Task Group on Atmospheric Chemical Kinetic Data Evaluation – Data Sheet V.A5.1 HNDT1

O_3 + NAT → products

Experimental data

Parameter	Temp./K	Reference	Technique/ Comments
Uptake coefficients: γ			
γ_{ss} = (1-5) x 10^{-4} (1.0 x 10^{-8} mbar)	195	Dlugokencky and	CWFT-CLD(a)
γ_{ss} = (0.2-9) x 10^{-5} (5.0 x 10^{-9} mbar)	196	Ravishankara, 1992	
γ_{ss} < 8 x10^{-5} (1.6 x 10^{-4} mbar)	183	Kenner, Plumb and Ryan, 1993	CWFT-MS(b)

Comments

(a) Coated flow tube reactor using high sensitivity chemiluminescence detection of ozone. [O_3] = 10^8 molecule cm^{-3} to 10^{12} molecule cm^{-3} with 1.3 mbar of He carrier gas. The flow tube was coated by freezing a 0.25 mole fraction solution at 196 K onto the flow tube walls, resulting in a coating of approx. 2 mm thickness. These films were not characterized. They presumably contain some NAT, but likely also remaining nitric acid solution. A measurable but not well reproducible uptake of O_3 was observed that decreased with time.

(b) Fast flow reactor with electron-impact MS. A 4-7 µm thick NAT film was deposited from a 3:1 gas phase mixture of H_2O:HNO_3 on top of a previously deposited 2-3 µm thick ice film. No loss of O_3 could be observed, and the value given in the table is an upper limit based on the sensitivity. As ClO was the main target of this study, the O_3 detection by mass spectrometry was not calibrated, and the pressure given is only a rough estimate.

Preferred Values

Parameter	Value	T/K
γ	< 1 x 10^{-6}	180 - 200

Reliability

Δ log (γ)	undetermined

Comments on Preferred Values

Even though the study using the more sensitive method to detect O_3 at very low concentration detects a measurable loss of O_3, which decreases with time, the authors caution that they may have observed uptake of O_3 into cracks and remaining liquid nitric acid solution of the not well characterized NAT film. At higher O_3 concentration, the study by Kenner et al. could not detect any uptake. No products have been observed. We therefore use the lowest observed uptake coefficient of the experiment by Dlugokecky and Ravishankara (1992) to recommend an upper limit for γ.

References

Kenner, R. D., Plumb, I. C., and Ryan, K. R.: Laboratory measurement of the loss of ClO on pyrex, ice and NAT at 183 K, Geophys. Res. Lett., 20, 193-196, 1993.

Dlugokencky, E. J., and Ravishankara, A. R.: Laboratory Measurements of Direct Ozone Los on Ice and Doped-Ice Surfaces, Geophys. Res. Lett., 19, 41-44, 1992.