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Inter-comparison of laboratory smog chamber and flow reactor systems on organic aerosol yield and composition

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Table S1. Primary emission characteristics in the SC from wood combustion experiments*

experiment	MCE	wood burned per chamber volume (g m^{-3})	CO_2 (ppmv)	CO (ppmv)	CH_4 (ppmv)	THC (ppmvC)	NO_x (ppbv)	EBC (µg m^{-3})^	POA (µg m^{-3})^	NO_3 (µg m^{-3})^	SO_4 (µg m^{-3})^	NH_4 (µg m^{-3})^	chloride (µg m^{-3})^	% of POA mass above *m/z* 100
5	0.97 (0.01)	0.713 (0.005)	700 (5)	21.7 (0.1)	1.915 (0.003)	4.37 (0.02)	>200	38.5 (0.4)	255 (9)	31 (5)	1.5 (0.1)	7.3 (0.8)	7 (1)	12.6
6	0.95 (0.03)	0.319 (0.007)	305 (7)	15.27 (0.04)	1.161 (0.002)	4.08 (0.02)	123.9 (0.7)	19.8 (0.2)	380 (10)	49 (2)	1.3 (0.1)	13.0 (0.1)	9 (1)	13.2
7	0.958 (0.001)	0.5087 (0.0005)	492.5 (0.5)	21.56 (0.09)	1.540 (0.001)	3.95 (0.07)	169.3 (0.9)	107.3 (0.9)	134 (5)	15.2 (0.5)	0.44 (0.05)	4.5 (0.2)	7.6 (0.3)	13.3
8	0.973 (0.003)	0.701 (0.001)	700 (1)	19.22 (0.08)	1.387 (0.002)	4.12 (0.02)	168 (1)	44.2 (0.4)	166 (4)	35 (1)	1.44 (0.06)	8.0 (0.2)	3.3 (0.1)	15.8
9	0.992 (0.002)	0.616 (0.001)	621 (1)	4.88 (0.04)	0.211 (0.008)	0.60 (0.01)	174 (2)	~350	53 (1)	15.2 (0.3)	0.8 (0.1)	0.9 (0.1)	0.47 (0.05)	18.7
10	0.960 (0.002)	0.7644 (0.0009)	742.8 (0.9)	30.71 (0.08)	2.924 (0.002)	5.03 (0.04)	142.5 (0.8)	168 (6)	58 (4)	4.8 (0.2)	1.1 (0.1)	0.55 (0.09)	3.5 (0.2)	20.2
11	0.929 (0.003)	0.515 (0.001)	473 (1)	36.2 (0.1)	6.55 (0.02)	14.73 (0.06)	83.8 (0.7)	500 (20)	116 (5)	6.8 (0.2)	0.97 (0.06)	1.6 (0.1)	3.7 (0.3)	53.1
12	0.890 (0.002)	0.4899 (0.0008)	443. 6(0.8)	55.0 (0.1)	10.41 (0.03)	>10	50 (8)	211 (3)	100 (20)	8 (1)	1.0 (0.2)	1.4 (0.2)	1.7 (0.3)	57.2

*Two sample standard deviations are given in parentheses.

^Reported particulate concentrations take wall losses into account.

Table S2. Aerosol yields and emission factors without accounting for particulate wall losses in the PAM*

	organic aerosol yield			factor increase in yield due to wall loss correction applied to Table 1
experiment	PAM_{high}	PAM_{low}		PAM_{high}, PAM_{low}
1	0.23 (0.02)	0.34 (0.05)		1.42^, 1.43^
2	0.24 (0.02)	0.22 (0.03)		1.42^, 1.43^
3	0.28 (0.04)	0.22 (0.06)		1.42, 1.43
4	0.48 (0.05)	-		1.42^, 1.43^
	total organic aerosol per mass wood burned (g kg^{-1})			factor increase in yield due to wall loss correction applied to Table 1
experiment	PAM_{high}	PAM_{low}	$PAM_{direct\ sampling}$	PAM_{high}, PAM_{low}, $PAM_{direct\ sampling}$
5	1.4 (0.2)	0.4 (0.1)	-	1.32, 1.29
6	3.6 (0.7)	1.0 (0.2)	-	1.27, 1.25
7	1.9 (0.3)	0.418 (0.007)	0.61	1.29, 1.28, 1.29
8	1.1 (0.3)	0.61 (0.08)	-	1.33, 1.31
9	0.201 (0.005)	0.106 (0.004)	0.12	1.31^, 1.30^, 1.31^
10	0.65 (0.05)	0.28 (0.06)	-	1.31^, 1.30^
11	4.1 (0.5)	0.7 (0.1)	-	1.31, 1.32
12	2.49 (0.07)	0.62 (0.03)	-	1.31^, 1.30^

*All measurements correspond to SC sampling unless otherwise noted. Two sample standard deviations are given in parentheses. Yields and emission factors correspond to OH exposures given in Table 1.

^AMS size distributions not available for factor calculation; value is average of other experiments from same system.

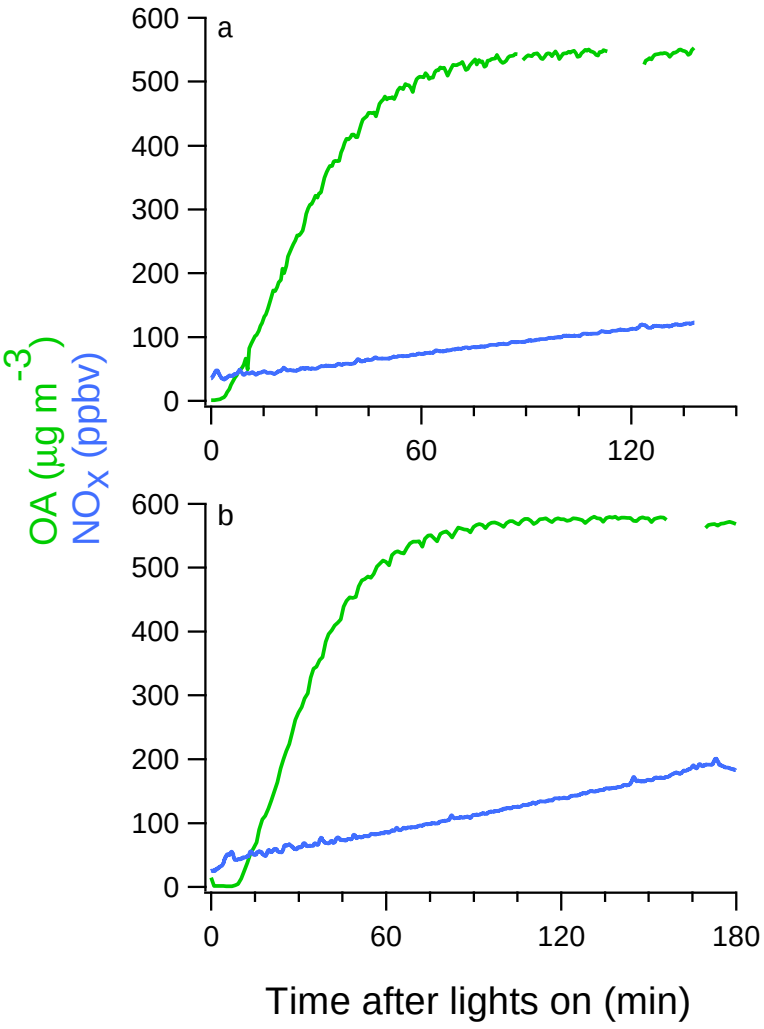

Figure S1. Temporal evolution of NO_x and OA in the SC during (a) experiment 2 and (b) experiment 3. OA data have been corrected for particulate wall losses.

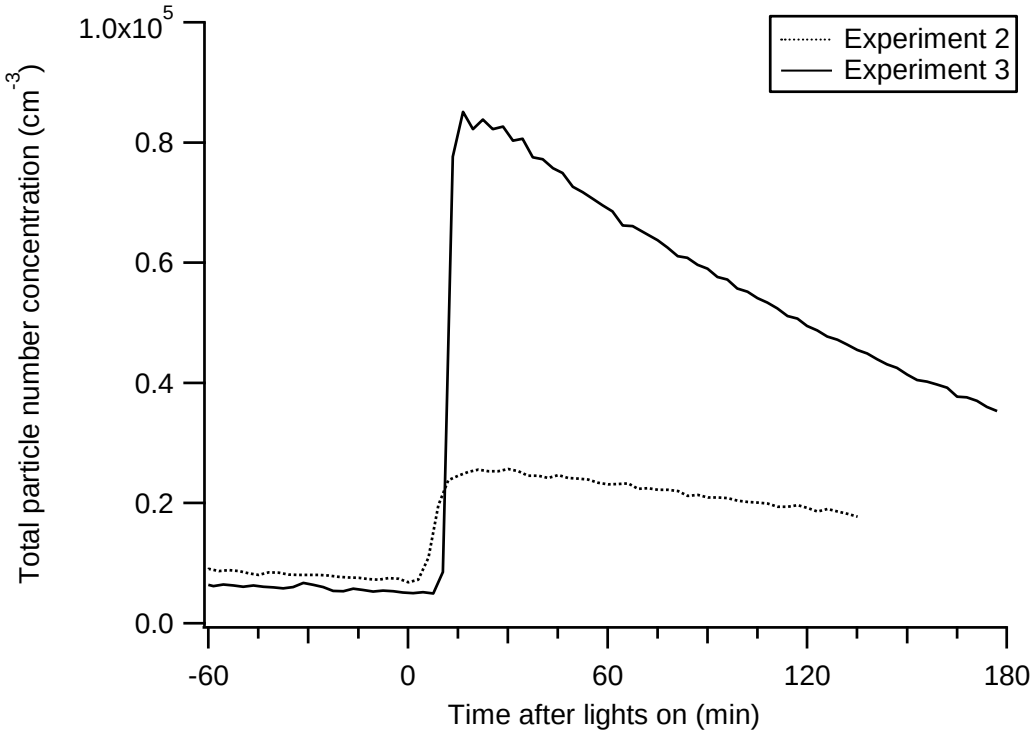

Figure S2. Temporal evolution of particle number concentration in the SC during α-pinene photo-oxidation experiments 2 and 3. Wall losses have not been taken into account.

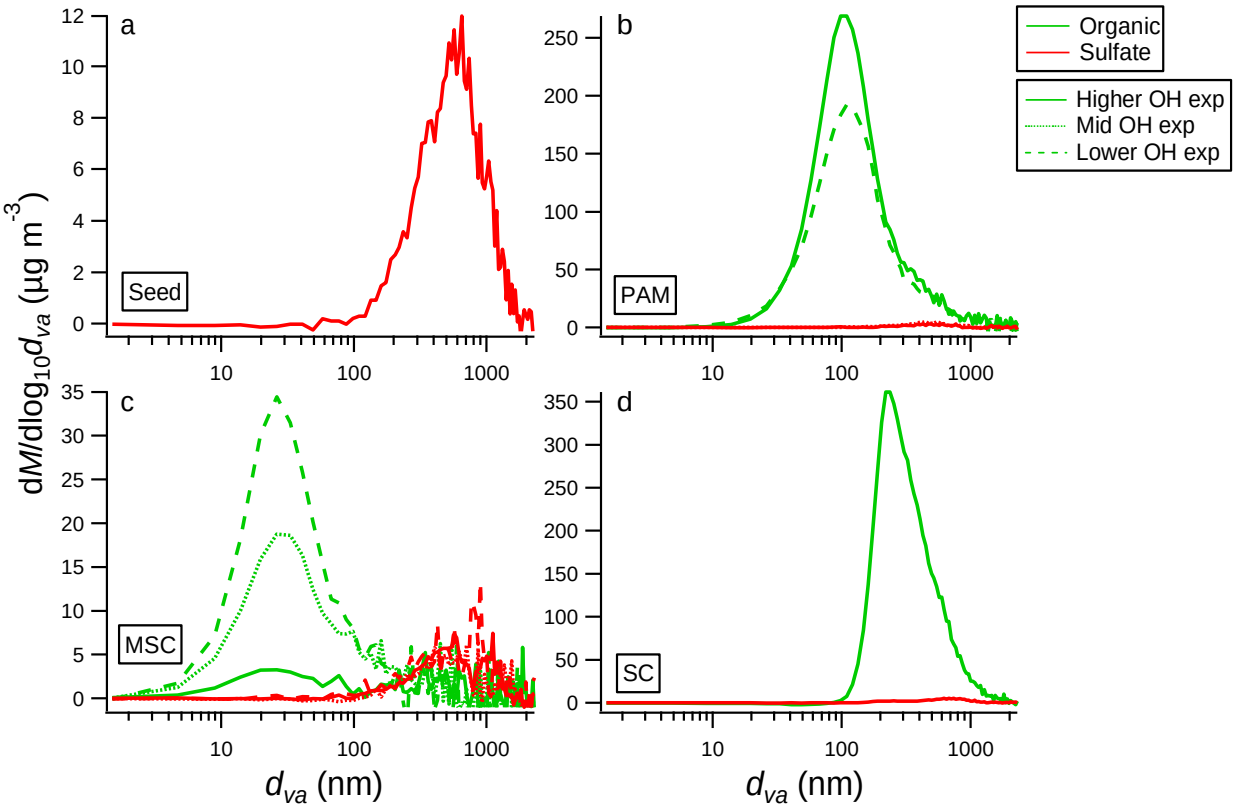

Figure S3. Organic and sulfate mass based size distributions from experiment 3 measured by AMS of (a) $(NH_4)HSO_4$ seed in the SC prior to oxidation, (b) particles in the PAM after exposure to 2.75×10^8 or 1.09×10^8 OH molec cm^{-3} h (PAM_{high} and PAM_{low}, respectively), (c) particles in the MSC after exposure to 4.56×10^8, 3.88×10^8 or 2.54×10^8 OH molec cm^{-3} h (MSC_{high}, MSC_{mid} and MSC_{low}, respectively)and (d) particles in the SC after exposure to 1.0×10^8 OH molec cm^{-3} h. The initial α-pinene mixing ratio was 200 ppbv. Wall losses have not been taken into account. Exp refers to exposure.

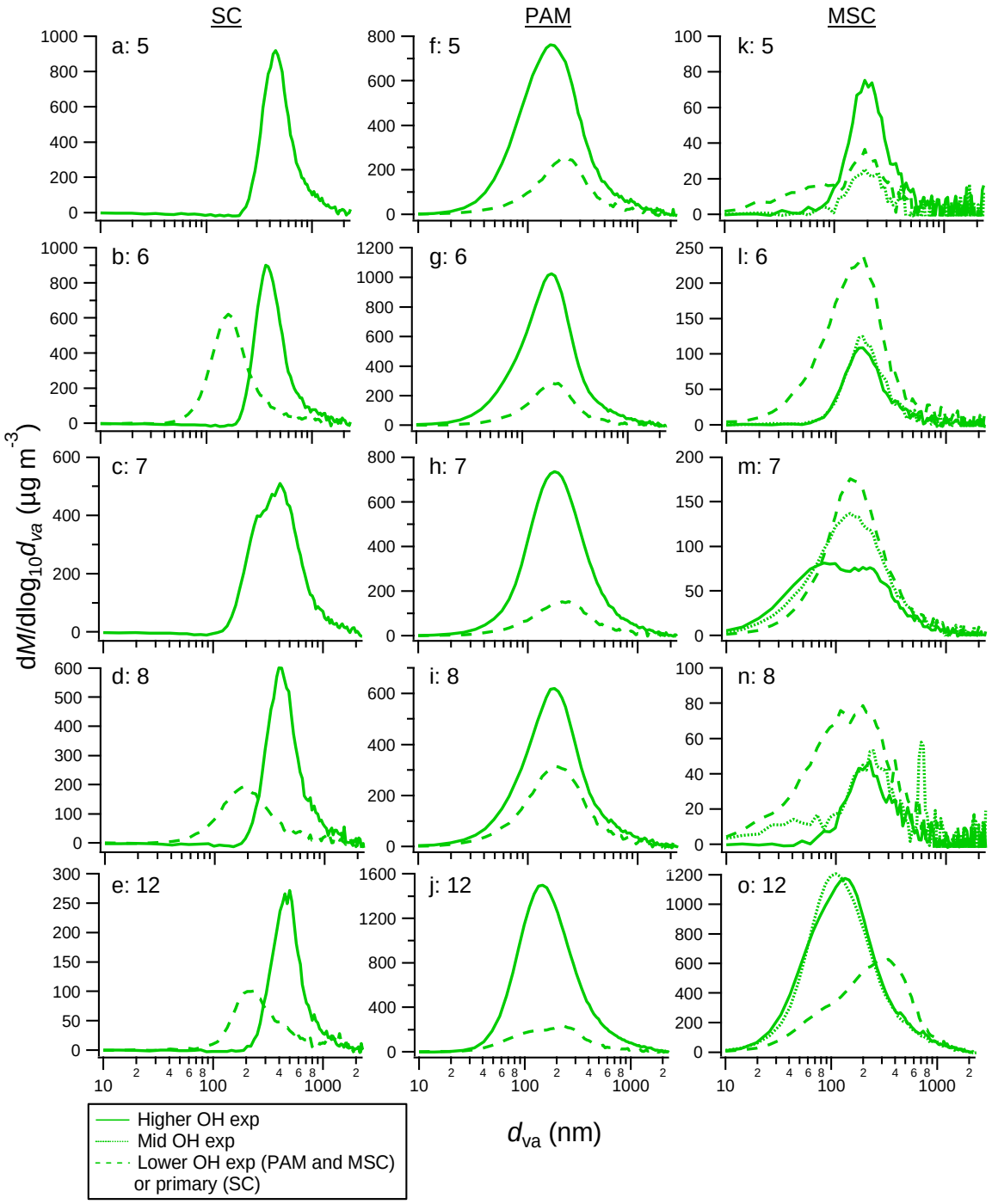

Figure S4. Mass based size distributions from wood combustion experiments measured by AMS of (a-e) OA in the SC before and after aging, (f-j) OA in the PAM and (k-o) OA in the MSC after aging for experiments 5-8 and 12, respectively. Exposures to OH are given in Table 1 and exp refers to exposure. Wall losses have not been taken into account.

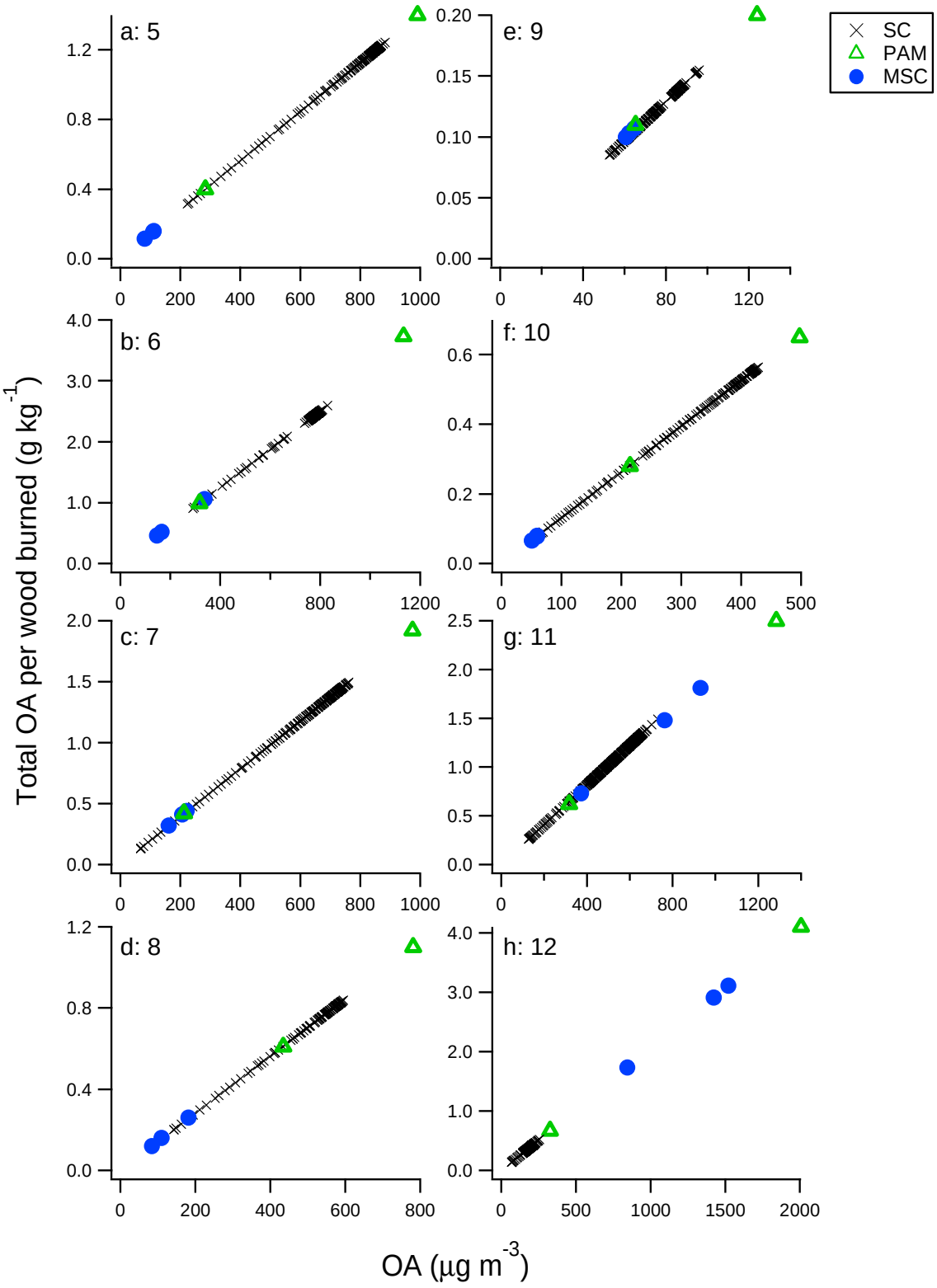

Figure S5. Total organic aerosol per mass wood burned as a function of organic aerosol loading for the SC, PAM and MSC for each wood combustion experiment (a-h; experiments 5-12, respectively).

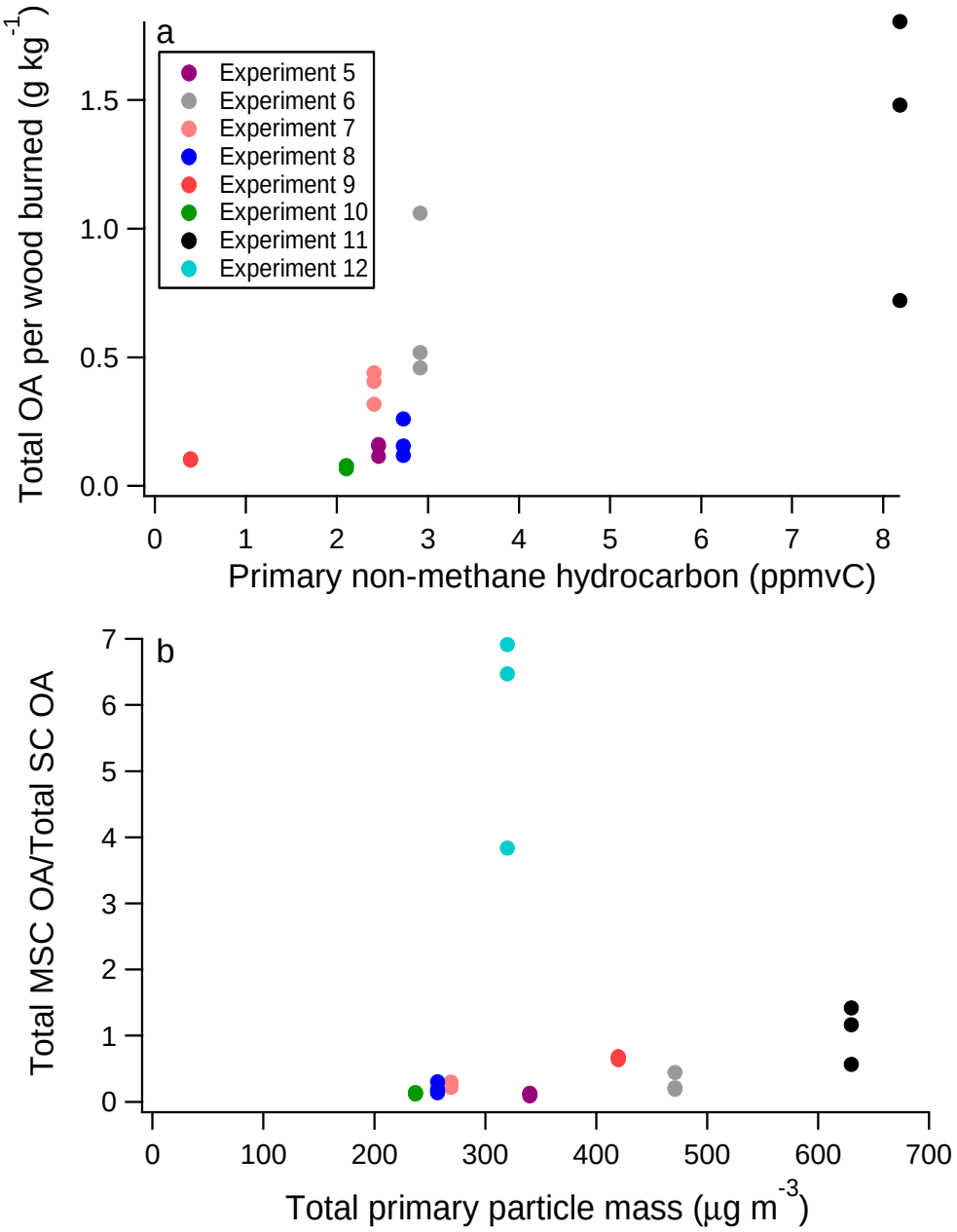

Figure S6. (a) Total OA emission factors determined in the MSC as a function of primary gas phase non-methane hydrocarbons mixing ratio as measured by the THC analyzer. The non-methane hydrocarbon mixing ratio is not known precisely for experiment 12. (b) Ratio of total OA formed in the SC and MSC as a function of total primary particle mass (sum of non-refractory material measured by the AMS and EBC measured by the Aethalometer) in the SC. Legend in (a) also applies to (b).

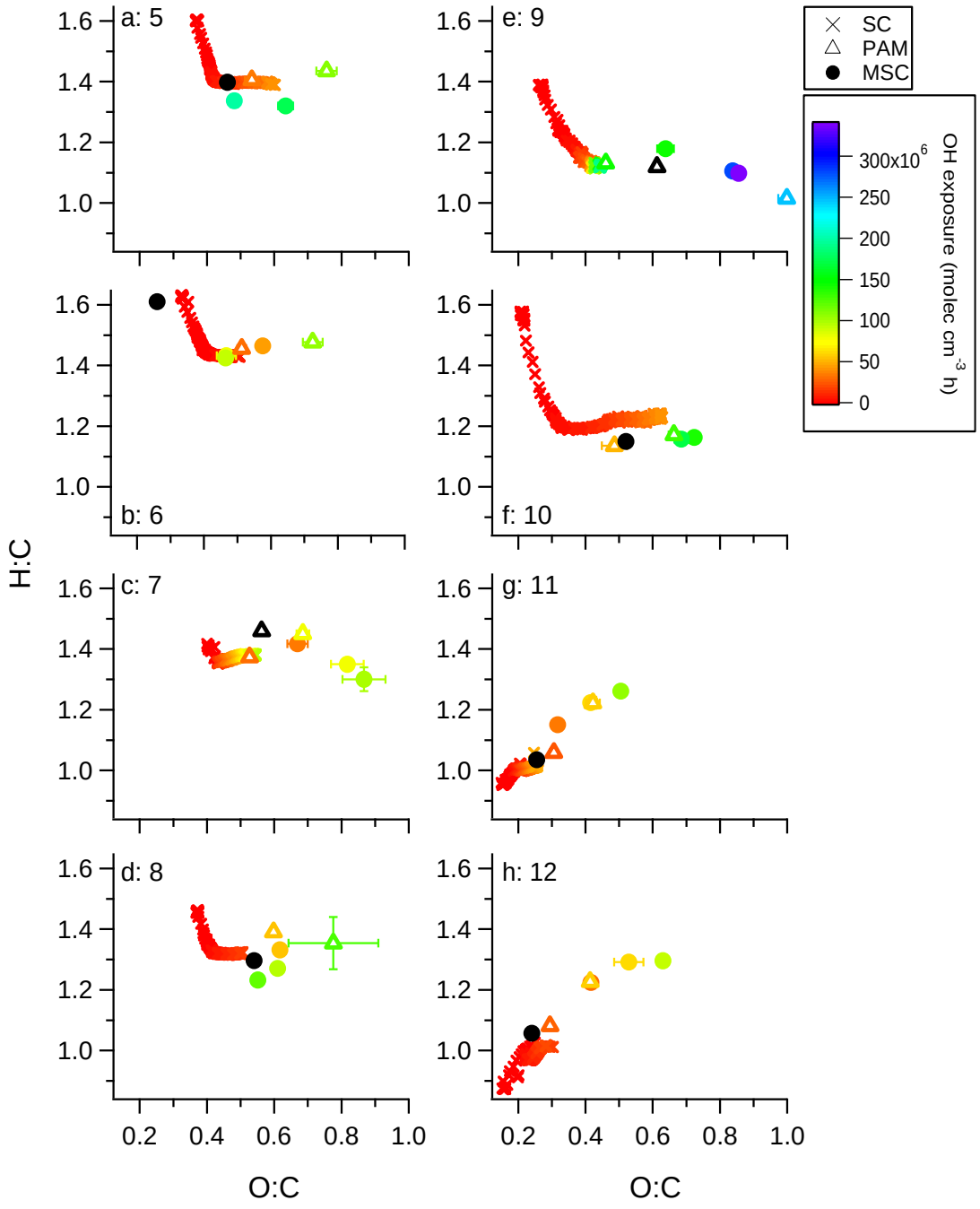

Figure S7. Elemental ratios of the bulk OA measured for each wood burning experiment (a-h, experiments 5-12, respectively) as a function of OH exposure. Colored data points correspond to the SC and the PAM and MSC when sampling from the SC. Black data points correspond to direct emission measurements, for which OH exposures are not known.

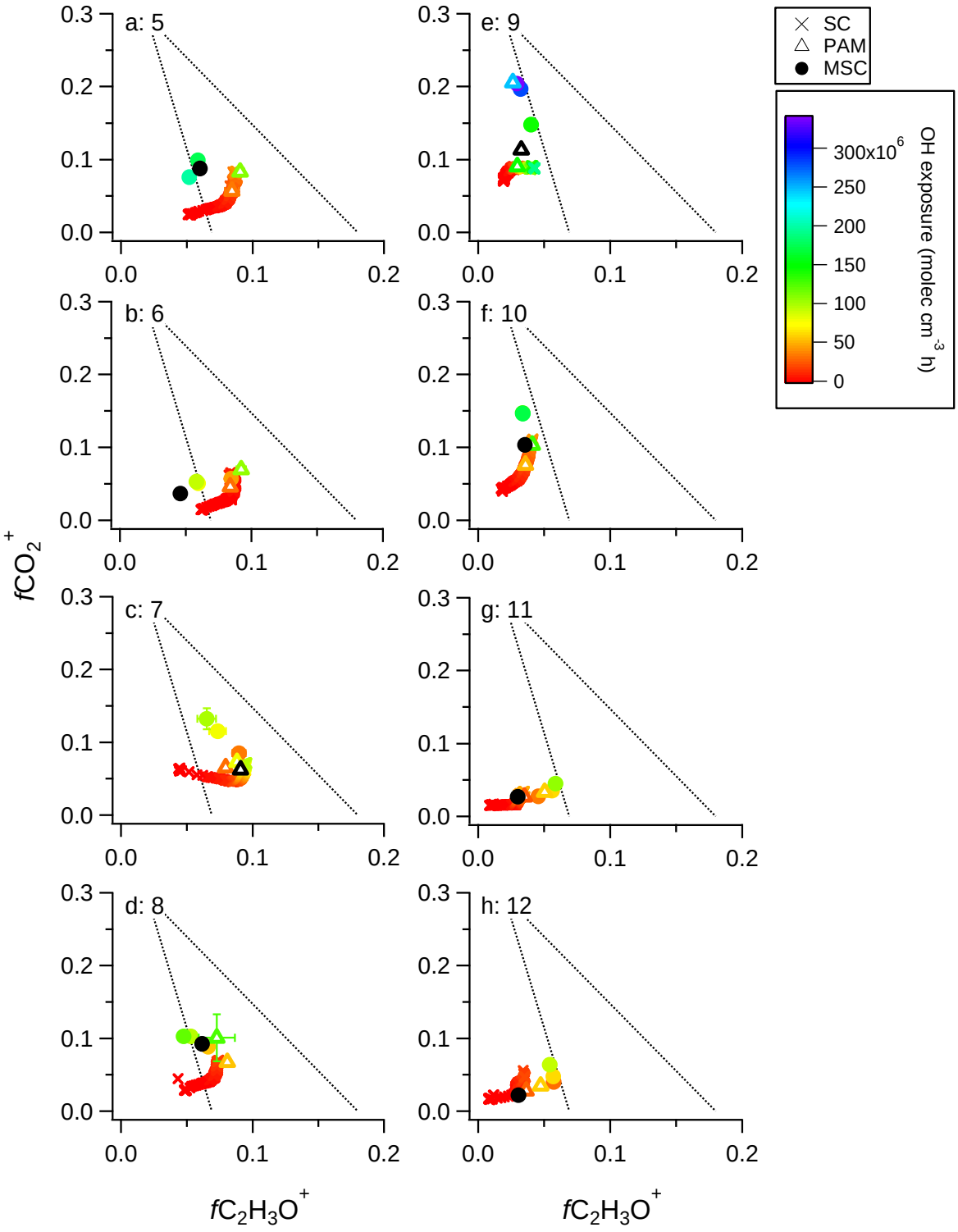

Figure S8. Plot of fCO_2^+ as a function of $fC_2H_3O^+$ for bulk OA generated in each wood burning experiment (a-h, experiments 5-12, respectively). Colored data points correspond to the SC and the PAM and MSC when sampling from the SC. Black data points correspond to direct emission measurements, for which OH exposures are not known.