

Atmos. Chem. Phys. Discuss., referee comment RC3  
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## Comment on acp-2021-411

Anonymous Referee #1

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Referee comment on "Mixing state of refractory black carbon in fog and haze at rural sites in winter on the North China Plain" by Yuting Zhang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-411-RC3>, 2021

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Black carbon aerosol (BC) is a key component that affects radiation balance in the atmosphere by absorbing and solar radiation, and it possibly serves as seed of secondary pollution formation. Mixing state and lifespan of BC is mostly determined by meteorology condition. This study adopted single-particle soot photometer to measure variability of mass size distribution of refractory black carbon,  $D_p/D_c$  of black carbon-containing particles was also investigated. The study reported that increase of CMD of rBC particles during snowfall episodes was because that smaller rBC-containing particles were much more effectively removed than pre-snowfall period. Such phenomena was mainly attributed to Wegener-Bergeron- Findeisen (WBF) processes. This study particularly pointed out that enhancement of Eabs of rBC-containing particles was related to nitrate instead of organics and sulfate at temperature  $-4\sim 0$  oC conditions. I would like to recommend the manuscript for publication after following comments as addressed.

specific comments:

1ã□□The Wegener-Bergeron-Findeisen process, or being called "cold-rain process" is used to describe ice crystal growth in a mixed phase clouds environment where it is a subsaturated environment for liquid water but a supersaturated environment for ice. As an assumption,

ice crystals or tiny black carbon core can grow faster if the number density is much small compared to liquid water. Generally it may a good explanation for the favorable formation of thickly coated rBC-containing particles. If possible, I would courage the authors to collect more evidence to have more solid conclusion.

2ã□□The basic information of instrumentation of HR-AMS is missing. Please add more introduction about the measurement of chemical composition. Note that HR-AMS provides the mass concentration of non-refractory species in PM<sub>1</sub>, and rBC measured by SP2 normally have MED peak at 200 nm. Therefore, it should be much careful about the relationship between the coating thickness of rBC and chemical composition in section 3.5.

3ã□□There are lots of symbols and abbreviations in the manuscript, please summarize them in a table list.

4ã□□line 120: "nonrefractory" is not a word, please change to "non-refractory"

5ã□□Line 424¼□The expression "in California 2013 during winter" seems wrong, Please check the grammar thoroughly the manuscript.