Atmos. Chem. Phys. Discuss., 10, C12303–C12306, 2011
www.atmos-chem-phys-discuss.net/10/C12303/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterization of individual aerosol particles collected during a haze episode in Incheon, Korea using the quantitative ED-EPMA technique" *by* H. Geng et al.

H. Geng et al.

curo@inha.ac.kr

Received and published: 13 January 2011

First of all, we deeply appreciate the reviewer's review and very valuable comments on our manuscript, which helped very much to improve our manuscript.

Comment 1. Page 26646, the classification information was briefly mentioned, which is not very clear to me how the authors assign different types of particles, especially regarding the differentiation between carbonaceous particles and (NH4)2SO4/NH4HSO4 containing particles. It seems that both particles may contain more than 95% atomic fraction of C+O+S as discussed on page 26648. If the authors also used particle morphology information to distinguish the particles, which seems to be the case, a little

more clarification is necessary. An additional table about the classification rules used in the work would be helpful.

Reply: Thank the reviewer for the suggestion. Following the comment, we made an additional table about the classification rules used to identify the different types of particles. Please see the present Table 2.

Comment 2. The statement about the two types of organic carbon on page 26648 seems speculative. I wonder if there are more evidences or literature data to support it.

Reply: Since the presence of hydrogen fails to be detected in EPMA, it is difficult to exactly distinguish organic compounds by this method. There are few literatures about classification of organic carbon by the way of electron microscopy such as SEM and EPMA, to our knowledge. Herein, relying on our observation of many carbonaceous particles containing high concentrations of C and O, we made a further classification based on their morphology. One is a type of particles which are solid and look bright and angular on their SEIs, likely primary or water-insoluble secondary organic particles (maybe a few biogenic particles are included); the other is a type of particles which are liquid droplet and look dark and round on their SEIs, likely water-soluble secondary organic aerosol (WSOA). These classification seems speculative, but we think it is all what we can get from EPMA and SEI data. However, respecting the reviewer's comment, we change the name of first type to "water-insoluble or solid organic particles", in order to match with the name of the second type: CO/COS-rich droplets. Please see the present Table 2.

Comment 3. On page 26649, the authors state that holes observed on the particle from secondary electron images. X-ray analysis showed that N signals were very low due to apparent beam damage and vast majority of signals were actually from C+O+S. The authors assigned those particles as (NH4)2SO4/NH4HSO4-containing ones seemingly based on morphologic information only. Is that conclusive? What is typical electron

beam scanning time? Have the author tried to lower the scanning time or the electron voltage to reduce beam damage so that N signals may be acquired.

Reply: In the revised manuscript, the contents on previous page 26649 were deleted. Some of them were removed into the present Table 2. Further research will be done in the future about how to exactly distinguish (NH4)2SO4/NH4HSO4-containing particles by the ED-EPMA.

Comment 4. On page 26649, the atomic concentration ratio of [Na]:[Cl] close to 1:1. Did the authors make any ZAF corrections for the quantification? The concentration ratios of [Na]:[Cl] in NaCl based on energy dispersive X-ray microanalysis have been known to be dependent on particle size. For typical micron size particles as shown in the figure 3, the [Cl]:[Na] is usually close to 1.10-1:15. The ratio reported in the paper close to stoichiometry is sort of surprising.

Reply: In order to obtain elemental concentrations from the X-ray spectral data, we performed a quantification procedure based on Monte Carlo calculation which makes ZA corrections together with particle size correction. About this quantification procedure (providing relative accuracy less than 12%), several references are given in the text (please see the section, 2.2. Data measurement and analysis).

Comment 5. On page 26650, for particles containing Al, how the authors distinguish its signal from the Al foil background contribution?

Reply: We corrected the influence of Al substrate to the first approximation. I.e., the intensity ratio of Al/Si is 0.55 $\pm$0.06, obtained from about 2000 AlSi-containing particles collected on Ag foils in our previous studies, is used for the correction; the part of Al intensity greater than the "Si intensity $\times$ 0.55" is regarded from the Al substrate. As we described this correction in our previous papers (e.g., Geng, H., Jung, H.-J., Park, Y., Hwang, H., Kim, H., Kim, Y. J., Sunwoo, Y., and Ro, C.-U.: Morphological and chemical composition characteristics of summertime atmospheric particles collected at Tokchok Island, Korea, Atmos. Environ., 43, 3364-3373, 2009a (listed in the reference), we did

not include this thing in the text.

Comment 6. The discussion on page 26654 seems very generic and applicable to many cases. More concise and specific explanation is recommended.

Reply: It is right. We made great modification on the discussion and deleted many sentences that are generic and applicable to many cases. Also, please see the response to the 21th comment of the Reviewer 1.

My remaining comments are minor: 1. In line 24 on page 26642, the period was improperly used.

Reply: It was a typo that was avoided in the revised version.

2. The labels in the figure 3 seem a little crowded. It may be helpful to only keep the particle numbers and have particles information tabulated.

Reply: We found that the labels of the particles beside their SEI would be more helpful for readers, although the figure seems crowded as the reviewer pointed out.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 26641, 2010.