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Atmospheric Measurement Techniques Discussions

Interactive comment on "Sensitivity of the Single Particle Soot Photometer to different black carbon types" *by* M. Laborde et al.

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General comments

The work that is presented will benfit researchers applying the Single Particle Soot Photometer (SP2) for the sensitive detection of atmospheric refractive black carbon (rBC) aerosol components. The paper presents important conclusions and recommendations concerning the "best" carbonaceous particle material that should be used in laboratory calibration procedures in order to get an instrument response that closely resembles that of ambient rBC particles.

The paper presents a novel concept for a more direct discrimination between coated and non-coated BC particles also in case of thin coatings. This concept is compre-

hensively described in the paper. However, the paper lacks a proof that the concept is indeed more sensitive to thinly coated particles than e.g. the time lag method.

The work is presented in a structured and concise style.

I recommend to publish the paper in AMT after the following specific comments and technical corrections have been addressed by the authors.

Specific comments

The Abstract should mention that the analysis of the SP2 mass sensitivity is based on the Aerosol Particle Mass Analyzer (APM).

Page 666, line 7: How is refractory BC mass defined? Is it defined as the carbonaceous particle mass that shows a LII signal? Please give a brief description.

Page 668, line 24: Please add ", and the applicability of a concentric coated sphere optical model." at the end of the sentence starting with "However the accuracy ...".

Page 669, lines 15 to 17: Strictly, a differential scattering cross section is measured by the SP2 which is defined by the solid angle of the scattering detector.

Page 669, lines 24: The exact laser intensity profile is not shown in Fig. 1a. What is shown is the normalised laser intensity profile $I(t)/I(t_{centre})$ that can be determined by a statistical analysis of a set of time resolved single particle scattering signals from purely scattering particles. I suggest to introduce the normalised intensity profile here and use this definition later in Eq. (4).

Page 670, Eq. (4): The authors might want to substitute t by t_α to be more consistent with the argumentation in this paragraph.

Page 671, lines 3 and 4: substitute $I(t)$ by the normalised intensity profile $I(t)/I(t_{centre})$ to be consistent with Eq. (4) (see my comment above).

Page 675, line 21: Please give the OC content found in the work by Chirico et al.

(2010).

Page 679: The authors argue that the observed increase in the incandescence signals of thermodenuded Aquadag and fullerene soot particles at equal mass is due to a small amount of non-refractory coatings on the untreated particles. Now it is well known from laboratory studies (e.g. Mennella et al. (1995) and references therein) that the annealing of hydrogenated armorphous carbon particles results in a change of the electronic structure of the material and to a relative increase of the sp^2 hybridisation. This would be an alternative explanation for the observed changes in the calibration and scattering cross section curves. The authors should address this alternative explanation.

Fig. 3: Why does the thermodenuded Diesel exhaust BC show a more uniform scattering distribution, and why is the scattering signal on average higher for those particles?

Technical corrections

Page 671, line 12: Remove the redundant “thus”.

Page 671, line 28: Remove “only”.

References

Mennella, V., Colangeli, L., Blanco, A., Bussoletti, E., Fonti, S., Palumbo, P., Mertins, H.C., A dehydrogenation study of cosmic carbon analogue grains, The Astrophysical Journal, 444, 288-292, 1995

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