

## ***Interactive comment on “Heterogeneous Kinetics of H<sub>2</sub>O, HNO<sub>3</sub> and HCl on HNO<sub>3</sub> hydrates ( $\alpha$ -NAT, $\beta$ -NAT, NAD) in the range 175–200 K” by Riccardo Iannarelli and Michel J. Rossi***

**Anonymous Referee #1**

Received and published: 16 May 2016

Comments on the manuscript entitled: “Heterogeneous kinetics of H<sub>2</sub>O, HNO<sub>3</sub> and HCl on HNO<sub>3</sub> hydrates ( $\alpha$ -NAT,  $\beta$ -NAT, NAD) in the range 175-200 K” Author(s): R. Iannarelli and M. J. Rossi MS No.: acp-2016-247

This paper reports the results of heterogeneous kinetics of H<sub>2</sub>O, HNO<sub>3</sub> and HCl on HNO<sub>3</sub> hydrates under stratospheric temperature conditions in the range of 175-200 K. Langmuir adsorption isotherms were used to take into account wall interactions for the aforementioned species. Experiments were performed using a combination of transmission FTIR spectroscopy and mass spectrometry where partial and total pressure measurements have been employed in order to monitor growth and evaporation processes as a function of temperature using both pulsed admission and continuous

C1

monitoring using multi-diagnostic stirred flow reactor. The manuscript is well written and contains thorough sets of experiments that can add to the understanding of adsorption of gases on nitric acid hydrates under stratospheric conditions. I recommend the manuscript be published following the authors response to the following comments.

Specific comments: 1- Page 1, line 19, FTIR absorption spectroscopy and not spectrometry 2- Page 7, line 185, silicon has a cutoff of 1500 cm<sup>-1</sup> in the FTIR so how is the range extends from 4000-700 cm<sup>-1</sup> 3- Page 8, lines 219-220, the authors discuss that the transition in phases was observed via FTIR yet no FTIR or MS spectra were shown in the entire 52 pages of the manuscript. It would be interesting to the readers to show sample spectra and also to mention in a table the m/z and the wavenumbers where hydrates, HNO<sub>3</sub>, HCl and water were observed. 4- Page 13, lines 369-372, the authors discussed the difference between  $\alpha$ -NAT and HCl; yet no HCl results were shown in figure 2 5- Page 14, line 421, can the authors comment how the relative errors were calculated and why same error in PV (30%) and TO (60%) experiments were observed on both the NAT and NAD films? 6- Page 15, lines 448-453, again the authors talk about comparisons to HCl experiments however no HCl data are present in Figure 4b. Which figure the authors want the reader to check to compare HCl case to figure 4a, please mention the figure since HCl experiments are introduced in the next section 7- Page 17, lines 484-488, why are the authors making assumptions regarding the substrates can't they get information on changes due to HCl from FTIR? 8- Page 18, lines 534-535, the authors mentioned a decrease in  $\alpha$ - $\beta$ -NAT as a function of increasing temperature but looking at figure 7a it looks like there was no change in the signal within experimental error 9- Page 19, lines 563-574 are the two distinct temperature regimes in Figure 2a due to surface disorder on ice? 10- Page 24, lines 704-709 why only TO experiments were possible for HNO<sub>3</sub>? This point is not so clear 11- Page 25, lines 753-758 can the authors comment why their results for HCl experiments were different from those by Haynes (2002)? 12- Figures 2-7 although the

C2

authors mentioned the symbols in the text but it was so confusing to keep going back and forth between the text and the figure given the extra length of this manuscript and the different systems studied. I recommend that the authors explain the symbols in the caption for every figure.

---

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-247, 2016.