Atmos. Meas. Tech. Discuss., 4, C106–C108, 2011
www.atmos-meas-tech-discuss.net/4/C106/2011/

Atmospheric Measurement Techniques Discussions

Interactive comment on "

Design of a new multi-phase experimental simulation chamber for atmospheric photosmog, aerosol and cloud chemistry research" *by* J. Wang et al.

Anonymous Referee #2

Received and published: 12 March 2011

General Comments

This paper describes a new chamber that has been developed for studies of atmospheric chemistry and clouds. The authors describe in detail the design of the chamber and the instruments available for physical and chemical measurements of gases and particles, and also the studies they have carried out to evaluate its performance. The

evaluation includes the irradiation used for photolysis, mixing timescales, temperature, pressure, and RH range, flushing and filling behavior, cleaning procedures, particle wall loss, cloud formation, and comparisons of results obtained in this system with others for well-studied photochemical and SOA systems.

This is a wonderful system and the design and evaluation have been carefully and thoughtfully preformed. I am sure that much good and useful data will be obtained from future studies carried out here. The manuscript is very well written and it contains necessary and appropriate references and figures. I think is should be published in ACP, although I have a few comments for the authors to consider.

Specific Comments

1. Page 334, Section 4.3. Cleaning procedure: Is the rate of removal of wall contaminants by molecular diffusion under vacuum faster than by flushing with clean air? What about heating to increase evaporation from the walls?

2. Page 342, Section 4.5.1. Aerosol particle background: I think an additional test of background that is probably more important than the one performed here would be to measure the amount of SOA formed when NOx is present and the lights are turned on, or OH radicals are formed by some other means, all in the presence of a seed such as ammonium sulfate. Of course the result can depend on chamber history, but this is what really matters for an SOA study.

3. Page 346-347, Section 4.5.3. Particle lifetime: I suggest the authors read the papers by Crump & Seinfeld, J. Aerosol Sci. 12: 405-415 (1981); Crump, Flagan, & Seinfeld, Aerosol Sci. Technol. 2:303-309 (1983); and McMurry and Rader, Aerosol Sci. Technol. 4:249-268 (1985). They describe measurements and modeling of particle wall losses in chambers with and without electrostatic effects. Comparison of their results with those presented here would be useful.

4. In my opinion the authors have missed an excellent opportunity to evaluate an

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important property of their chamber, which is the loss of semi-volatile organics to the chamber walls. It has recently been shown by Matsunaga & Ziemann, Aerosol Sci. Technol. 44: 881-892 (2010), that semi-volatile organics absorb into Teflon chamber walls and establish gas-particle partitioning equilibrium fairly rapidly. The fraction that absorbs can be substantial (>50%) and is likely to affect chamber measurements. It would be very interesting to determine the degree to which sorption occurs on the stainless steel walls of this chamber. If, for example, the walls can be passivated by the adsorption of a monolayer or so of organics, then it might be possible to operate this chamber in such a way that wall losses of semi-volatiles are much smaller than in Teflon chambers. This would be a great advantage.

Technical Corrections

1. Throughout the text: “dependant” should be “dependent”.

2. Table 7: “Pasadena” should probably be “Caltech”.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 315, 2011.