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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The adsorption of peroxynitric acid on ice between 230 K and 253 K" *by* T. Ulrich et al.

Anonymous Referee #1

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This paper reports the results of adsorption experiments of peroxynitric acid on ice. Experiments were performed in a coated wall flow tube at conditions of temperature and pressure that are atmospherically relevant. The experimental results are potentially interesting and novel. However, the presentation of the results was confusing in parts, and there are some major questions that must be addressed before the manuscript should be published.

General comments: One of my main concerns is related to way the authors presented their experimental procedures and some of their results. For instance, section 2 in the paper was very confusing especially that the authors lumped up all their experimental methods in one long section which made paying attention to the details hard. In addition to this there were some problems in structuring the sentences and numerous

grammatical errors that exist throughout which make it more difficult for the reader to understand the results. Most of the paper is written in good English, so I don't think professional English language editing is required. Rather, the authors themselves need to read through the manuscript and catch clunkers.

Specific comments: 1- It will be easier and clearer for the readers if the authors divided section 2 (pages 26818-2682) into titled sub-sections rather than lumping everything in one huge section. It will also be better if the authors were more organized. For instance, have a section describing the general setup. Then have another section of chemicals used, a section about ice preparations, a section about CWFT-CIMS and a section about the photolysis reactor, etc. 2- Page 26821, Line 15 to 18 is confusing, in line 15 the authors stated that, NO could not be quantified since CO interfered with NO detection, but this interference was not observed when CO was passed through the molybdenum. Is there a contradiction here, since in line 15 the authors stated that they were only able to detect NO after all the NOy species were passed through the convertor. Can the authors please clarify this point better? Are the authors here talking about NO generated from the conversion of NOy? and if CO interfered with the detection of NO does'nt this mean that it interfered with the NOy detection after they were converted to NO. 3- Pages 26823 -26824, the authors had to use a Ti (IV) denuder to reduce the interference of H2O2, however the use of the denuder although eliminated 99% of H2O2 it increased the HNO3 levels by 240% this is why a cooling trap was needed to reduce the HNO3 levels. Once I reached page 26824 lines 11-17, the authors stated that without purification levels of HNO3 stayed within 10% of HO2NO2 concentration and that's why Ti(IV) denuder is not needed. This is really confusing so did the authors use a denuder in their experiments or not. 4- Page 26825 line 24, the authors stated that error estimates were based on experiments performed at 230K, is there a reason why did they use 230 K and what about experiments performed at 253 K? 5- Page 26826, line 17 neither McNeill et al 2006 nor Ullerstram et al 2005 reported information about CF3COOH a reference is needed here. 6- Page 26828 lines 25-27, the authors stated that HNO3 desorbs at higher temperatures (+25K). Is this the

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temperature or is it 25 degrees higher than that of HO2NO2? 7- Page 26829, lines 20-23. Are the authors discussing their results or still talking about the Sokolov data? 8- Page 26831 line1, by long experiments do you mean long term uptake experiments? 9- Page 26832, line 5 what does the authors mean by the upper 1.1 nm of the ice? 10- Page 26842, table 1 I would suggest that the authors change the citation of references from number to letters so that is can be less confusing to the reader.

Technical comments:

As stated on page beofre, the data in this manuscript are so novel and interesting. However proofreading and editing for grammar, punctuation and fixing sentence structure are needed. This is necessary so that the readers do not miss the points the authors want to send across. Here are few comments but the authors are encouraged to edit the manuscript. 1- Page 26817, lines 15- 16 change the sentence to read probability that a gas molecule kinetically collide rather than a molecule that gas-kinetically collide. 2- Page 26828 line 14, omit “and” before “Arrhenius type”. 3- Page 26828 line 20, add “the following references” after on data from. 4- Page 26829 line1, replace better by more. 5- Page 26829 line18, replace is mainly that by is mainly what, same page line 22, omit “-“ after ice. 6- Page 26830 line 2, add a period after the word “each” and before “where slope” so the sentence now reads “each. The slope and uncertainty..” Same page, line 3, replace “:While” by “. The slopes”. Same page lines 4-5 rewrite so it reads “The slopes of the HNO3-HONO and the HNO3-HO2NO2 pair were not different, which might be due to...”. Line 7, replace were statistically by was statistically. 7- Page 26830, line 9, the uncertainties of what??? were given by 95% confidence?? 8- Page 26830, lines 9-10, replace “the effect that competitive. . .” by: “the effect of the competitive. . .” 9- Page 26830, line 11, later is misspelled it should be latter. 10- Page 26830 lines 15-16, rewrite the sentence so that it reads: “The higher enthalpy of adsorption compared the other nitrogen oxides is indicative of stronger HO2NO2 – ice interactions”. 11- Page 26830 lines 18-20. Rewrite so it reads, “ Despite careful purification steps, there is a possibility that the remaining H2O2, HNO3, HONO and

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NO2 impurities can interfere with the adsorption measurements of HO2NO2 and is discussed below:. 12- Page 26830 line 27, add the word “level” after background. 13- Page 26831 line1, rewrite the sentence so that it reads “while the onset of the recovery for the H2O2 signal was only visible in some very long experiments”. 14- Page 26831 line3-4, omit “which as a side note strengthens” and rewrite the sentence as follows “to ice compared to HO2NO2, which is consistent with the recent work on H2O2 adsorption to ice by Pouvesle (2010) rather than the work by Clegg and Abbatt (2001)”. 15- Page 26832 lines 11, omit the word “could” before “show” 16- Page 26833 line1, does the symbol [-] means unitless? Same page line 5, omit the – after Thus. Same page line7, omit That before Kim. Line 14, omit connected with that. Line 22, omit “where SAD is the surface area density [cm-1] because it was defined on same page line 3. In summary, I would suggest this manuscript for publication in ACP once this manuscript is improved. I hope that my suggestions were helpful.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 26815, 2011.