



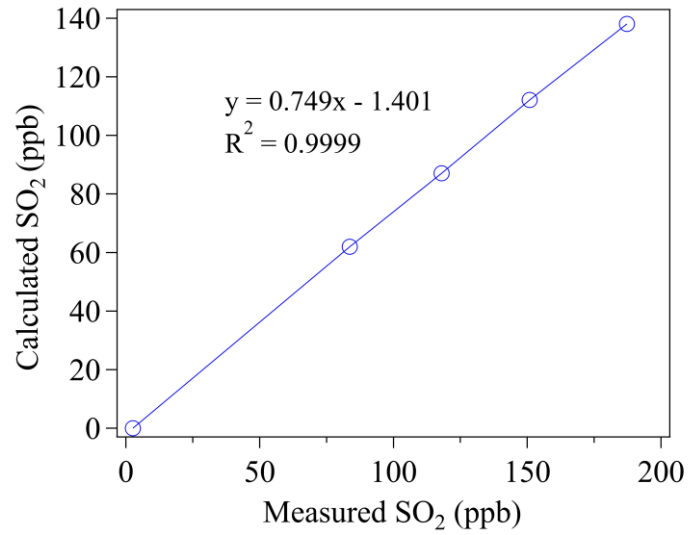
*Supplement of*

## **Reactive uptake coefficients for multiphase reactions determined by a dynamic chamber system**

**Guo Li et al.**

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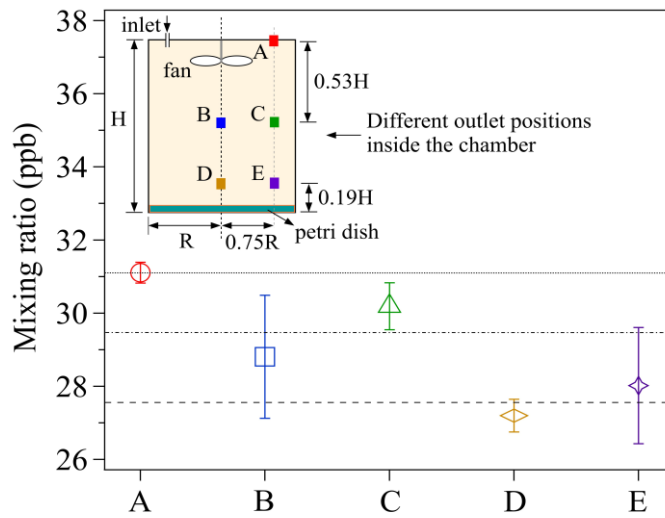


**Figure S.1.** Calibration curve of the SO<sub>2</sub> analyzer. Measured SO<sub>2</sub> means the measured mixing ratios of  
5 SO<sub>2</sub> by the instrument and the calculated SO<sub>2</sub> shows the calculated mixing ratios based on the gas  
standard and the flow rate. The symbols represent measured data and the solid line shows the linear  
least square fit.

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**Figure S.2.** The effects of different chamber outlet positions on detected  $C_{sam}$ . The sample petri dish I.D. is 116 mm and the background  $O_3$  mixing ratio is  $\sim 105$  ppb. The labels (A - E) of the X axis represent the different outlet positions shown in the chamber sketch, and the lines mean the averaged mixing ratios at the three different vertical outlet heights. The error bars represent the standard deviation of three replicate experiments.

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**Table S.1. Results of *t*-test on the detected mixing ratios at different chamber outlet positions**

Samples	<i>t</i> -test results						
	<i>t</i>	<i>sd</i>	<i>df</i>	<i>ci</i>	<i>h</i>	<i>p</i>	
Fig.4	B vs C	0.369	0.675	4	(-1.326, 1.733)	0	0.731
	D vs E	-0.920	0.435	4	(-1.312, 0.659)	0	0.410
	A vs B+C	1.118	NA	6	(-0.353, 0.936)	0	0.308
	B+C vs D+E	3.072	0.529	10	(0.258, 1.619)	1	0.012
Fig.S.2	B vs C	-1.328	1.272	4	(-4.264, 1.504)	0	0.255
	D vs E	-0.856	1.168	4	(-3.465, 1.832)	0	0.440
	A vs B+C	2.764	NA	6	(0.172, 3.042)	1	0.034
	B+C vs D+E	2.603	1.257	10	(0.272, 3.505)	1	0.026

*t*: value of the test statistic; *sd*: pooled estimate of the population standard deviation; *df*: degree of freedom; *ci*: confidence interval (95%); *h*: hypothesis test result; *p*: probability (p-) value; NA: no available data. The listed results are from two-sample *t*-test using a Matlab software. For the *t*-test, the null hypothesis is set as the tested two samples have equal means. The hypothesis test result *h* returns as 0 or 1: *h* = 0 indicates the *t*-test doesn't reject the null hypothesis and *h* = 1 otherwise. The p-values of over 0.1 suggest there is no evidence that the null hypothesis doesn't hold, and the p-values between 0.01 and 0.05 indicate there is moderately strong evidence that the null hypothesis doesn't hold (see <http://www-ist.massey.ac.nz/dstirlin/cast/cast/htestpvalue/testpvalue4.html>).

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### Comparison between $R_a$ and $R_b$

Approximations of  $R_a$  and  $R_b$  can be achieved using the methodology developed by Seinfeld and Pandis (2016), i.e.,  $R_a$  and  $R_b$  can be derived based on Eqs. (1) and (2), respectively.

$$R_a = \frac{1}{\kappa u_*} \ln\left(\frac{z}{z_0}\right) \quad (\text{S1})$$

$$5 \quad R_b = \frac{5 Sc^{2/3}}{u_*} \quad (\text{S2})$$

where  $\kappa$  is the von Karman constant ( $\kappa = 0.41$ ),  $u_*$  is the friction velocity,  $z$  is the outlet height above the chamber bottom (for our chamber configuration,  $z = 62$  mm),  $z_0$  is the roughness length and  $Sc$  is the dimensionless Schmidt number.  $z_0$  can be viewed as a length-scale representation of the roughness of the sample surface. For the prepared oxide coatings, their corresponded  $z_0$  are assumed as  $\sim 100$   $\mu\text{m}$   
10 based on our previously reported coating surface roughness range (Li et al., 2018).  $Sc$  can be calculated according to the equation  $Sc = \nu/D$ , where  $\nu$  is the kinematic viscosity of air and  $D$  is the diffusion coefficient of  $\text{SO}_2$  (at 296K,  $\nu = 1.53 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$  and  $D = 1.26 \times 10^{-5} \text{ m}^2 \text{ s}^{-1}$ ).

### References:

- 15 Li, G., Su, H., Kuhn, U., Meusel, H., Ammann, M., Shao, M., Pöschl, U., and Cheng, Y.: Technical note: Influence of surface roughness and local turbulence on coated-wall flow tube experiments for gas uptake and kinetic studies, *Atmos. Chem. Phys.*, 18, 2669-2686, 10.5194/acp-18-2669-2018, 2018.
- 20 Seinfeld, J. H., and Pandis, S. N.: *Dry Deposition*, in: *Atmospheric Chemistry and Physics: from Air Pollution to Climate Change*, 3rd ed., John Wiley & Sons, Inc., Hoboken, New Jersey, 2016.