

## ***Interactive comment on “Comparison of secondary organic aerosol formed with an aerosol flow reactor and environmental reaction chambers: effect of oxidant concentration, exposure time and seed particles on chemical composition and yield” by A. T. Lambe et al.***

**Anonymous Referee #2**

Received and published: 30 December 2014

Lambe et al. present an intercomparison study of secondary organic aerosol formation in a flow reactor and four environmental chambers. The authors focus on differences in the oxidation mechanisms by comparing H/C vs. O/C ratios and the average carbon oxidation state derived from AMS mass spectra, and SOA mass yields derived from AMS and SMPS measurements. In particular, they evaluate the effect of OH exposure, the residence time, and the presence of seed particles in the experimental setups.

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The manuscript is clearly written and well-structured. A systematic intercomparison of SOA chemistry and SOA yields derived from flow reactor and chamber setups is a very important contribution to an improved understanding of SOA formation in order to assess laboratory-derived yields and oxidation pathway simulations with respect to their relevance for atmospheric conditions. While this study is not a full systematic intercomparison and some of the data analyses might be extended, it is a valuable contribution and should stimulate follow-up intercomparison studies in the same direction. Therefore, I recommend publication of this manuscript in ACP after the authors have considered the following comments:

1) Since the authors do not really discuss oxidation mechanisms in detail, it is not necessary for this manuscript to show the various SOA precursors in Figure 1. I recommend removing Figure 1 and adjusting section 2.2 accordingly, just mentioning the precursors in the text.

2) In section 3.1, the SOA mass spectra generated from alpha-pinene and naphthalene in an environmental chamber and a flow reactor are compared. It is stated that the chamber and flow reactor mass spectra are similar. What is the measure of similarity used for this statement? Did the authors use a quantitative measure for comparing mass spectra, e.g. a cluster analysis approach? What exactly are the SOA signal data shown in the insets of Figure 2c and d? Are these the sum signal of the AMS data? Please extend the comparison of the mass spectra and the explanation of the derived SOA signal!

3) I do not agree with the interpretation of Figure 4 in section 3.3! The authors state that their results show that the chambers and the flow reactor provide similar average carbon oxidation states for a specific SOA type over the range of measured SOA composition for comparable OH exposures. They justify this statement by noting that the observed deviations between the flow reactor and the chambers are no larger than deviations between two chambers. From this, the only conclusion I can draw is that for various types of SOA there is no preference for a flow reactor or a chamber exper-

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iment. However, the average carbon oxidation states obtained from experiments with different setups may vary substantially. They are not always similar! Please clarify your statement.

4) In section 3.4 (page 30587, lines 3/4) it is stated again that mass spectra and elemental ratios of SOA from flow reactor and chamber experiments are similar. What is the used measure of similarity for mass spectra?

5) Page 30587, lines 21/22: It is not evident to me from Figure 5 that SOA yields at comparable OH exposures are a factor of 2 to 10 lower in the flow reactor than in chambers. Given the strong dependence of alpha-pinene SOA yields on OH exposure shown in Fig. 5b, I cannot compare any data points in Fig. 5a. In Fig. 5b, there are no large differences between flow reactor and chamber data points. Fig. 5c may suggest a lower SOA yield by a factor of about 5 in the flow reactor, but given the large uncertainties of the yield estimates, I think a quantitative interpretation of Figure 5 is not adequate. Please clarify this passage.

Technical comments

page 30583, line 20: remove "degree" in "-0.02 per degree K"

page 30589, line 27: replace "concentrations" by "concentration"

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 30575, 2014.