**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on **"Homogeneous nucleation rates of nitric acid dihydrate (NAD) at simulated stratospheric conditions – Part I: Experimental results"** *by* **O. Stetzer et al.**

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I have tried several times to make sense of what is plotted in this paper in terms of my previous published work (Tabazadeh et al., 2002) on NAD nucleation rates and comparisons to other laboratory, which we also presented in our paper. I only make a few comments that the authors probably need to look into in more depth before this paper is published since I don't believe the comparisons shown are correct.

Please note that the rates discussed in our paper from Prenni et al., Salcedo et al., and Bertram et al. were all shown for a mole fraction of $X = 0.33$ (NAD mole fraction),

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where you are presenting your rates for a solution mole fraction of about 0.2 (see page 2097, section 10). You state that the desired composition of HNO3 was 45% by weight for your droplets, which translates into a mole fraction of about 0.2. This brings out several issues of concern:

a) The rest of the lab data shown in Figure 6 is for a mole fraction of 0.33 where your data is for 0.2 (according to text, see above) or 0.26 according to Table 1. I am not sure why your data should line up here with the rest of the data shown since the mole fractions are different. I have looked at the rates from the other labs and you are using the rates for a 0.33 mole fraction in Figure 6. For example, Sacledo et al. only saw NAD nucleation for a mole fraction of 0.25 (the same range that you have looked at) at much colder temperatures than you have. You MUST replot the data shown in Figure 6 using the mole fraction data from Salcedo et al. at 0.25 only and not 0.33 since that is much closer to your mole fraction range. There are huge differences in NAD nucleation rates between these two mole fractions (see Salcedo et al. paper for more discussion on this).

b) I don't recall seeing the flat triangles attributed to Bertram et al. in their published work.

c) As shown in Tabazadeh et al. (their Figure 4) they could reproduce the trend in the data for mole fraction of 0.33. The data in this range was used in parameterizing the nucleation code. Thus it is odd that you are obtaining a lower nucleation rate in the same data range. It may well be true that Tabazadeh et al.'s extrapolated rates are higher than actual rates in the real atmosphere, but the rates should match the data for high mole fractions if your data is in agreement with Salcedo et al. However, I emphasize again that your data SHOULD NOT agree with Salcedo et al.'s data set obtained for a mole fraction of 0.33. The fact that it does is very puzzling and troubling to me! Either your rates are not interpreted correctly or the reported rates by Salcedo et al. are in error.

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