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Interactive comment on “TEM analysis of the internal structures and mineralogy of Asian dust particles and the implications for optical modeling” by G. Y. Jeong and T. Nousiainen

Anonymous Referee #2

Received and published: 29 March 2014

General comment

This manuscript reports detailed mineralogy of selected Asian dust particles and their implication to the optical properties by considering their internal structures. They found many dust particles include pore and light absorbing components such as iron oxide, both of which are optically important. They conclude such internal structure will affect the particle optics and should be considered for optical calculations. This manuscript is well written, and the detailed TEM analyses well characterize the mineralogy of the particles. Although the very detailed mineralogical analyses may be out of the scope of most readers of this journal, the implication would be useful to the atmospheric science.

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Specific major comments

1. Throughout the manuscript, the descriptions of particle mineralogy are detailed but, I believe, most readers in the atmospheric field have little knowledge about mineralogy. The mineralogical descriptions should be written in general terms so that readers in atmospheric science can understand. For example, I suggest writing general chemical formula of each mineral so that readers can have idea about their chemistry.

2. This manuscript shows examples of selected Asian dust particles, most of which are larger than 10 micrometer. The discussion in this manuscript mainly based on such large dust particles, although they are small number fraction within all dust particles (Jeong et al., 2014; ACP). I question the significance of these large particles having relatively small number concentrations to the atmospheric aerosol optical properties. In general, atmospheric number concentrations are important as well as volume concentrations. Also, dust particles with several micrometer or smaller were more abundant in their samples (Jeong et al., 2014) and may not neither have pore nor polycrystal structure that are proposed in the current paper. I believe further discussion regarding particle sizes including smaller but more abundant dust particles will be needed to clarify the implication of this study to ambient optical modeling.

3. I am unsure if small pores (< 1 micrometer) within such large particles ($>$ several tens micrometer) indeed have an effect to their optical properties. When dust particles are large enough (tens micrometer), the solar radiation may not be able to penetrate inside the particles. A simple core-shell calculation suggests that small core (pore) within large particles have negligible effects on the optical properties of the entire particles, depending on the choice of refractive index. Note that discrete dipole approximation (DDA) method (Page 6639 line 22) will not be available for large particles such as those used in this study (Draine and Flatau, 1994). As author said further investigations do need to confirm the effects, I would like to see more quantitative discussion.

Minor or technical comments

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1. P6620, L6-8: This sentence contradicts to that in P6622 (L1-6). For example, Jeong et al (2014) reported mineralogical composition of individual particles. In abstract, it says there have been many reports on the microphysical characterization, whereas in Introduction, it says the microphysical properties of individual particles have not been fully resolved.

2. P6620 L 25-28: “likely have a great impact”: This statement is qualitative, and no evidence is shown if they have a great impact. Please see Major comment 3.

3. P6623 L18-19: I think there is at least one report by Jeong et al. (2014), who reports internal structures of dust particles.

4. P6627 L25-26: Why they are unlikely to have formed?

5. P6632 L19-21: I guess Iberulite, which is formed from mineral aggregates within rain droplet in atmosphere, may be one of potential formation process of the clay-rich particles.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 6619, 2014.

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