-11, it says &#8220;our sulfates were neutralized by ammonium&#8221;.

11 Page 12, it says &#8220;Biomass burning is one of the most important sources of aerosol particles in MC&#8221; (line 9) and &#8220;K occurs in more than 60% of the particles&#8221; (line 12), but as a result this study observed &#8220;relatively low biomass-burning contribution&#8221; (lines 25-26), and the tar ball fraction is small (Figure 5), do these statements contradict?

12 In some sections, the authors didn&#8217;t clearly indicate their own new/original contribution, for example, on Page 13, &#8220;sulfate implications&#8221; section,

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there is no proof from the data from this study to confirm how sulfate coating changes the particle property; also on Page 14, line 1-7, these conclusions are not from the analysis of data of this study.

Moreover, soot occurs in more than 60% of all particles in the MC plumes, suggesting its important role in the formation of secondary particles; does this conclusion really follow?

Technical corrections:

In the abstract, lines 1-7 can be put into introduction; lines 13-15, "Coatings on particles"; and lines 17-18, "Through changes in particle size", these statements are only implications and are not direct from the data.

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 9179, 2008.

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8, S3374–S3378, 2008

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