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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observation of nitrate coatings on atmospheric mineral dust particles" *by* W. J. Li and L. Y. Shao

W. J. Li and L. Y. Shao

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We thank referee#2 for his/her constructive comments. They have been useful in improving the manuscript. We have modified our manuscript in response to these comments.

Q: Comments from referee; A: Answers from author; Italic sentence: New sentence or revised sentence.

(**Q1**) In my opinion, it would be very important to show the major core types (e.g. table rows: Si-rich=quartz, Si-Al-rich=aluminosilicates such as clays and feldspars or hornblende, Ca/Mg-rich=dolomite, Ca-rich=calcite, Fe-rich=hematite) and the major

coating types (table columns: Ca-rich, Mg-rich, Na-rich, K-rich and S-rich) at a new table. That kind of table would give an interesting and clear general view on the association between core and coating types. The values at the table could be given in percent but it would be necessary to mention the total number of particles analyzed, as was also mentioned in F. Dulac8217;s comments. How many particles were analyzed from each sample? The other comments from F. Dulac were also important, and I hope that they are considered carefully. If the number of particles is quite low (e.g. 300-500 particles), it might be reasonable to show it even in the abstract.
(**A1**) Thank you for your suggestion. One table suggested by the referee was added in the paper. We made changes about number of particles measured in each sample.
Secition2.3:*Mineral particles with various sizes in the chosen samples were observed at different magnifications ($\times$2550 to 40,000) using TEM. There were between 10 and 40 mineral particles measured in each haze sample.*
Abstract:*Sizes, morphologies, and compositions of 332 mineral dust particles together with their coatings were analyzed using transmission electron microscopy (TEM) coupled with energy-dispersive X-ray (EDX) microanalyses. Structures of some mineral particles were verified using selected-area electron diffraction (SAED).*

(**Q2**) It would be necessary to mention that analysis on nitrogen is very difficult with EDS and that semivolatile compounds are lost in conventional electron microscopy. For instance, Fig. 4 demonstrates that peaks for N are very low in the EDX spectra. Is it possible to reliably compare elemental results between this work and Laskin et al (2005) in Fig. 6? The elemental ratios might be different due to analytical differences (differences in the sensitivity of EDS, accelerating voltage, vacuum strength, the coating material of TEM grids). At least it would be very important to mention that the elemental results are semiquantitative, especially for light elements.
(**A2**) I agreed with referee#2's s suggestion. We made $CaCO_3$ and $Ca(NO_3)_2$ samples in laboratory. Their elemental compositions were described in Fig. 6. One sentence suggested by the referee was added.

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Interactive Comment

Section 2.3: *EDX results are semiquantitative, especially for light elements, such as C, N, and O. Because EDX spectra were affected by carbon film and copper grids, C and Cu were not calculated in our study. Inorganic components from mineral dust particles were considered.*
Fig. 6. Ternary diagrams showing EDX data of elemental compositions of Ca-rich coatings of 236 mineral particles. Reference areas represent the elemental compositions of laboratory generated $CaCO_3$ (red ellipse) and $Ca(NO_3)_2$ (blue ellipse) particles. All the particles were analyzed in the same TEM system with very close conditions.

(**Q3**) Is it possible to reliably analyse N content difference between the cores and coatings for Ca-rich and Ca/Mg-rich particles because those cores might (potentially) also contain N?
(A3) We can control beam scale to exactly measure coatings instead of the whole coated particles. Therefore, EDX measure affects elemental compositions of coatings instead of cores.

(**Q4**) Could it be possible that some of those cores have also been in liquid form during transport if RH has been high, and therefore, the whole particle have been subject to the substitution of carbonate by nitrate or sulphate?
(**A4**) It is possible. We found some particles in one sample which only include $Ca(NO_3)_2$ or the mixtures of $Ca(NO_3)_2$ and $CaSO_4$. The particles only occurred in one of our samples.

(**Q5**) Page 19251, rows 7-10: This sentence is too long and unclear. It would be reasonable to separate it into two parts. "Fresh mineral dust particles in the troposphere are far more inert than chlorides, sulfates, and nitrates. When aged by soluble aerosol components, mineral dust particles will have enhanced their hygroscopicity

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and altered their sizes and shapes (Krueger et al., 2003; Krueger et al., 2004; Laskin et al., 2005b)."
(**A5**) Corrected

(**Q6**) Page 19251, row 17: The year is missing from Krueger et al.
(A6) Corrected

(**Q7**) Page 19252, row 11: Semi-colon is missing between Johnson and Niemi.
(**A7**) Corrected

(**Q8**) Section 2.2: It would be good to add short description of the sampling site (urban background or traffic site, height above sea level?).
(**A8**) We added the short description about the sampling site.
Section 2.2: *The collection site (39°59'N, 116°20'E) was located in the northwest of Beijing around 1 km from the fourth ring road of Beijing city. The height of the collection site was 60 m above sea level. Samplers were mounted on the top of a building located at the China University of Mining and Technology, 18 m above ground. The campus is surrounded by residential houses and a shopping center.*

(**Q9**) Page 19253, row 25. It would be good to mention that ELEMENTAL compositions were determined with EDS.
(**A9**) Corrected

(**Q10**) Section 3.2. The current structure of the section was a bit unclear during first reading. The clarity could be increased by adding the names of each coating types at the beginning of each paragraph. The names of the coating types could be underlined.
(**A10**) We added the bold names of the coating types at the beginning of each

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paragraph.

(**Q11**) Fig. 1. Where the RH was measured? Are these modeled results from transport routes or local measurements during sampling day?
(**A11**) RH values were obtained from HYSPLIT model. These modeled results are from transport routes.

(**Q12**) Fig. 4. It would be nice to show the spectra at the same order as they are described in the section 3.2.
(**A12**) Corrected

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 19249, 2008.