

# ***Interactive comment on “Ozonolysis of $\alpha$ -phellandrene, Part 1: Gas- and particle-phase characterisation” by Felix A. Mackenzie-Rae et al.***

## **Anonymous Referee #2**

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### General Comments

In this manuscript the authors describe results of a series of environmental chamber experiments in which  $\alpha$ -phellandrene was reacted with ozone under a variety of conditions. Gas phase products were monitored with a PTR-MS and aerosol composition with an AMS. Yields for a number of low molecular weight gas phase products, OH radicals, and SOA were measured, and the rate constants for the reaction of  $\alpha$ -phellandrene and first generation products with ozone were determined. A large number of higher molecular weight gas phase products were also observed, but could not be identified. Aerosol elemental composition, carbon oxidation state, and density were also measured. Overall, these experiments were well done and generated a large volume of data on gas and aerosol composition. The data analysis is very thorough and the authors have extracted about as much from this study as possible. The manuscript

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reports useful new information on an important monoterpene emission, which may be an important contributor to nucleation and SOA formation in some forested areas. When combined with results of ongoing molecular analysis of SOA products should provide a more complete picture of the chemistry. I think the manuscript is suitable for publication, but suggest the following comments be addressed.

### Specific Comments

1. Page 5, lines 23–25; Page 6, lines 5–9: What role might gas-wall partitioning of products play in these observations? It is now well established that this can be important for oxidized compounds. The authors could explore the extent to which their products might partition to the walls using empirical approaches that have recently been developed (e.g., Krechmer et al. ES&T, 2016).
2. Page 6, 32–35: Are NO<sub>3</sub> radicals formed under the conditions of these experiments, and if so how might that chemistry affect the results?
3. Page 7, lines 21–23: Are you certain that organic nitrates would be observed with the PTR-MS? It seems likely that these compounds could lose HNO<sub>3</sub>.
4. Page 10, lines 1–25: No mention is made of the possible effect of particle-phase reactions of O<sub>3</sub> with first-generation products. These reactions would be very fast (reactive uptake coefficient about 0.001) and could form a variety of low volatility products.
5. Page 12, lines 26–27: Please provide a reference for the proposed relationship between density and phase state.
6. Page 12, lines 26–27: How well do the measured densities compare with those expected from measured O//C/H composition. Parameterizations have been developed for this (e.g. Kuwata et al. ES&T, 2011).
7. Page 13, lines 5–6: The reported wall loss rates for particles seem to be much higher than those measured by others, especially for such a large chamber. Any idea why?

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8. Page 13, lines 25–26: I would have expected that for a four-parameter fit would give a set a four different values. Doesn't this result imply that a two-parameter fit is as good as a four-parameter fit?

9. Because of the large rate constant for reaction of a-phellandrene with O<sub>3</sub> it seems likely that these experiments were conducted under conditions where RO<sub>2</sub>-RO<sub>2</sub> reactions dominate the radical chemistry. In a clean atmosphere where this reaction might be thought to play a role in nucleation, it is likely that autoxidation may be important, or RO<sub>2</sub>-HO<sub>2</sub> reactions. Some discussion of this would be useful.

Technical Comments

None.

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