This is a review of the manuscript:

Particle shapes and infrared extinction spectra of nitric acid dehydrate crystals: Optical constants of the β-NAD modification

by:

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in: Atmospheric Chemistry and Physics, 2023.

Main comments:

This is an overall well written and structured publication on the measurements of particle shapes, infrared extinction spectra of nitric acid dehydrates (NAD) and optical constants of the metastable form β-NAD in the AIDA aerosol and cloud chamber. The paper is well structured and the main results on the optical constants for β-NAD are especially important for the remote sensing measurements and the characterisation and retrievals of particle size distributions of polar stratospheric clouds (PSCs).

The study is well suited for Atmospheric Chemistry and Physics, but due to its large number of details in laboratory measurements it would even better fit – to my mind - to the sister Journal Atmospheric Measurement Techniques.

The only caveat with the presented study is the open question why the authors have taken so much effort to measure and characterise a PSC particle type in the laboratory so far not measured in the real atmosphere. The authors have presented a discussion addressing this critical question at the end of the manuscript, where they very nicely outline how the 'next' measurements on NAT particles with the AIDA chamber should look like. Hopefully, these kind of measurements will be successful and are coming soon. It might be helpful for the reader to include one summarizing sentence in the abstract and/or introduction section to highlight the importance of NAD lab measurements even though NAT are so far the only measured nitric acid hydrates particles in the atmosphere.

Minor comments:

At some place in the manuscript the authors should state that the PSD parameter (e.g. effective radius and or bimodality) are also an important factor for the exact location of the spectral features PSC particles (e.g. Kalicinsky et al. (2021) showed changes in the 820 cm^{-1} NAT feature in direction to a step function for observations under NH polar vortex conditions with radiative transport calculations without taken aspherical particle into account).

L396ff: Here the authors present quite a number of parameters and numbers, maybe a table summarizing the details would be feasible.

L634: Are not Höpfner et al. (2002) and Spang and Remedios (2003) the first publications regarding the NAT identification at 820 cm^{-1} and should be listed here first? Same in the introduction L41, where only Spang and Remedios is mentioned but Höpfner et al. is missing.

Technical details:

To my mind the 800-900 cm^{-1} wavenumber range is not very well presented in many figures (6,8,9). It is too tiny, the details are not visible. I have seen this in many publications and is caused by the presentation of a typically huge wave number range. This specific region is of special interest for the remote sensing community due to the characteristic features for nitric acid trihydrate (NAT) at 820 cm^{-1} and the shift of this position and changes in the form of the feature due to various reasons (Woiwode et al. 2016, 2019, Kalicinsky et al. 2021). Maybe the separation in two wavelength region and/or an additional zoom, like in Figure 5 (still very small), for the Fig. 6,8, and 9 would help to show some more details here.

Fig. 6+7: The SID-3 measurements/images are very dark and the diffraction patterns are not very well to see. Can you brighten the images?

References:

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