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,

$$m = \frac{\pi}{6}\frac{Cc(d_{ae})\rho_0 d_{ae}^2 d_m}{Cc(d_m)}, \quad (1)$$

$$\frac{\pi}{6}\rho_m d_{ve,n}^3 = \frac{\pi}{6}\frac{Cc(d_{ae})\rho_0 d_{ae}^2 d_m}{Cc(d_{m,n})}, \quad (2)$$

where $d_{ve,n}$ is volume equivalence diameter, ρ_m is particle density, and ρ_m =1.8 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/dlog(d_{ae}) were converted to dN/dlog(d_{ve}) using the calculated d_{ve} range.

2 Classification limitations of DMA-AAC

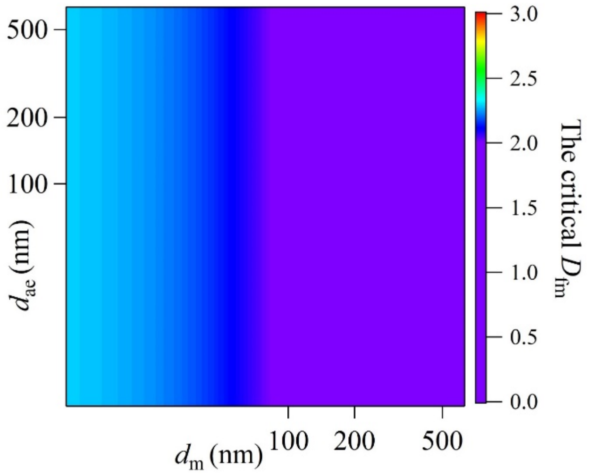

Figure S1: Variations of the critical D_{fm} as a function of classified d_m and d_{ae}. The following parameter set was employed for the calculations: β_{DMA} = 0.1, β_{AAC} = 0.1. The background color coding denotes the critical D_{fm}. The background color coding denotes the critical D_{fm} of particles that DMA-AAC can select monodispersed particles.

3 Classification results for two sizes soot particles

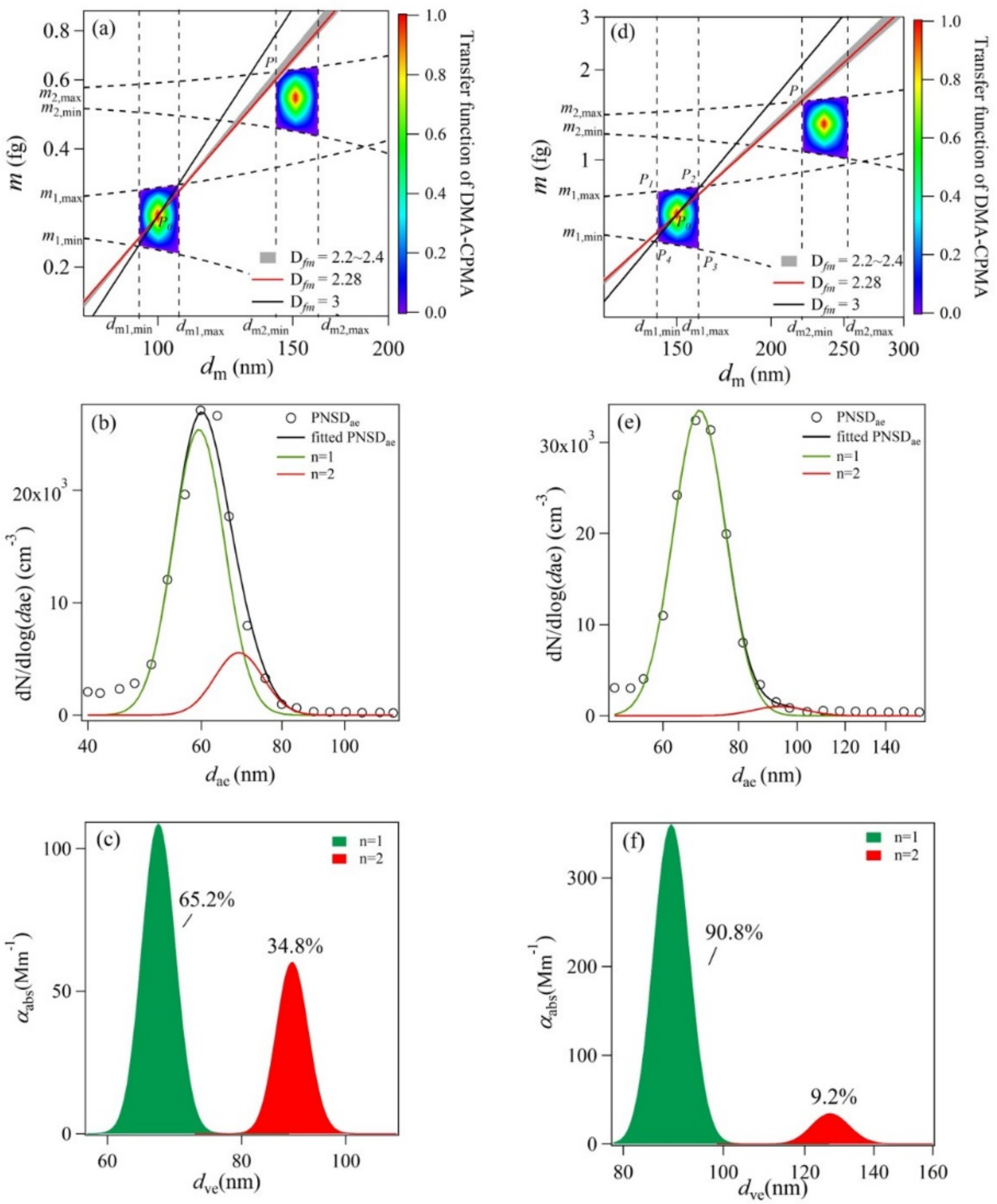

Figure S2: (a) The transfer functions of DMA-CPMA when selecting 100 nm particles. The following parameter set was employed for the calculations: d_{m1} = 100 nm, β_{DMA} = 0.1, m_1 = 0.27 fg, Q_{CPMA}=0.3 L min^{-1}, R_m = 8. (d) The transfer functions of DMA-CPMA when selecting 150 nm particles. The following parameter set was employed for the calculations: d_{m1} = 150 nm, β_{DMA} = 0.1, m_1 = 0.66 fg, Q_{CPMA}=0.3 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.