Supplement of

Multi-wavelength optical measurement to enhance thermal/optical analysis for carbonaceous aerosol

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Figure S1. Example of typical thermal/spectral analysis (TSA) thermogram for: (a) Fresno ambient and (b) diesel exhaust samples. Laser reflectance and transmittance (LR_λ/LT_λ) at 7 wavelengths (405, 455, 532, 635, 780, 808, and 980 nm) are reported in millivolts (mV) as detected by the photodiodes. Filter reflectance and transmittance (FR_λ/FT_λ) for (a) and (b) are shown in (c) and (d), respectively, after calibrating LR_λ and LT_λ against absolute reflectance and transmittance measurements by the Lambda 35 integrating-sphere spectrometer. FR_λ is between 0.1 and 1 (i.e., 100%) while FT_λ is generally <0.1 . The temperature steps follow the IMPROVE_A protocol: OC1 (140°C), OC2 (280°C), OC3 (480°C), OC4 (580°C), EC1 (580°C), EC2 (740°C), and EC3 (840°C) with oxygen introduced at the beginning of EC1. The last carbon peak corresponds to the internal methane standard.

Figure S2. Calibration of ATN_{λ} of a 7-wavelength carbon analyzer with EC loading ([EC]) measured during the EC2 step of IMPROVE_A analysis of a diesel exhaust sample (CIFQ074, acquired from the Gasoline/Diesel Split Study). Regressions are based on Eq. (6).

Figure S3. Decomposition of measured absorption optical depth ($\tau_{a,\lambda}$) from (a) Fresno ambient; and (b) Reno wildfire samples into the BC and BrC contributions based on spectral dependence of light absorption.

Figure S4. Measured $\tau_{a,\lambda}$ (455, 635, and 808 nm are shown) compared with $\tau_{a,\lambda}$ fitted from Eq. (7) assuming a two-component model. All samples in this study are included.