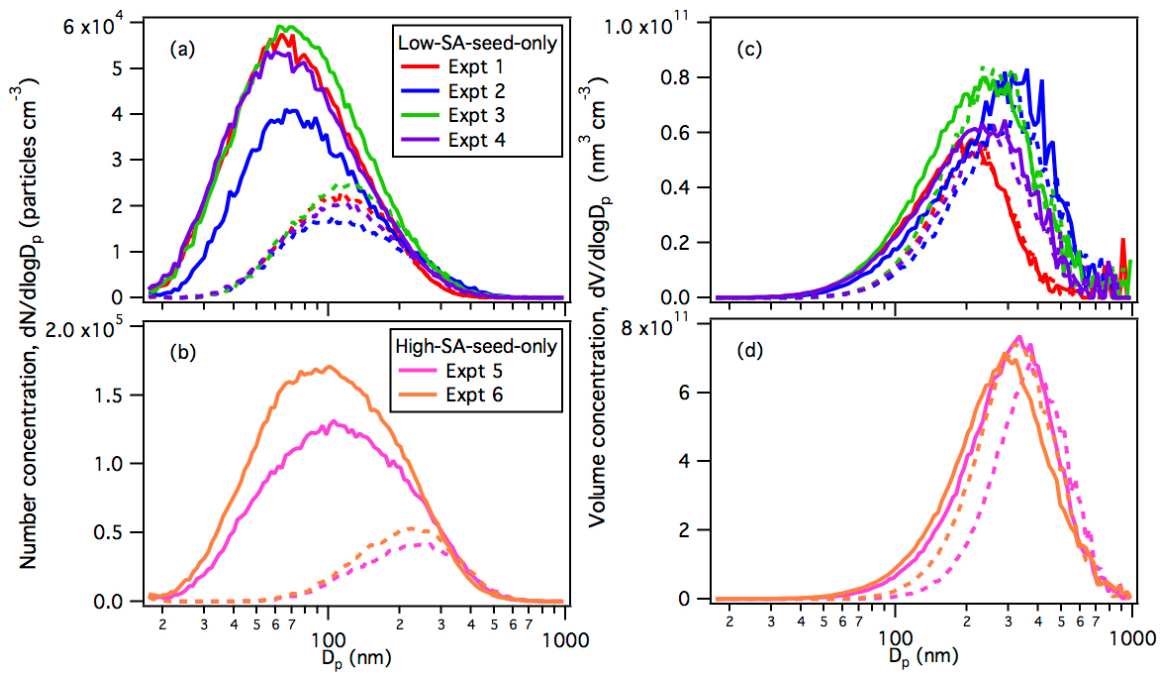Atmospheric
Chemistry
and Physics

Open Access

EGU

Supplement of

Constraining uncertainties in particle-wall deposition correction during SOA formation in chamber experiments

Theodora Nah et al.

Correspondence to: Nga L. Ng (ng@chbe.gatech.edu)

Figure S1: Initial (solid lines) and final (420 min later, dashed lines) number and volume size distributions during the low-SA-seed-only (panels (a) and (c)) and high-SA-seed-only (panels (b) and (d)) experiments. Refer to Table 1 for information on the AS solution(s) used to generate the seed aerosol and the initial seed aerosol surface area concentrations in these experiments.
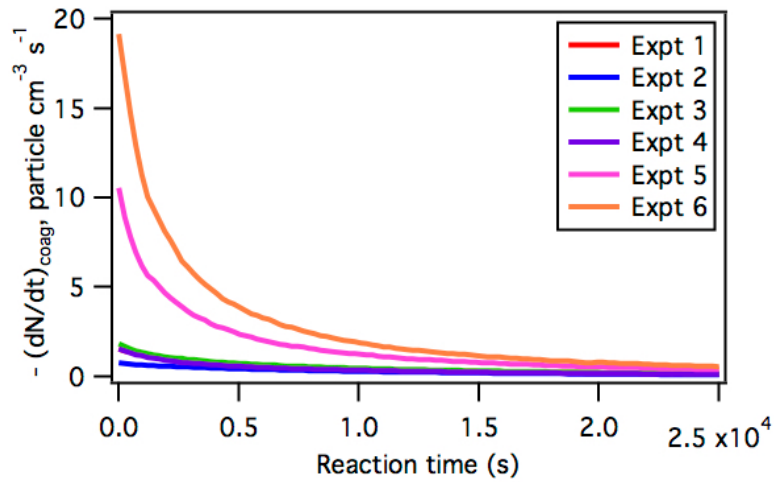
34

Figure S2: Change in total particle number concentration due to coagulation alone as a function of reaction time for the seed-only experiments. These results are obtained from the aerosol-dynamics model using the raw time-dependent number distribution data measured by the SMPS during seed-only experiments and coagulation coefficients calculated from Table 13.1 in Seinfeld and Pandis (2016).
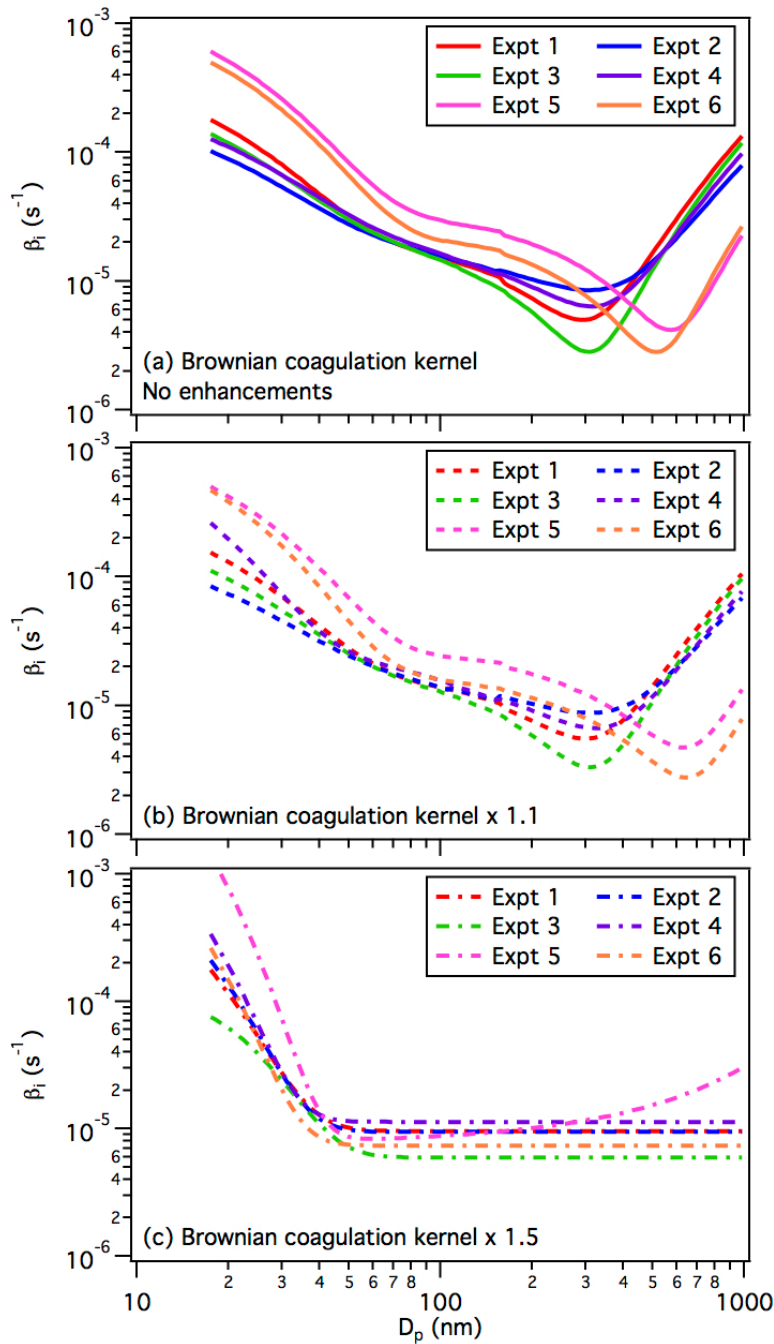
40

41

42

43

44

45

46

47

Figure S3: Coagulation-corrected particle wall-deposition coefficients (β_i) for seed-only experiments. In panel (a), the coagulation-corrected particle wall-deposition coefficients are obtained using the Brownian coagulation kernel calculated from Table 13.1 in Seinfeld and Pandis (2016). In panels (b) and (c), the Brownian coagulation kernel is scaled by 1.1 and 1.5 uniformly across all particle sizes, respectively.
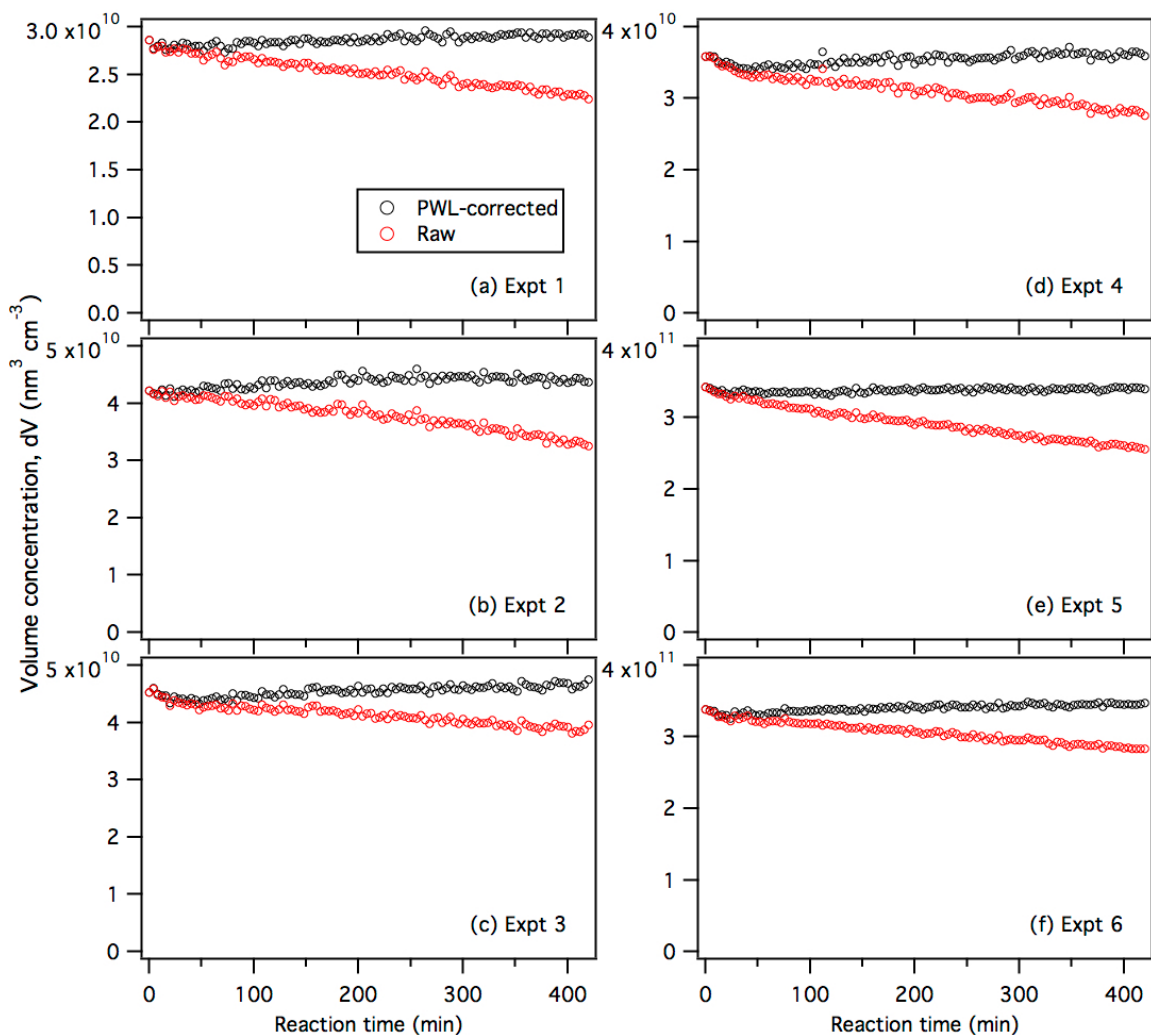
Figure S4: Raw (red) and particle wall-loss-corrected (black) volume concentrations as a function of reaction time for the low-SA-seed-only and high-SA-seed-only experiments. Coagulation-corrected size-dependent particle wall-deposition coefficients are used to correct for particle wall-deposition in the analysis shown here. Refer to Table 1 for information on the AS solution(s) used to generate the seed aerosol and the initial seed aerosol surface area concentrations in these experiments.
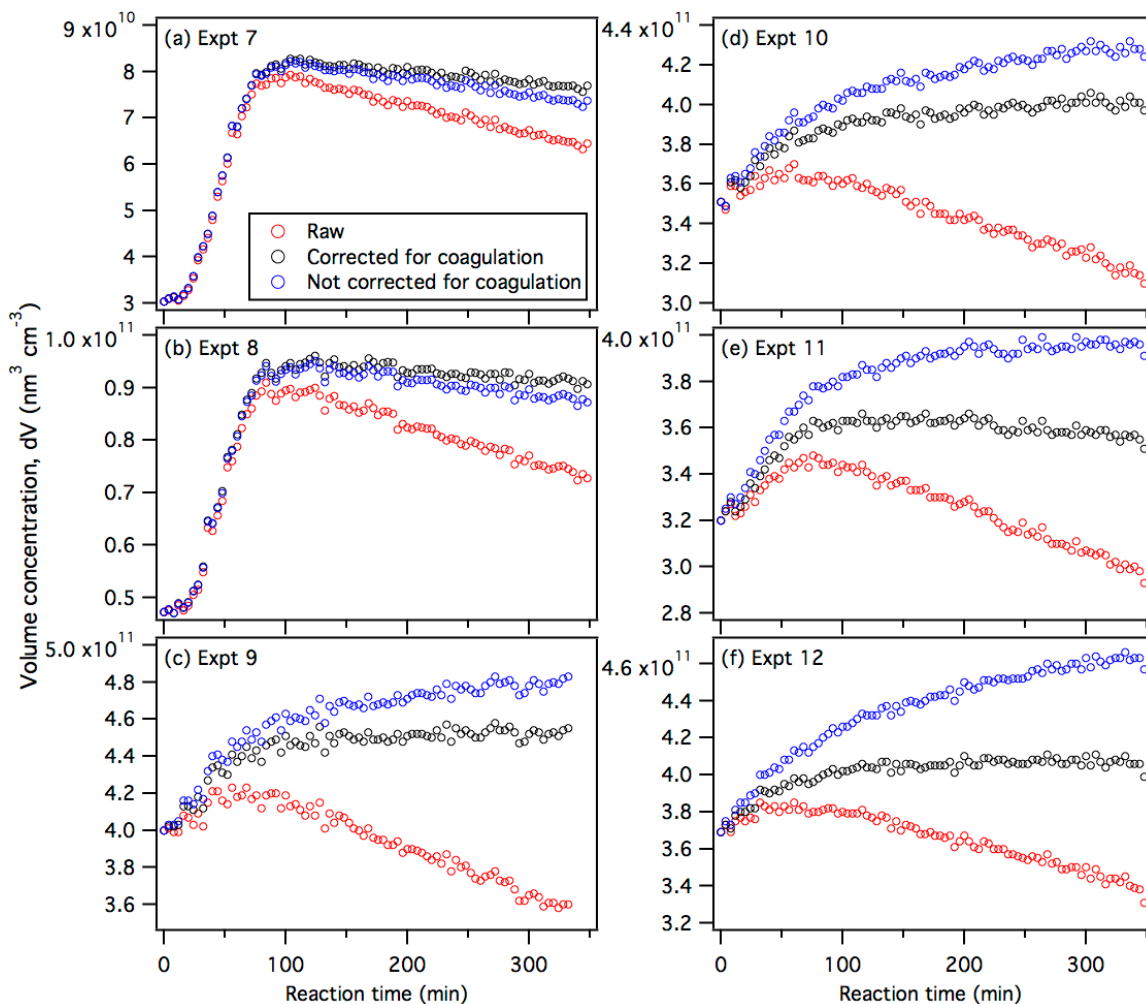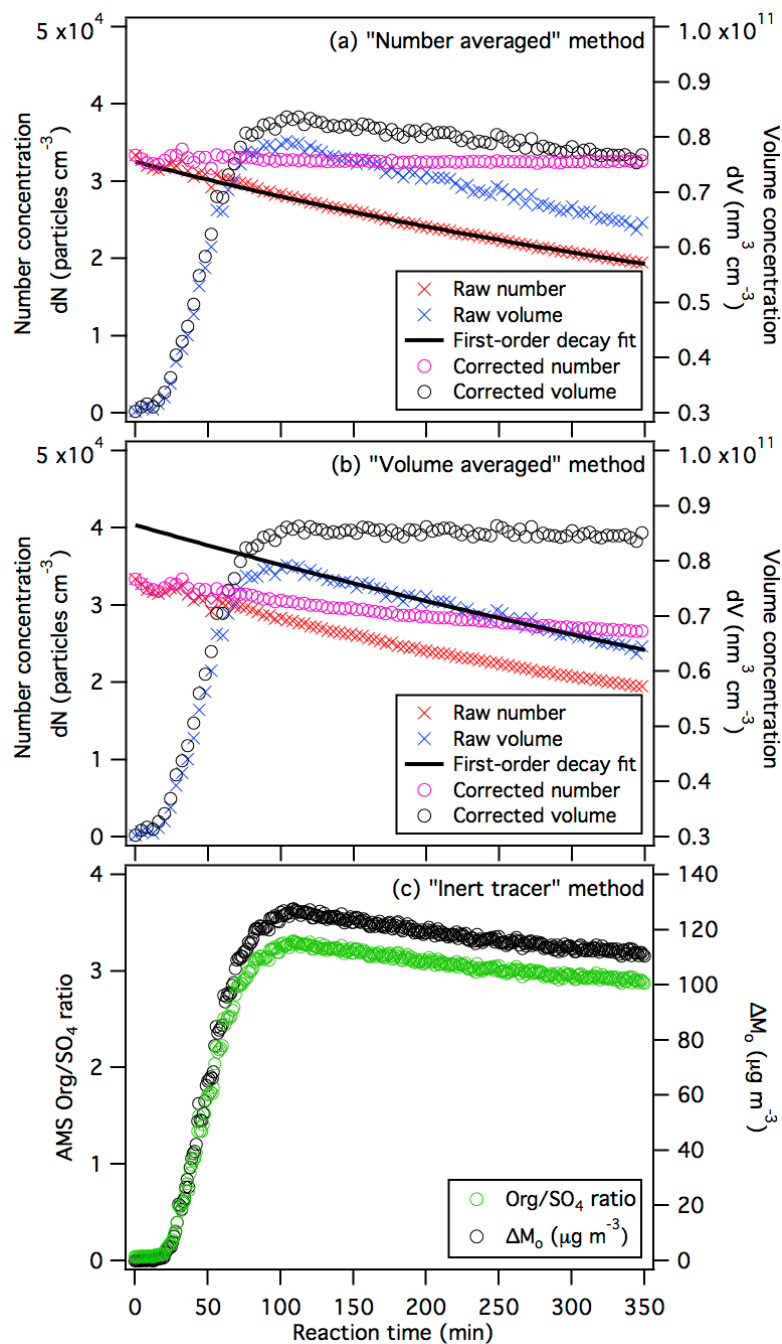
Figure S5: Raw (red) and particle wall-deposition-corrected volume concentrations for the α-pinene ozonolysis experiments. The uncorrected (blue) and coagulation-corrected (black) size-dependent particle wall-deposition coefficients are used to correct for particle wall-deposition in the analyses shown here.

66
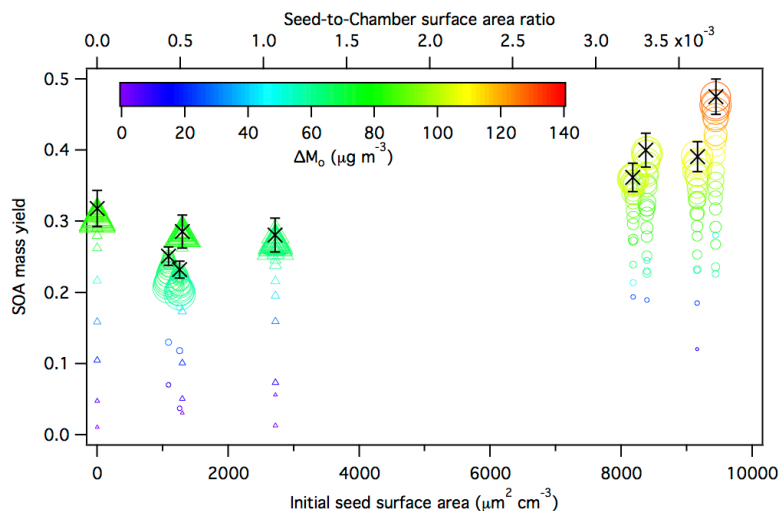
Figure S6: Averaged SOA mass yields over the course of an α-pinene ozonolysis
experiment as a function of initial total AS seed aerosol surface area concentration. Results
from this study (15 min-averaged) are shown as circles, while results from the study by
Nah et al. (2016) (10 min-averaged) are shown as triangles. All the SOA mass yields shown
here (this study and the study by Nah et al. (2016)) are obtained using the uncorrected size-
dependent particle wall-deposition coefficients (that do not account for coagulation).
Symbol color indicates the SOA mass concentration and symbol size indicates the time
after O_3 is injected into the chamber. The $\times$ symbols are the SOA mass yields at peak SOA
growth obtained from the experimental data. The y-axis error bars represent the uncertainty
in the SOA mass yield at peak SOA growth, which originates from the α-pinene injection
and the aerosol mass concentration at peak SOA growth (one standard deviation).

78

Figure S7: Example of particle wall-deposition rate calculation and correction (experiment 7) using the (a) "number averaged", (b) "volume averaged" and (c) "inert tracer" particle wall-deposition correction methods. The "number averaged" and "volume averaged" methods apply the first-order decay fits of the raw number and volume concentrations, respectively, to the entire experiment to account for particle wall-deposition. The "inert tracer method" uses the organic-to-sulfate (Org/SO_4) ratio obtained from HR-ToF-AMS measurements to determine the SOA mass concentration.

86

87 **Table S1:** Initial and particle wall-deposition-corrected final total volume concentrations
88 for seed only experiments[a]

Expt	AS seed conditions	Initial Seed aerosol surface area (μm^2 cm^{-3})	Initial Volume Concentration (nm^3 cm^{-3})	Final Volume Concentration (nm^3 cm^{-3})[b]	% Change[c]
1	0.015 M AS	1090	2.86×10^{10}	2.89×10^{10}	1.0
2	0.05 M AS	1190	4.22×10^{10}	4.37×10^{10}	3.6
3	0.015 M & 0.05 M AS	1470	4.53×10^{10}	4.75×10^{10}	4.9
4	0.015 M & 0.05 M AS	1210	3.58×10^{10}	3.59×10^{10}	0.3
5	0.05 M AS	8000	3.43×10^{11}	3.4×10^{11}	-0.9
6	0.015 M & 0.05 M AS	8580	3.38×10^{11}	3.47×10^{11}	2.7

89 [a]Particle volume concentrations (dV)
90 [b]The data shown here correspond to those shown in Fig. S4. The data have been particle
91 wall-deposition-corrected using coagulation-corrected particle wall-deposition coefficients
92 (with no enhancement to the coagulation rates) determined using the aerosol-dynamics
93 model (described in section 3) and the experimental data.
94 [c]% Change $= \dfrac{\text{(Difference between initial and particle wall-loss-corrected final number concentration)}}{\text{Initial number concentration}} \times 100\%$