

Influence of coating on optical properties of carbonaceous aerosols

Luka Drinovec¹, Asta Gregorič², Maja Remškar³, Janja Vaupotič³, Griša Močnik¹, Erwin Karg⁴, Gert Jakobi⁴, Jurgen Schnelle-Kreis⁴, Ralf Zimmermann⁴

¹Aerosol d.o.o., Ljubljana, Slovenia

²Laboratory for Environmental Research, University of Nova Gorica, Slovenia

³Jožef Stefan Institute, Ljubljana, Slovenia

⁴Helmholtz Zentrum München, Cooperation group „Comprehensive Molecular Analytics“, Germany

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Presenting author email: luka.drinovec@aerosol.si

The mixing state of an aerosol influences the optical properties of absorbing particles considerably, but is challenging to measure. Some authors (Lack and Cappa, 2010; Bond et al., 2006) propose that the lensing effect, where the absorbing particle is covered by a transparent shell, can significantly enhance optical absorption. The mixing state can be assessed using advanced mass spectrometers ATOFMS (Healy et al., 2012) or SP2 for particles with diameters down to about 100 nm (Subramanian et al., 2010).

Previous research (Drinovec et al., 2013) showed that the filter-loading effect in an Aethalometer also relates to particle coating. The filter-loading effect is the reduction of the filter based photometer sensitivity due to filter loading. It was shown that the filter-loading effect varies with season and location (Virkkula et al., 2007; Drinovec et al., 2014). Using an Aethalometer model AE33 (7 wavelengths, Magee Scientific) it is possible to measure the filter loading effect which is described by compensation parameter k .

The influence of coating on k was investigated, during both laboratory and ambient sampling campaigns. During the laboratory experiments, soot particles were coated by different organic and inorganic substances. During the ambient campaign, conducted in Ljubljana in summer 2014, the influence of coating k was investigated by applying a drier and a thermodenuder to remove the coating.

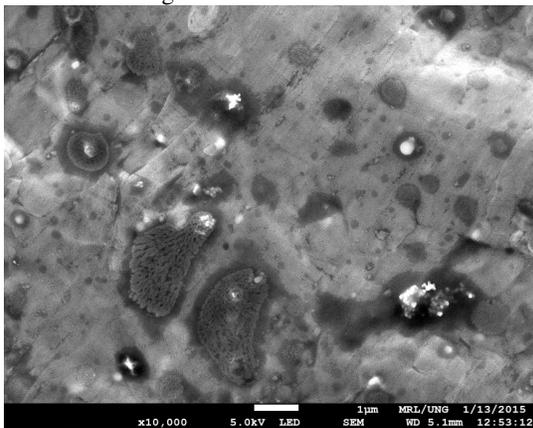


Figure 1. SEM image of ambient particles on the 260 nm cut size impactor stage. Several internally and externally mixed particles are observed.

Particle size distributions measured by SMPS and SEM images (Figure 1) were used to assess the mixing state of the aerosols during the ambient campaign. Placing the drier and/or thermodenuder at the sample inlet caused an increase of the parameter k at $\lambda = 880$ nm (Figure 2). An unchanged k indicated fresh, uncoated particles; the effect of aerosol drying implies the presence of hygroscopic coating material.

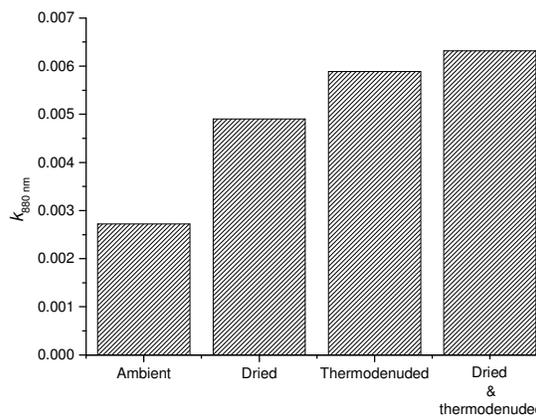


Figure 2. Removing the coating from the filter loading influences the compensation parameter k .

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