

General Comments

Atmospheric simulation chambers have a very important role to play in elucidating many aspects of atmospheric chemistry and in the validation of field equipment. A wide variety of types of chamber exist each with their own advantages and disadvantages. In addition to references cited in this paper, the referee has recently published a brief review of role of chambers in gas phase chemistry (Seakins 2010). This current paper describes the construction and validation of a new chamber which should provide novel information and fills an important 'gap in the market' of chambers. The stainless steel construction allows for a wide variety of temperature and pressure variation which in combination with a focus on multiphase capability, provides an important new resource to the community.

The paper provides a detailed description of the construction of the chamber, characterisation of physical properties such as wall-loss rates and radiation fields and validation via studies of well characterized gas phase and multiphase systems.

Specific Comments

- 1) Temperature control – a major advantage in the construction of metal chambers is the potential for temperature control. This is mentioned in the description of the chamber construction (e.g. p 322), but there is no discussion about the performance of the temperature control in Section 4. Have temperature controlled experiments been carried out? I would be interested in seeing the performance in terms of the uniformity of the temperature within the chamber. A significant chiller unit would be required! One possible concern is that the description implies that there is just one continuous volume – this could mean that the residence time of the thermofluid is quite long and there could be the potential for temperature gradients to be formed. Some temperature controlled chambers have multiple circuits to avoid this problem.
- 2) Wall loss rates – Wall loss rates for ozone at $3e-4 \text{ s}^{-1}$ seem to be quite high, although the authors do note that this is dependent on the state of the walls. Extended treatment with 100 ppm ozone may of course cause damage to materials/instruments inside the chamber. Have wall loss rates been measured for other species?
- 3) FTIR analysis – FTIR is the primary technique for monitoring hydrocarbons. Is there any particular reason why there is no conventional GC capability? Possibly this is planned for the future. FTIR analysis of multi-component mixtures is relatively complex and a little information on the method of spectral deconvolution and analysis might be helpful.
- 4) NO_x-Propene Experiments – The role of incidental HONO in OH formation is an important one in chamber experiments and it is good to see that HONO measurement will be available for future experiments. It would be helpful to slightly expand the discussion on HONO/initiation times to give a feel of the sensitivity of the system to HONO and the role of HONO generated OH as opposed to other sources of OH (this

should be available from the MCM simulation). Clearly the reader and authors want to have confidence that all important sources of OH are well characterised.

Technical Corrections

P317 – Worth referencing the most recent IPCC report in terms of role of O₃ in climate change.

P319 Except FOR the AIDA chamber....

P321 Close bracket around reference to Eurochamp website.

P322 ...double layers which allow circulating....

P323 Re-word description of pumping set up (lines 9-13).

P324 3 Basic analytical equipment

P326 line 17 multi-pass cell. Do you have any protective coating on the mirrors? Another alternative is to have a sheath of inert gas blowing in front of the mirrors. Given that gas is always being taken from the chamber, it might be worth introducing the make-up gas in front of the mirrors.

P327 What is the temporal resolution with which samples can be taken for subsequent HPLC analysis? A sample volume of 100 L is not insignificant in either the time taken or compared to the volume of the chamber if several samples are to be taken.

P332 (and elsewhere) superscripts in electronic states don't always work out.

P335 wiping

P340 Remove HCOOH from the list of compounds for which there is good agreement.

P343 ...using a SMPS, the data from which were cross checked....

Table 2 – I understood Table 2 to be related to the mixing times at various fan speeds. However, fan speed is not mentioned in this table.

Figure 5 – Would be helpful to label each disk with the actual distance from the lamps.

Seakins, P. W. (2010). "A brief review of the use of environmental chambers for gas phase studies of kinetics, chemical mechanisms and characterisation of field instruments." The European Physical Journal, Web of Conferences **9**: 143-163.