

# Krypton (Kr)

## 1. Recommended electron collision cross sections<sup>[1]</sup>

The following cross section set was compiled so that it can reproduce the drift velocity, the  $ND_L$  and the Townsend's ionization coefficient measured in Kr gas by the two-term Boltzmann code.

### (1) Elastic momentum transfer cross section

Energy (eV)	Cross section( $A_2$ )	Energy (eV)	Cross section( $A_2$ )
0.000	31.000	1.400	1.550
0.001	30.000	1.600	2.070
0.005	29.500	2.000	3.100
0.010	26.200	2.500	4.650
0.020	21.400	3.000	6.200
0.030	18.400	3.500	8.000
0.040	15.700	4.000	9.600
0.060	12.100	4.500	11.300
0.080	9.400	5.000	13.300
0.100	7.200	5.500	15.300
0.120	5.750	6.000	17.500
0.140	4.600	6.500	19.000
0.160	3.650	7.000	19.500
0.180	2.900	7.500	20.000
0.200	2.300	8.000	19.500
0.250	1.230	9.000	18.000
0.300	0.640	10.00	16.000
0.350	0.345	12.00	12.500
0.400	0.230	15.00	9.400
0.450	0.182	20.00	6.000
0.500	0.171	25.00	4.100
0.550	0.174	30.00	3.000
0.600	0.190	40.00	2.100
0.700	0.265	50.00	1.800
0.800	0.395	60.00	1.650
1.000	0.720	80.00	1.470
1.200	1.110	100.0	1.360

### (2) Electronic excitation cross section (metastable), Threshold = 9.91 eV, Energy loss = 9.91 eV

Energy (eV)	Cross section( $A_2$ )	Energy (eV)	Cross section( $A_2$ )
9.910	0.000	22.00	0.380
10.00	0.072	25.00	0.370
11.00	0.112	30.00	0.325
12.00	0.187	35.00	0.290
13.00	0.308	40.00	0.250
14.00	0.337	45.00	0.200
15.00	0.389	50.00	0.170
17.00	0.403	60.00	0.140
18.00	0.403	70.00	0.120
19.00	0.400	80.00	0.080
20.00	0.395	100.0	0.065

### (3) Electronic excitation cross section (others), Threshold = 10.03 eV, Energy loss = 10.03 eV

Energy (eV)	Cross section( $A_2$ )	Energy (eV)	Cross section( $A_2$ )
10.03	0.000	10.50	0.014

11.00	0.022	25.00	1.037
12.00	0.046	30.00	1.008
13.00	0.101	35.00	0.922
14.00	0.187	40.00	0.835
15.00	0.317	45.00	0.763
17.00	0.662	50.00	0.691
18.00	0.806	60.00	0.590
19.00	0.864	70.00	0.547
20.00	0.922	80.00	0.418
22.00	0.994	100.00	0.317

**(8) Ionization cross section, Threshold = 14.00 eV, Energy loss = 14.00 eV**

Energy (eV)	Cross section	Energy (eV)	Cross section
14.00	0.0000 <sup>[2]</sup>	30.00	2.7700
14.50	0.0783	32.00	2.9600
15.00	0.1600	34.00	3.1300
15.50	0.2550	36.00	3.2600
16.00	0.3580	38.00	3.3800
16.50	0.4640	40.00	3.4900
17.00	0.5760	42.50	3.5800
17.50	0.6840	45.00	3.6700
18.00	0.7990	47.50	3.7500
18.50	0.9060	50.00	3.8400
19.00	1.0100	52.50	3.9100
19.50	1.1200	55.00	3.9700
20.00	1.2200	57.50	4.0300
20.50	1.3100	60.00	4.0900
21.00	1.4100	65.00	4.1700
21.50	1.5000	70.00	4.2100
22.00	1.5800	75.00	4.2500
22.50	1.6700	80.00	4.2600
23.00	1.7600	85.00	4.2500
23.50	1.8500	90.00	4.2300
24.00	1.9200	95.00	4.2100
26.00	2.2400	100.0	4.2000
28.00	2.5200		

[1]

[2] D. Rapp and P. Englander-Golden, *J. Chem. Phys.*, **43** (1965) 1464-1479

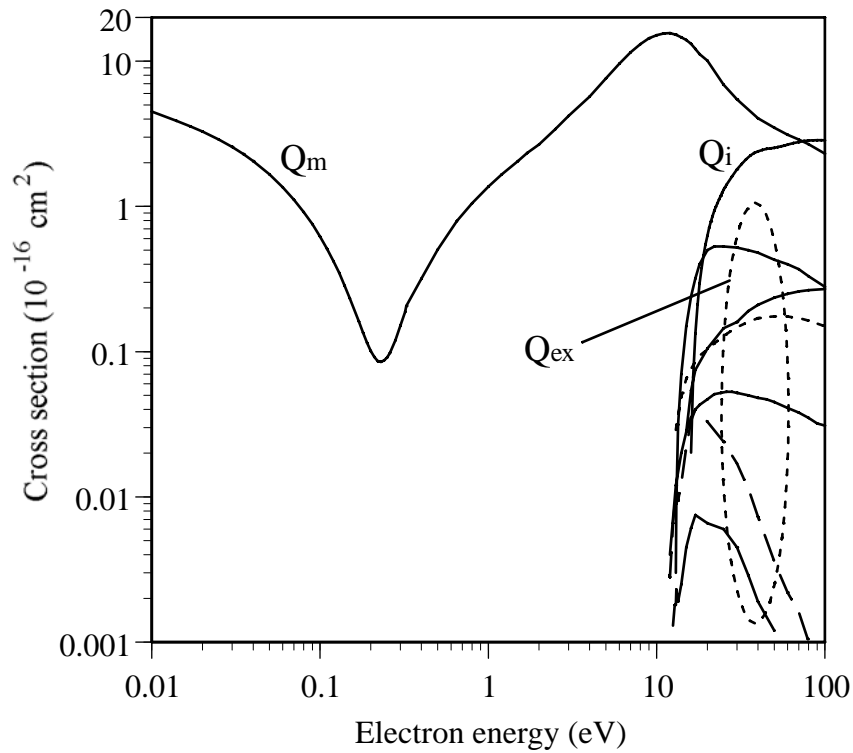


Fig.1 Recommended cross sections for Kr

## 2. Related electron swarm data

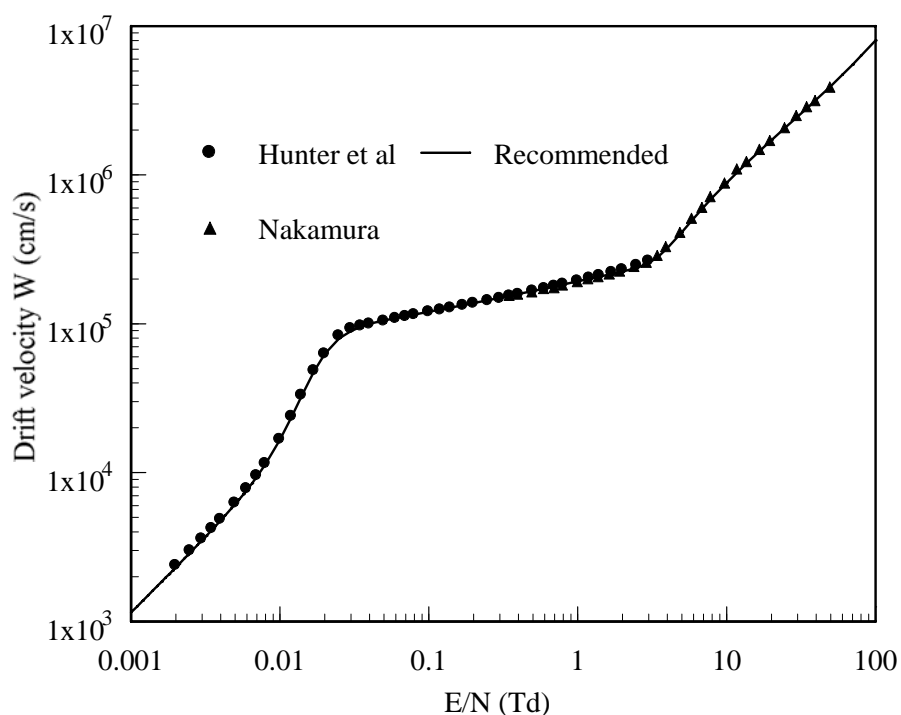
### (1) Electron drift velocity, W, in Kr

E/N (Td)	W ( $10^6$ cm/s)	E/N (Td)	W ( $10^6$ cm/s)
0.002	0.0237 <sup>[3]</sup>	0.2	1.367
0.0025	0.0297	0.25	1.424
0.003	0.0357	0.297	1.483 <sup>[1]</sup>
0.0035	0.0419	0.3	1.476
0.004	0.0483	0.346	1.548
0.005	0.0622	0.35	1.531
0.006	0.0777	0.394	1.582
0.007	0.0950	0.4	1.572
0.008	0.1146	0.492	1.635
0.01	0.1668	0.5	1.654
0.012	0.238	0.589	1.725
0.014	0.330	0.6	1.717
0.017	0.482	0.692	1.745
0.02	0.625	0.7	1.784
0.025	0.827	0.789	1.821
0.03	0.924	0.8	1.840
0.035	0.963	0.994	1.921
0.04	0.992	1.	1.935
0.05	1.039	1.168	2.005
0.06	1.082	1.2	2.020
0.07	1.115	1.371	2.072
0.08	1.148	1.4	2.100
0.1	1.199	1.627	2.162
0.12	1.234	1.7	2.200
0.14	1.274	1.911	2.257
0.17	1.324	2.	2.300

2.384		2.431	9.671	8.806
2.5	2.460		11.69	10.966
2.885		2.591	13.59	12.306
3.	2.630		16.60	14.856
3.421		2.878	19.48	17.023
3.896		3.297	24.52	20.770
4.855		4.107	29.35	25.069
5.810		5.114	34.45	28.725
6.817		6.045	39.24	31.569
7.761		7.144	49.40	38.919

[3] S. R. Hunter et al., *Phys. Rev. A*, **38** (1988) 5539-5551

[4] Y. Nakamura, *Nonequib. Effects in Ion And Elec. Trans.*, Ed. J. W. Gallagher (1990) 363-365



**Fig.2 Electron drift velocity in Kr**

**(2) Product of longitudinal diffusion coefficient and gas number density,  $ND_L$ , in Kr**

E/N (Td)	$ND_L (10^{22} \text{ cm}^{-1} \text{ s}^{-1})$	E/N (Td)	$ND_L (10^{22} \text{ cm}^{-1} \text{ s}^{-1})$
0.184	2.992 <sup>[4]</sup>	1.411	2.658
0.208	2.814	1.559	3.012
0.279	2.650	1.903	3.992
0.324	2.442	2.211	4.434
0.370	2.297	2.470	4.626
0.409	2.183	2.787	4.679
0.491	2.054	5.257	4.703
0.571	1.994	5.991	4.857
0.658	1.895	7.254	4.864
0.765	1.878	8.524	4.771
0.873	1.748	9.619	4.775
1.046	1.733	10.85	4.880
1.240	2.113		

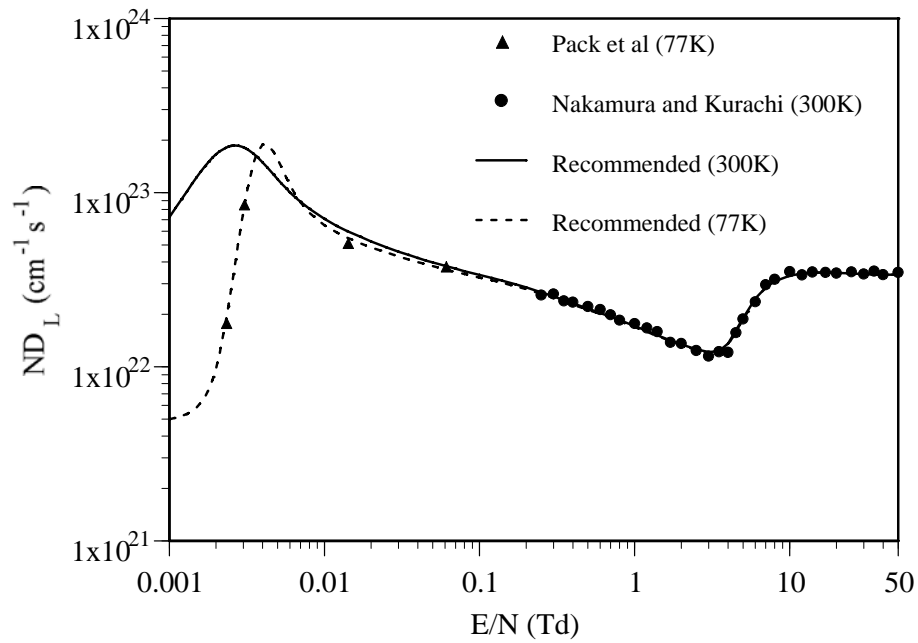
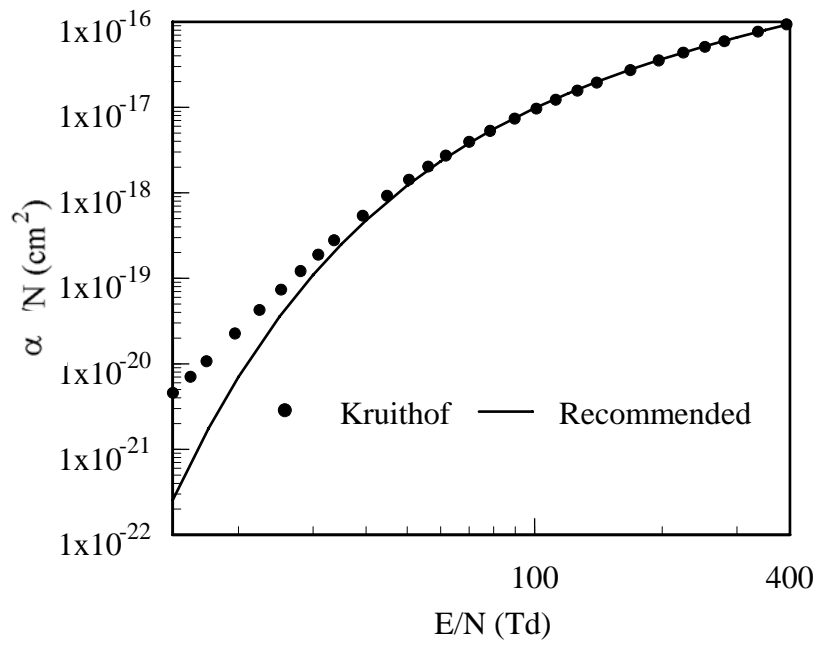


Fig.3  $ND_L$  in Kr

**(3) Ratio of ionization coefficient to gas number density,  $\alpha/N$ , in Kr**

E/N (Td)	$\alpha/N (10^{-18} \text{ cm}^2)$	E/N (Td)	$\alpha/N (10^{-18} \text{ cm}^2)$
14.12	0.0044 <sup>[5]</sup>	70.6	3.8
15.54	0.0068	79.1	5.1
16.95	0.0103	90.4	7.1
19.77	0.0218	101.7	9.3
22.60	0.041	113.0	11.8
25.42	0.071	127.1	15.1
28.25	0.117	141.2	18.7
31.1	0.182	169.5	26.2
33.9	0.268	197.7	34
39.6	0.52	226.0	42
45.2	0.89	254.2	49
50.9	1.37	282.5	57
56.5	1.95	339.	74
62.2	2.62	396.	90

[5] A. A. Kruithof, Physica 7 (1940) 519-540



**Fig.4  $\alpha/N$  in Kr**