

**Supplemental Information**  
**Table S1: Experimental Data**

<i>T</i> (K)	<i>H</i> <sup>*</sup> (mol L <sup>-1</sup> atm <sup>-1</sup> )	<i>k</i>	<i>β</i>	<i>D</i> (cm <sup>2</sup> s <sup>-1</sup> )	notes
<b>43.6 and 45.3 wt% H<sub>2</sub>SO<sub>4</sub></b>					
201.5	2.2E+7	0	7.5	2.89E-8	
210.5	7.0E+6	0	16.8	8.40E-8	
210.9	3.7E+6	2.0E-5	10.3	8.75E-8	
211.0	1.2E+7	0	10.6	8.94E-8	43.6%, b
211.0	1.1E+7	0	10.2	8.94E-8	43.6%, b
212.3	3.0E+6	0	27.9	1.01E-7	
212.6	3.6E+6	0	15.1	1.04E-7	
213.4	3.9E+6	0	17.2	1.14E-7	43.6%
214.6	2.5E+6	0	10.7	1.27E-7	43.6%
214.6	4.0E+6	2.7E-6	15.6	1.33E-7	43.6%, c
214.6	1.0E+7	0	12.5	1.33E-7	43.6%, c
214.8	2.6E+6	0	15.5	1.30E-7	43.6%, d
214.8	2.5E+6	0	13.8	1.30E-7	43.6%, d
215.6	5.3E+6	0	27.5	1.38E-7	
216.6	1.1E+6	6.0E-6	22.2	1.51E-7	
218.2	6.9E+5	0	36.2	1.84E-7	43.6%
218.9	1.1E+6	9.8E-5	14.3	1.85E-7	
219.0	6.3E+5	0	10.3	1.86E-7	
219.0	2.3E+6	0	26.3	1.86E-7	
219.1	6.2E+5	2.5E-5	18.2	1.88E-7	
219.6	7.7E+5	0	23.3	1.96E-7	
223.0	3.3E+5	2.0E-4	17.2	2.57E-7	
223.4	3.6E+5	0	19.7	2.65E-7	
223.6	3.6E+5	0	19.1	2.69E-7	
225.6	4.5E+5	0	34.5	3.12E-7	
226.1	3.2E+5	0	43.7	3.23E-7	
226.2	4.4E+5	0	41.5	3.26E-7	
226.8	4.7E+5	0	53.0	3.40E-7	
227.0	5.3E+5	0	62.7	3.45E-7	
233.0	1.1E+5	0	111.8	5.14E-7	
233.1	1.1E+5	0	79.4	5.17E-7	
233.7	1.2E+5	0	75.3	5.36E-7	
237.8	5.4E+4	0	143.0	6.85E-7	
237.9	4.0E+4	0	131.2	6.89E-7	

<i>T</i> (K)	<i>H</i> <sup>*</sup> (mol L <sup>-1</sup> atm <sup>-1</sup> )	<i>k</i>	<i>β</i>	<i>D</i> (cm <sup>2</sup> s <sup>-1</sup> )	notes
<b>54.8 wt% H<sub>2</sub>SO<sub>4</sub></b>					
217.5	7.2E+5	0	17.2	9.63E-8	e
217.5	7.3E+5	0	12.1	9.63E-8	e
217.5	6.0E+5	0	13.8	9.63E-8	f
217.5	6.1E+5	0	13.0	9.63E-8	f
218.2	4.9E+5	3.3E-5	42.7	1.03E-7	g
218.2	5.0E+5	2.8E-5	40.8	1.03E-7	g
218.8	8.4E+5	0	28.9	1.08E-7	h
218.8	8.0E+5	0	20.5	1.08E-7	h
231.2	1.6E+5	1.3E-5	49.4	2.84E-7	j
231.2	1.5E+5	3.0E-5	43.9	2.84E-7	j
<b>60.7 wt% H<sub>2</sub>SO<sub>4</sub></b>					
209.2	5.8E+5	0	187.2	2.15E-8	
209.2	4.1E+5	2.5E-4	38.6	2.15E-8	
209.6	4.9E+5	3.3E-4	11.2	2.27E-8	
215.0	1.6E+5	1.2E-4	170.0	4.29E-8	
215.3	2.4E+5	0	47.7	4.43E-8	
215.5	1.3E+5	0	95.6	4.53E-8	
216.1	1.7E+5	2.7E-4	74.1	4.83E-8	
220.0	1.3E+5	3.3E-4	72.4	7.14E-8	k
220.0	1.9E+5	1.2E-5	78.2	7.14E-8	k
220.2	1.9E+5	2.9E-4	134.0	7.22E-8	
220.5	1.2E+5	0	90.6	7.46E-8	
220.5	1.9E+5	1.1E-5	66.0	7.49E-8	
220.6	1.7E+5	0	20.2	7.56E-8	l
220.6	1.6E+5	2.7E-5	12.5	7.56E-8	l
220.9	6.1E+4	0	1.0	7.78E-8	
223.6	2.1E+5	3.1E-5	21.1	9.93E-8	m
223.6	2.0E+5	3.6E-5	15.4	9.93E-8	m
224.7	2.1E+5	1.8E-5	32.9	1.09E-7	n
224.7	2.2E+5	1.3E-5	29.9	1.09E-7	n
225.1	1.1E+5	8.1E-4	240.8	1.13E-7	o
225.1	5.6E+4	3.1E-3	164.7	1.13E-7	o
225.3	2.3E+5	0	7.8	1.15E-7	
225.8	1.9E+5	0	6.1	1.20E-7	
226.0	4.5E+4	0	57.8	1.22E-7	
226.0	1.1E+5	3.6E-5	127.9	1.22E-7	
226.1	1.7E+5	1.2E-6	3.8	1.23E-7	
226.2	1.3E+5	7.3E-6	1.8	1.24E-7	
226.2	1.4E+5	0	1.0	1.24E-7	
226.4	3.1E+4	0	23.5	1.26E-7	
226.4	4.5E+4	0	214.0	1.26E-7	
226.4	4.3E+4	2.7E-3	1.0	1.26E-7	
226.4	7.6E+4	0	49.8	1.26E-7	
226.5	5.8E+4	0	146.8	1.27E-7	

<i>T</i> (K)	<i>H*</i> (mol L <sup>-1</sup> atm <sup>-1</sup> )	<i>k</i>	<i>β</i>	<i>D</i> (cm <sup>2</sup> s <sup>-1</sup> )	notes
<b>70.1 wt% H<sub>2</sub>SO<sub>4</sub></b>					
211.9	4.3E+5	1.8E-2	5.6	5.73E-9	
211.9	1.6E+6	2.1E-4	37.7	5.73E-9	
212.2	5.3E+5	1.1E-2	1.0	6.02E-9	
215.0	2.6E+5	1.1E-2	7.4	9.37E-9	
215.2	4.1E+5	3.1E-3	33.8	9.65E-9	
215.4	3.6E+5	6.8E-3	30.7	9.94E-9	
217.2	2.2E+5	6.5E-3	1.0	1.29E-8	
220.1	3.6E+5	5.8E-4	32.2	1.90E-8	
220.2	1.3E+5	1.3E-2	1.0	1.92E-8	
220.4	3.5E+5	2.3E-4	43.7	1.97E-8	
223.6	1.5E+5	2.9E-3	1.0	2.90E-8	
223.6	1.6E+5	3.2E-3	19.3	2.90E-8	
223.8	1.5E+5	3.7E-3	13.7	2.96E-8	
226.6	1.9E+5	4.6E-4	211.4	4.03E-8	
228.0	2.4E+5	0	192.0	4.66E-8	p
228.0	2.8E+5	0	201.6	4.66E-8	p
230.3	3.1E+4	2.0E-3	1.0	5.84E-8	
231.0	5.9E+5	1.4E-4	12.9	6.25E-8	
232.7	2.4E+4	3.6E-3	1.0	7.30E-8	
232.9	9.6E+4	0	81.1	7.44E-8	q
232.9	8.1E+4	7.9E-5	57.0	7.44E-8	q
233.0	1.6E+4	3.3E-3	1.0	7.50E-8	
233.0	3.5E+4	6.6E-3	1.0	7.50E-8	
233.0	2.9E+4	1.3E-2	1.0	7.50E-8	
233.1	7.3E+4	4.7E-8	1.1	7.57E-8	
233.2	3.7E+4	1.1E-3	109.1	7.64E-8	
233.2	6.3E+4	4.0E-4	64.9	7.64E-8	
233.3	4.1E+4	1.6E-4	57.8	7.71E-8	r
233.3	2.4E+4	1.6E-3	1.0	7.71E-8	r
241.0	1.8E+4	8.1E-4	55.6	1.44E-7	
241.1	3.5E+4	8.0E-6	1.0	1.45E-7	
244.5	2.3E+4	3.6E-4	8.1	1.85E-7	
251.5	9.2E+3	0	252.6	2.90E-7	
251.6	4.7E+3	6.0E-4	1.0	2.92E-7	
251.6	7.6E+3	4.8E-4	277.5	2.92E-7	

Read 2.89E-8 as 2.89 x 10<sup>-8</sup>.

notes: 43.6% indicates experiments which employed 43.6 wt% H<sub>2</sub>SO<sub>4</sub> solutions. Unmarked experiments in the first portion of the table had a solution composition of 45.3 wt% H<sub>2</sub>SO<sub>4</sub>. Letters b - r indicate pairs of isotopic results from a single experiment. Letters l and k represent a pair of exposures performed sequentially without stirring the acid solution during the ~160 s which elapsed after experiment l was concluded, before experiment k was begun. Note that the *H\** values are equivalent, but the *β* values for the latter experiment are higher.