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Interactive comment on “Heterogeneous reaction of peroxyacetic acid and hydrogen peroxide on ambient aerosol particles under dry and humid conditions: kinetics, mechanism and implications” by Q. Q. Wu et al.

Anonymous Referee #1

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Major revisions:

Table 1 shows mass, concentration, and effective surface area of PM_{2.5} particles, with no chemical analysis done. Instead, the authors cite other papers from previous years on the chemical characteristics of these particles. It is emphasized in the manuscript that chemical processes are the major contributors to the observed trends. The lack of chemical analysis of the PM_{2.5} particles used in this study would add more weight to the credibility of analysis.

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Since the same filter was used for experiments at different humidities, how long did each experiment take? Why not each humidity was done on a separate 'unexposed' filter? this means that the particles from the first experiment are different than the second, third, etc. Emphasize that the 'uptake' coefficient measured in these experiments is 'average' uptake on aged particles.

page 5723, line 20-24: where is the data that show the trends in these lines?

page 5724, line 10: this line discusses data on the effect of decreasing relative humidity on the uptake, but the reader is referred to Figs. 3 and 5, which were recorded with increasing RH, and contain no data on decreasing RH?!

page 5728: the literature summary in section 3.3 is useful to understand the heterogeneous chemistry of H₂O₂. However, it is used to extrapolate on the behaviour of PAA under the same conditions. Since the authors have the experimental setup optimized for measuring uptake of PAA on different samples, why not run few more experiments to show data relevant to PAA to support the extrapolations?

page 5729: the authors refer to 'pristine' particles, but their experiments were not conducted on this type of particles. Needs fixing.

Figure 4: the line shown is connecting the data points. Why not use Eq.12 to show best fit from this empirical equation?

Figure 7: same comment as for Figure 4, where Eq. 14 and 15 could be used to show best fits?

Minor revisions:

Abstract, page 5714, line 11: state enhancement magnitude quantitatively

Introduction, page 5715, lines 8-15: sentence too long, consider splitting into two

Introduction, line 21: start new paragraph starting with "To the best of our knowledge...". In this same paragraph, add details about known sources and sinks

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Introduction, page 5716, line 3: rewrite this sentence, how is it related to the one following it.

Introduction, page 5716, line 10: add 'uptake' after 'H₂O₂'

section 2.1, page 5716: reformat by adding name of chemicals first, and then chemical formula inside brackets for consistency. Add the word 'gas' after N₂ and O₂. Add details about the mineral dust samples used

section 2.2.1, page 5717: describe briefly how the concentration of PAA and H₂O₂ was determined in the gas mixture

section 2.2.2, page 5718: were PM_{2.5} particles collected on the filter subjected to any washing prior to installing in reactor?

section 2.2.3, page 5718: replace 'Fig. 1' with 'Figure 1'. Comment on the reactivity of stainless valves towards the gases used relative to PFA valves. Add details about the type of tubing used for gas flow. What is residence time of the gas inside the reactor?

section 2.2.3, page 5719, line 8: {C} is better defined as the number of molecules of gaseous peroxide for consistency with its unit.

section 2.3, page 5720: how long does it take to collect a chromatogram? what are the retention times of PAA and H₂O₂ under these HPLC conditions?

section 2.4, page 5720, line 21: replace 'dispersive' with 'dispersed'

page 5724, line 15-20: rewrite for a better transition to section 3.2

page 5726, line 1-3: remove the questions or convert them to introductory sentences where appropriate in the discussion below.

page 5727, line 8: replace 'are' with 'is'

page 5728, line 14: replace 'cation' with 'mineral'

Table 1: add units in the column headings

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Figure 2: spell out 'SD'

Figure 5: start the y-axis at '0' same as Figure 4 for consistency.

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