

## IUPAC Subcommittee on Gas Kinetic Data Evaluation – Data Sheet V.A4.1

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### HNO<sub>3</sub> + SAT

#### Experimental data

Parameter	Temp./K	Reference	Technique/ Comments
<i>Experimental uptake coefficients: <math>\gamma</math>, <math>\gamma_0</math></i>			
$\gamma_0 > 0.3$	191.5	Hanson, 1992	CWFT-CIMS a)
$\gamma_0 > 0.2$	200		
$\gamma_0 = 0.20$ 10% H <sub>2</sub> SO <sub>4</sub>	180	Aguzzi and Rossi, 1991	Knud (b)
$\gamma_0 = 0.05$ 98% H <sub>2</sub> SO <sub>4</sub>	180		
$\gamma_0 = 0.10$ 10% H <sub>2</sub> SO <sub>4</sub>	200		
$\gamma_0 = 0.03$ 98% H <sub>2</sub> SO <sub>4</sub>	200		
<i>Partition coefficients: <math>K(cm)</math></i>			
No reversible adsorption observed			

#### Comments

(a) HNO<sub>3</sub> deposited on ice condensed from the vapor phase onto the cold flow tube.  $\gamma$  corrected for gas diffusion using estimated diffusion coefficients. Pressure = 0.6 mbar He. Rapid uptake observed, but with increasing surface coverage of HNO<sub>3</sub> the rate of uptake decreased. The steady-state partial pressure of HNO<sub>3</sub> over an ice surface with a coverage of approximately 1 monolayer of HNO<sub>3</sub> was about a factor of five higher than the vapor pressure over NAT, showing that new hydrate was not formed.

(b) SAT film made by freezing aqueous sulphuric acid solutions of composition indicated in wt.%. Uptake was continuous and  $\gamma$  was time independent except at the highest [H<sub>2</sub>SO<sub>4</sub>], when some decline with exposure time was noticed. The initial uptake coefficient decreased linearly with increasing [H<sub>2</sub>SO<sub>4</sub>] in the range given at both temperatures. If H<sub>2</sub>O vapour was added to the flow into the Knudsen cell, the uptake coefficient was independent of [H<sub>2</sub>SO<sub>4</sub>] up to ~ 60-70%, depending on temperature.

#### Preferred Values

$\alpha_s > 0.2$  over the range 190 K to 240 K

#### Reliability

$\Delta\log(\alpha) = 0.3$

### *Comments on Preferred Values*

The results of the two experimental studies of nitric acid interaction with specifically prepared solid  $\text{H}_2\text{SO}_4$ -hydrate surfaces at temperatures and concentrations relevant for the lower stratosphere are in good agreement. Under these conditions uptake is rapid, continuous and irreversible. Evidence from measurements of the  $p(\text{HNO}_3)$  over the surfaces indicated that the NAT-type solids formed on the surfaces were not in complete vapour-solid equilibrium. The data do not allow determination of the partition coefficient for adsorption, but the agreement between the results from different techniques allows us to recommend accommodation coefficient.

### **References**

- Aguzzi, A. and Rossi, M.J.: Phys. Chem. Chem. Phys. 3, 3707 (2001).  
Hanson, D. R.: J. Geophys. Res. Lett. 19, 2063 (1992).