

Interactive comment on “Quantification of black carbon mixing state from traffic: implications for aerosol optical properties” by M. D. Willis et al.

Anonymous Referee #3

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This study presents measurements of the mixing state of black carbon (BC) containing aerosols from traffic-related emission sources in urban environments using a soot-particle aerosol mass spectrometer. BC particles from fresh vehicle emission were found to exist in two distinct particle types: BC-rich and hydrocarbon organic aerosol (HOA)-rich particles, with most of the detectable refractory BC mass in the former type. The effect of BC mixing state on the optical properties (i.e. single scattering albedo, or SSA) was assessed using a particle-resolved box model constrained by observations. It was concluded that accurately presenting the BC mixing state is critical in estimating the particle SSA and thus aerosol direct radiative forcing. The experiments were carefully carried out and the data processing and analysis are well performed. The paper is generally well written but lack some of details about the measurements and discussion

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on the uncertainties, some of which are provided as supplemental materials. I recommend publishing this paper on ACP after minor revision. My specific comments are listed below for the authors to consider.

Page 33557 Line 10: define “HOA” in the abstract.

Page 33562, Line 5-7: Please be specific about “these calculations”.

Page 33563 Line 19: define “HOA” as this is the first time this term appears in the main text. Also I suggest that the authors briefly mention the speciation of the organics in Section 2.1 (e.g., in page 33561, line 14).

Page 33564, Line 13: are the BC particles in rBC-rich particles coated only with HOA-material? This statement sounded so but Figure 3 shows that there certainly are other types of coating materials such as nitrate and sulfate aerosols, which are often neglected in the discussion. For example, in Section 3.3, the effect of other (inorganic) coating materials on the modeled bulk particle hygroscopicity should also be discussed.

Page 33565, Line 11: It is stated that mfrBC in HOA-rich factors is 0.16. I am a bit confused since in Page 33563 Line 26 the authors stated that the average mfrBC in HOA-rich particles are 0.03 and 0.05 during the non-roadside and roadside studies. How are these numbers related?

Section 3.3: It would be good to compare the modeled particle absorption with the in situ PASS-3 measurement, which was very briefly mentioned in the method section and should be expanded, to assess the potential bias resulted from assuming a core/shell morphology using Mie calculation. Were there any scattering measurements during any or both of the studies? If so, it would be good to compare the modeled SSA with the measurement.

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