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Atmospheric Measurement Techniques Discussions

Interactive comment on "Structural changes of CAST soot during a thermal-optical measurement protocol" *by* Theresa Haller et al.

Anonymous Referee #2

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The paper reports on the study of the effect of thermal treatment of carbonaceous particle samples emitted from a miniCAST burner. The paper is well written and clear for the most part. I think the work is useful to the community and relevant, and I found the experiments and the data analysis and interpretation to be mostly appropriate; therefore, I recommend publication after minor revisions. A few comments follow.

General comments

The authors use "black carbon", "elemental carbon", and "soot" throughout the paper and the impression is that the term is used interchangeably. While that might be the case (I do not want to enter into the merit of that discussion here), it might be good to at least acknowledge that a related terminology problem is debated in the literature, see for example:

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Discussion paper

Buseck, P.R., K. Adachi, A. Gelencsér, É. Tompa, and M. Pósfai, ns-Soot: A Material-Based Term for Strongly Light-Absorbing Carbonaceous Particles. Aerosol Science and Technology, 2014. 48(7): p. 777-788.

Petzold, A., J.A. Ogren, M. Fiebig, P. Laj, S.M. Li, U. Baltensperger, T. Holzer-Popp, S. Kinne, G. Pappalardo, N. Sugimoto, C. Wehrli, A. Wiedensohler, and X.Y. Zhang, Recommendations for reporting "black carbon" measurements. Atmos. Chem. Phys., 2013. 13(16): p. 8365-8379.

The authors might also find interesting the following recent paper, in relation to the issue of charring:

Sedlacek, A.J., T.B. Onasch, L. Nichman, E.R. Lewis, P. Davidovits, A. Freedman, and L. Williams, Formation of refractory black carbon by SP2-induced charring of organic aerosol. Aerosol Science and Technology, 2018: p. 1-6.

Specific comments

Abstract: Please define IS, or better yet, considering the term integrating sphere is used only twice in the abstract, just spell it out.

Introduction, page 2, paragraph starting on line 12: Regarding the internal mixtures of carbonaceous and non-carbonaceous materials: several other published works might be of interest such as:

Adachi, K., S.H. Chung, and P.R. Buseck, Shapes of soot aerosol particles and implications for their effects on climate. Journal of Geophysical Research-Atmospheres, 2010. 115.

Adachi, K. and P.R. Buseck, Changes of ns-soot mixing states and shapes in an urban area during CalNex. Journal of Geophysical Research: Atmospheres, 2013. 118(9): p. 3723–3730.

China, S., C. Mazzoleni, K. Gorkowski, A.C. Aiken, and M.K. Dubey, Morphology and

mixing state of individual freshly emitted wildfire carbonaceous particles. Nature Communications, 2013. 4.

Cappa, C.D., T.B. Onasch, P. Massoli, D.R. Worsnop, T.S. Bates, E.S. Cross, P. Davidovits, J. Hakala, K.L. Hayden, B.T. Jobson, K.R. Kolesar, D.A. Lack, B.M. Lerner, S.-M. Li, D. Mellon, I. Nuaaman, J.S. Olfert, T. Petaja, P.K. Quinn, C. Song, R. Subramanian, E.J. Williams, and R.A. Zaveri, Radiative Absorption Enhancements Due to the Mixing State of Atmospheric Black Carbon. Science, 2012. 337(6098): p. 1078-1081.

And several others

Page 2, lines 34-35: papers of interest might also be the two papers mentioned above by Buseck et al. and by Petzold et al.

Page 5, lines 5 to 7: it might be useful to add a sentence or two on the fractal-like or lacy structure of the black carbon aggregates. Several works discuss this aspect in detail.

Page 6, line 12: Spell out “IS” as “integrating sphere” considering the acronym is defined only in a later section

Page 6, line 14: Briefly explain the role of the liquid. Why is it necessary?

Page 10, line 25-26: I find the sentence “However, the “brown” heated (870°C He) sample seems to have a more ordered internal structure in the form of layers than its original version as indicated by stronger noticeable local fringe-like contrast (Fig. 11).” Confusing, I thought the original brown sample had no ordered structure at all (as from line 22 on the same page). Similarly for the first line of page 11.

Line 5 and line 11 on page 12: what might be the physical or chemical reason for an Angstrom exponent lower than that of BC? The explanation in lines 13 to 15 is not very satisfying from a fundamental point of view.

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