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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Uptake and reaction of HOBr on frozen and dry NaCl / NaBr surfaces between 253 and 233 K" *by* J. W. Adams et al.

J. W. Adams et al.

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The following are replies to the comments of anonymous referee 2.

Specific Comments:

Improve manuscript by including a section close to the beginning that speculates on the composition of the surfaces, with indication of which phases are expected to be present at the surface, and what the eutectic temperatures for the binary and ternary systems are.

Response: The information regarding the phase diagram and eutectic temperatures is at present found on pages 113 and 121. This information will be moved to page 113, close to the beginning of the revised manuscript.

p8 (now 116). Give a reference to justify the use of a $T^{3/2}$ dependence of the diffusion

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coefficient.

Response: A $T^{1.75}$ dependence for the diffusion coefficient of several polar gases in He has been cited in the literature (Hanson and Ravishankara, 1991; Chu and Chu, 1999). Due to the small range of temperatures over which the diffusion constant of HOBr was experimentally investigated, the temperature dependence is not well established. In the revised manuscript we therefore note that our data are consistent with a $T^{1.75}$ temperature dependence rather than $T^{1.5}$ as previously given.

p13 (now 121). The authors refer to a liquid layer on the ice surface. Are they referring to a "quasi-liquid layer" or to bulk liquid.

Response: We actually are referring to the presence of an aqueous phase. The text will be amended to clarify this.

p15 (now 122). Uptake coefficients were reported only when kcor < 4 kobs. How did the authors decide on this criterion.

Response: Analysis of many data sets showed that the mathematical correction procedure of Brown (1978) became unstable when the correction factor approached 10 for our experimental conditions, i.e. as the diffusion limit was approached. The choice of a factor 4 was therefore conservative.

p17 (now 124). For the "dry surfaces" measurements were performed at relative humidities between 0 and 100 %. What are the deliquescence relative humidities of the solids ?

Response: The deliquescence relative humidities of NaCl at 298 K is 75.6 % and shows a weak temperature dependence, increasing to $\sim$ 76 % at 273 K (Tang and Munkelwitz, 1993), that of NaBr is about 58 % at 298 K (Malvestuto and Ascoli, 2001). This information will be provided in the revised manuscript.

p20 (now 127). Do the authors have an explanation for the disagreement in the uptake coefficient of Cl_2 to a frozen mixed salt surface at 233 K between this study and that of

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Huff and Abbatt (2000).

Response: We have no explanation why, in contrast to our observations, Huff and Abbatt (2000) found a lower reactivity at 233 K than at 248 K for this system. The fact that we observe not only efficient uptake, but also the same product formation at 233 and 248 K would appear to support the contention that the 233 K surface is reactive.

Equation (iii). The source of this equation should be referenced.

Response: This equation was derived in (Hanson et al., 1992)(and references therein) which will be referenced in this context in the revised manuscript.

References:

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Hanson, D.R., and Ravishankara, A.R.: The reaction probabilities of $ClONO_2$ and N_2O_5 on polar stratospheric cloud material, J. Geophys. Res., 96, 5081-5090, 1991.

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Tang, I.N., and Munkelwitz, H.R.: Composition and temperature dependence of the deliquescence properties of hygroscopic aerosols, Atmos. Environ., 27A, 467-473, 1993.

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 109, 2002.