

## ***Interactive comment on “Direct observations of organic aerosols in common wintertime hazes in North China: insights into their size, shape, mixing state, and source” by S. R. Chen et al.***

**Anonymous Referee #2**

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The manuscript presented the physicochemical characterizations of aerosol particles collected during haze events in China from single particle analysis using TEM, AFM, and nanoSIMS. Based on the characteristics of particles analyzed by TEM, the manuscript discussed the classification of particles and their size, morphology, and mixing state with complement analysis from AFM and nanoSIMS. The manuscript then discussed the transport and aging of particles and their possible sources. The subjects of this manuscript are within the scope of ACP. The following comments should be addressed before it can be considered to publish in this journal.

General comments:

1, Although the observations of individual particles probed by TEM can provide cer-

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tain information to relate to the sources, the conclusions regarding the exact sources should be carefully evaluated. It could be expected that the sources during such haze events are complicate. To exclude the other sources and limit it to residential stove emission, additional information is needed to support such conclusion. For example, as discussed in the manuscript, there are two particle types, OM-fly ash and OM-sulfate(K)-fly ash as shown in Figure 5, what are the possible sources of these fly ash containing particles, what are the composition of these fly ash? Is it possible that these are from coal-fired plants or industrial emissions? In Line 142, as indicated by the authors that S1 can be influenced by the industrial emissions. The statements regarding the sources in Abstract and Conclusion section should be reworded if no further supporting evidences is provided to constrain the sources.

2, The Introduction and Conclusion sections should be revised. In the Introduction section, there is a long discussion between the severe haze and L&M haze events and their differences, but later there is no comparison or further discussion in the main text. This part should be shortened. It may be beneficial to reader or to the context to focus more on single particle analysis or source characterization. The Conclusion and Atmospheric Implication section can be more concise and focus more on the findings from these observations. For example, the discussion of BrC and the implications, for such discussion should be limited to a certain extend unless data are provided showing the OM particles are BrC.

3, The classification of the particle types is not very clear and straightforward in the current form. It is suggested to add a figure or table to describe how the particles are grouped. Some definitions are not consistent. For example, the “OM-coating (type 6)” in L33, “C-dominated” in L230, “OM-containing particles” in L237, “OM coating” in L269, these terms are confusing and not consistent throughout the text. In Figure 3 (e), the type 5 dispersed-OM is very similar to the particle in Figure5(d) which was bleached by the beam, why it is classified as OM particle which seems to have S and K? In Figure 3, for the type 6, what is the chemical composition of cores? Should type

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6 belong to OM internally mixed particles as showing in Figure5?

Specific comments:

1, L31, use “morphologies”?

2, L37, what does “cooling, polluted plumes” mean?

3, L38, what kind of detector is used for EDX analysis? Please justify the use of “Si-O-C ratio” to estimate to contribution of coal combustion.

4, L44, “aerosols” means “particles and gases”

5, L46, use “to” instead of “into”?

6, L58, the sentence should be revised.

7, L61 , “Poschl” should be “Pöschl”

8, L70-71, It is suggested to use “Ministry of Environmental Protection of People’s Republic of China” . I guess the Ministry of environmental protection is not monitoring the PM2.5 by itself. Please revise the statement.

9, L73, please use the right document citation, what is “HJ 663-2012”?

10, L75-76, use “associated with different levels of PM2.5 concentrations and RH”?

11, L93, delete “been”

12, L94 delete “their”

13, L98 delete “different”

14, section 2.1, more details should be provided regarding the sampling procedure and sample sites. What was the sample height at each site, what about the sampling time and duration?

15, L155, use “represent” instead of “display”

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16, L163, the impactors are used to collect particles not aerosols

17, L168, one sample for each day was analyzed? What is the sampling duration for each grid?

18, L174, use “acquired”?

19, L183, what is brand and model for NanoSIMS?

20, L218-221, it is not clear what the authors try to discuss. Please revise.

21, L253, please revise how the reference is cited.

22, L301-302, The sentence is not clear.

23, L318, there is no sufficient evidence to support this conclusion.

24, L326-331, this section should be carefully revised as discussed in the General Comments.

25, L333, what is the EDX detector; detector background may contribute to Si signal?

26, L339, as it is shown in Figure 8, the ratios are not following the lines, the data points are sort of deviating from the lines. Please discuss in more details.

27, L363-365, This is not very clear. Considering the scattering of the data points, is it significantly different among these three cases? It would be more straightforward if coating thickness is calculated and compared among these sites with statistical test.

28, L368, the statement is not convincing if only consider the number fractions of type 6 OM particles.

29, L393, “in other words”?

Figure 1, are the two black lines for each site indicating the range of the backward trajectories?

Figure 6, it is not easy to distinguish the green colors for the OM-soot and OM-soot-

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sulfate.

Figure 9, "OM coating", do you mean "OM-coating particles"?

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