Supplement of

Cloud scavenging of abundant anthropogenic refractory particles at a mountain site in North China

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AFM analysis

Three-dimensional morphology of aerosol particles was acquired by an atomic force microscope (AFM, Dimension Icon, Veeco Instruments Inc., USA) with a tapping mode under ambient conditions. When conducting the AFM analysis, parameters were set as follows: imaging force between 1 and 1.5 nN, scanning rate between 0.5 and 0.8 Hz, and scanning range size at 10 μm with a resolution of 512 pixels per length. Bearing area (S) and bearing volume (V) of each analyzed particle were obtained by the NanoScope Analysis software (Version 1.50, Bruker Corporation, USA) and then ECD and equivalent spherical diameters (ESD) were calculated according to S and V, respectively. By plotting ESD versus ECD, we found that ESD and ECD had a robust linear relationship (Fig. S1, ESD = 0.4952×ECD, r^2 = 0.9782). Therefore, the ECD of individual aerosol particles measured from the iTEM software can be further converted to ESD through the linear regression equation.

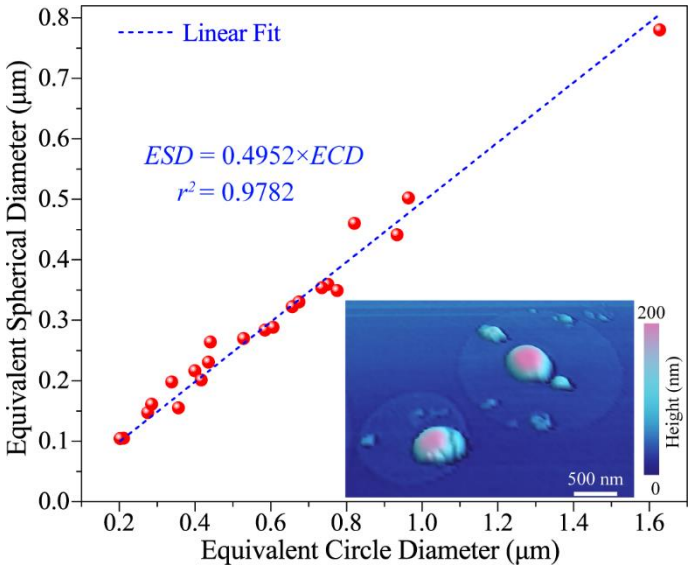

Figure S1. Plot of equivalent spherical diameter (ESD) versus equivalent circle diameter (ECD) of individual dry particles on the substrate analyzed by atomic force microscope (AFM). The AFM image shows the morphology and large rims of two cloud residual particles.

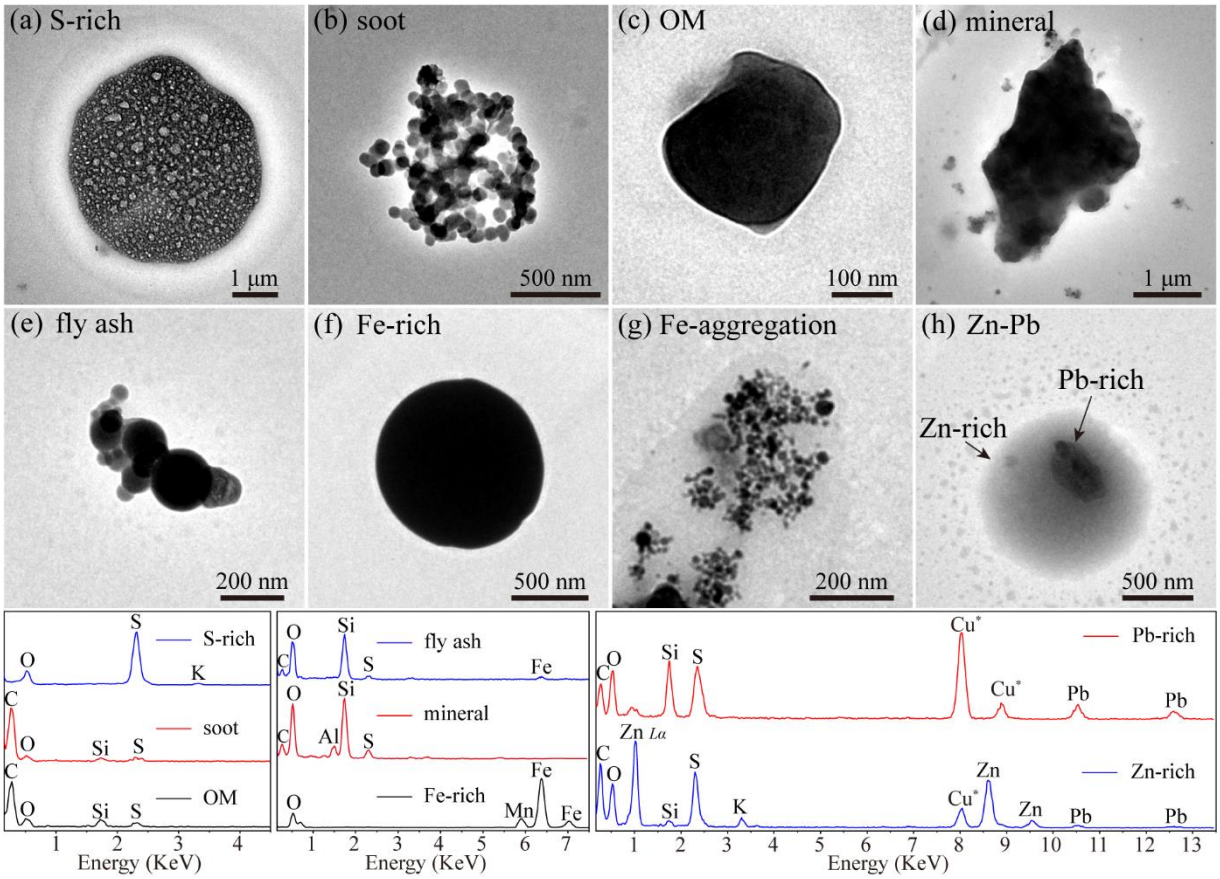

Figure S2. Typical TEM images and EDS spectra of different basic particle types. (a) S-rich, (b) soot, (c) organic matter (OM), (d) mineral, (e) fly ash, and (f-h) metal particles including Fe-rich, Fe-aggregation, and Zn-Pb.

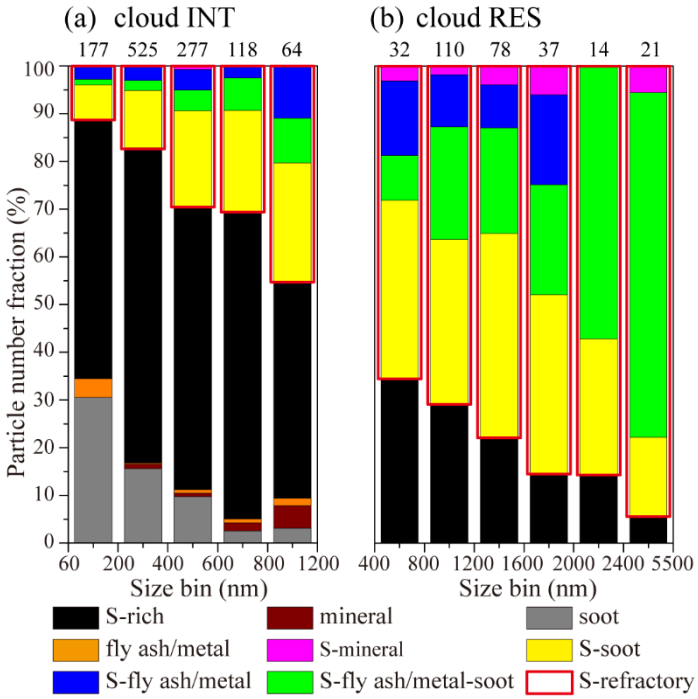

Figure S3. Size-resolved number fractions of different particle types in cloud RES and INT particles. The number of analyzed particles in each size bin is shown above each column. In total, 292 cloud RES and 1161 cloud INT particles were analyzed.