Characterization of tandem aerosol classifiers for selecting particles: implication for eliminating multiple charging effect

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1 Calculation of volume equivalent diameter

The fitted PNSD ae for each experiment was converted to number volume-equivalent size ($d_{ve}$) distribution (PNSD ve). According to Eq. 26, $d_{ve}$ is determined by,

$$m = \frac{\pi n C \rho d_{ae}^3}{6 C \rho d_{m}^3},$$  

$$\frac{\pi n C \rho d_{ve}^3}{6 C \rho d_{m}^3} = \frac{\pi n C \rho d_{ae}^3}{6 C \rho d_{m}^3},$$

where $d_{ve,n}$ is volume equivalence diameter, $\rho_m$ is particle density, and $\rho_m = 1.8 \text{ g cm}^{-3}$ is used, $d_{m,n}$ is the corresponding electrical mobility diameter for particles with $n$ charges. Assuming that all the particles have the same electrical mobility as it classified by DMA, according to Eq. 1, the $d_{m,n}$ of particles with single, double and triple charges can be calculated, respectively. It should be noted that in Fig. 5b, three peaks have the same $d_{ae}$ range but different $d_{m}$. As a result, their $d_{ve}$ ranges were different. The number concentration of $dN/d\log(d_{ae})$ were converted to $dN/d\log(d_{ve})$ using the calculated $d_{ve}$ range.
Figure S1: Variations of the critical $D_{m}$ as a function of classified $d_{m}$ and $d_{ac}$. The following parameter set was employed for the calculations: $\beta_{DMA} = 0.1$, $\beta_{AAC} = 0.1$. The background color coding denotes the critical $D_{m}$. The background color coding denotes the critical $D_{m}$ of particles that DMA-AAC can select monodispersed particles.
Figure S2: (a) The transfer functions of DMA-CPMA when selecting 100 nm particles. The following parameter set was employed for the calculations: \( d_{\text{mi}} = 100 \text{ nm}, \beta_{\text{DMA}} = 0.1, m_1 = 0.27 \text{ fg}, Q_{\text{CPMA}} = 0.3 \text{ L min}^{-1}, R_m = 8 \). (d) The transfer functions of DMA-CPMA when selecting 150 nm particles. The following parameter set was employed for the calculations: \( d_{\text{mi}} = 150 \text{ nm}, \beta_{\text{DMA}} = 0.1, m_1 = 0.66 \text{ fg}, Q_{\text{CPMA}} = 0.3 \text{ L min}^{-1}, R_m = 8 \). The red solid line is the generated soot particle population. (b) and (e) are the aerodynamic size distributions of particles classified by DMA-CPMA for 100 and 150 nm particles, respectively. The circles are data measured by AAC-CPC and the black, green and red lines are log-normal fitted distributions of bulk, singly charged and doubly particle population. (c) and (f) are the contributions to light absorption of particles with single and double charges when selecting 100 and 150 nm particles.