Fundamentals and Applications of Nonthermal Plasma Fluid Flows: A Review

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Supplemental data

Table S1. Considered chemical reactions

No.	Chemical reactions	A, m^3 $kmol^{-1}$ K^{-n} s^{-1}	n	E_j/R, K
1	$e + N_2 \rightarrow N_2^+ + 2e$	Collision cross section 1		
2	$e + N_2 \rightarrow N^+ + N + 2e$	Collision cross section 1		
3	$e + N_2 \leftrightarrow N_2 (A^3\Sigma_u^+) + e$	Collision cross section 2		
4	$e + N_2 \leftrightarrow N_2(a^1\Sigma_u^-) + e$	Collision cross section 3		
5	$e + N_4^+ \rightarrow 2N_2$	3.22E-13	-0.5	0
6	$e + N_2^+ \rightarrow 2N$	4.50E-14	-0.5	0
7	$e + N_2^+ \rightarrow 2N$	3.38E-13	-0.5	0
8	$2e + N_2^+ \rightarrow 2N+e$	7.18E-39	-4.5	0
9	$e + N_2^+ + N_2 \rightarrow 2N_2$	2.49E-41	-1.5	0
10	$e + N_3^+ \rightarrow N_2 + N$	3.22E-24	-0.5	0
11	$N_2^+ + 2\ N_2 \rightarrow N_4^+ + N_2$	5.00E-41	0	0
12	$N_2^+ + N_2 + N \rightarrow N_3^+ + N_2$	3.40E-41	0	0
13	$N_2^+ + N_2(A^3\Sigma_u^+) \rightarrow N_3^+ + N$	3.00E-16	0	0
14	$N_2^+ + N \rightarrow N^+ + N_2$	7.00E-19	0	0
15	$N_3^+ + N \rightarrow N_2^+ + 2N$	6.60E-17	0	0
16	$N_4^+ + N_2 \rightarrow N_2^+ + 2N_2$	2.40E-21	0	0
17	$N_4^+ + N \rightarrow N^+ + 2N_2$	1.00E-17	0	0
18	$N^+ + N_2 + N \rightarrow N_2^+ + N_2$	1.00E-41	0	0
19	$N_2(A^3\Sigma_u^+) + N \rightarrow N_2 + N$	4.00E-17	0	0
20	$N_2(a^1\Sigma_u^-) + N_2 \rightarrow N_2(B^3\Pi_g) + N_2$	2.00E-19	0	0
21	$N_2(A^3\Sigma_u^+) + N_2(a^1\Sigma_u^-) \rightarrow N_4^+ + e$	5.00E-17	0	0
22	$2N_2(a^1\Sigma_u^-) \rightarrow N_4^+ + e$	7.70E-17	0	0

23	$2N_2(A^3\Sigma_u^+) \rightarrow N_2 + N_2(B^3\Pi_g)$	2.00E-16	0	0
24	$2N_2(A^3\Sigma_u^+) \rightarrow N_2 + N_2(C^3\Pi_u)$	2.00E-16	0	0
25	$N_2(A^3\Sigma_u^+) + e \rightarrow N_2^+ + 2e$	Collision cross section 4		
26	$N_2(a^1\Sigma_u^-) + e \rightarrow N_2^+ + 2e$	Collision cross section 4		
27	$e + N_2 \rightarrow e + N_2$	Collision cross section 5		
28	$N_2(B^3\Pi_g) + N_2 \rightarrow 2N_2$	1.00E-17	0	0
29	$N_2(B^3\Pi_g) \rightarrow N_2$	1.00E+05	0	0
30	$N_2(C^3\Pi_u) + N_2 \rightarrow 2N_2$	1.00E-17	0	0
31	$N_2(C^3\Pi_u) \rightarrow N_2(B^3\Pi_g)$	2.50E+07	0	0
32	$e + O_2 \rightarrow O^- + O$	Collision cross section 6		
33	$e + O_2 \leftrightarrow e + O_2$ (v)	Collision cross section 7		
34	$e + O_2 \rightarrow e + O_2$	Collision cross section 8		
35	$e + O_2 \rightarrow e + O_2$	Collision cross section 9		
36	$e + O_2 \rightarrow e + O_2$	Collision cross section 10		
37	$e + O_2 \leftrightarrow e + O_2 (a^1\Delta)$	Collision cross section 11		
38	$e + O_2 \leftrightarrow e + O_2 (b^1\Sigma)$	Collision cross section 12		
39	$e + O_2 \rightarrow e + 2O$	Collision cross section 13		
40	$e + O_2 \rightarrow e + O + O (^1D)$	Collision cross section 14		
41	$e + O_2 \rightarrow 2e + O_2^+$	Collision cross section 15		
42	$e + O_2 \rightarrow 2e + O + O^+$	Collision cross section 16		
43	$e + 2\ O_2 \rightarrow O_2^- + O_2$	3.60E-43	-0.5	0
44	$e + O_2^+ \rightarrow 2O$	Collision cross section 17		
45	$e + O_2^+ \rightarrow O (^1D) + O$	Collision cross section 17		
46	$e + O_2 (a^1\Delta) \rightarrow 2e + O_2^+$	Collision cross section 18		
47	$e + O_2 (b^1\Sigma) \rightarrow 2e + O_2^+$	1.36E-15	1.1	10.43
48	$e + O_3 \rightarrow O^- + O_2$	Collision cross section 19		
49	$e + O_3 \rightarrow O_2^- + O$	Collision cross section 20		
50	$e + O \rightarrow e + O (^1D)$	Collision cross section 21		
51	$e + O \leftrightarrow e + O (^1S)$	Collision cross section 22		
52	$e + O \rightarrow 2e + O^+$	Collision cross section 23		
53	$e + O (^1D) \rightarrow e + O$	Collision cross section 24		
54	$e + O (^1D) \rightarrow 2e + O^+$	Collision cross section 25		

55	$e + O(^1S) \rightarrow 2e + O^+$	6.60E-15	0.6	9.43
56	$e + O^- \rightarrow 2e + O$	1.95E-18	0.5	3.4
57	$e + O^+ \rightarrow O(^1D)$	5.30E-19	-0.5	0
58	$2e + O^+ \rightarrow e + O(^1D)$	5.12E-39	-4.5	0
59	$e + O \rightarrow e + O$	Collision cross section 26		
60	$e + O \rightarrow e + O$	Collision cross section 27		
61	$e + O \rightarrow e + O$	Collision cross section 28		
62	$e + O \rightarrow e + O$	Collision cross section 29		
63	$e + O \rightarrow e + O$	Collision cross section 30		
64	$e + O(^1D) \rightarrow e + O(^1D)$	Collision cross section 26		
65	$e + O(^1S) \rightarrow e + O(^1S)$	Collision cross section 26		
66	$e + O_2 \rightarrow e + O_2$	Collision cross section 31		
67	$e + O_2(a^1\Delta) \rightarrow e + O_2(a^1\Delta)$	Collision cross section 31		
68	$e + O_2(b^1\Sigma) \rightarrow e + O_2(b^1\Sigma)$	Collision cross section 31		
69	$e + O_2(v) \rightarrow e + O_2(v)$	Collision cross section 31		
70	$e + O_2^{**} \rightarrow e + O_2^{**}$	Collision cross section 31		
71	$e + O_2 \rightarrow e + O_2$	Collision cross section 32		
72	$e + O_2 \rightarrow e + O_2$	Collision cross section 33		
73	$e + O_2 \rightarrow e + O_2$	Collision cross section 34		
74	$e + O_2 \rightarrow e + O_2$	Collision cross section 35		
75	$e + O_2 \rightarrow e + O_2$	Collision cross section 36		
76	$e + O_2 \rightarrow e + O_2$	Collision cross section 37		
77	$e + O_2(a^1\Delta) \rightarrow e + O_2(b^1\Sigma)$	Collision cross section 38		
78	$e + O_2(b^1\Sigma) \rightarrow e + O_2(a^1\Delta)$	Collision cross section 39		
79	$e + O_2 \rightarrow e + O_2^{**}$	Collision cross section 40		
80	$e + O_2^{**} \rightarrow e + O_2$	Collision cross section 41		
81	$e + O_2(a^1\Delta) \rightarrow e + O_2^{**}$	Collision cross section 42		
82	$e + O_2 \rightarrow e + O + O(^1S)$	Collision cross section 43		
83	$e + O_2(a^1\Delta) \rightarrow O^- + O$	Collision cross section 44		
84	$e + O_2^+ \rightarrow O_2^{**}$	Collision cross section 45		
85	$e + O_3 \rightarrow e + O_3$	Collision cross section 46		
86	$O^- + O_2^+ \rightarrow O + O_2$	5.96E-11	-1	0
87	$O^- + O_2^+ \rightarrow 3O$	1.00E-13	0	0

88	$O^- + O^+ \rightarrow 2O$	5.96E-11	-1	0
89	$O_2^- + O_2^+ \rightarrow 2\ O_2$	5.96E-11	-1	0
90	$O_2^- + O_2^+ \rightarrow O_2 + 2O$	1.0E-13	0	0
91	$O_2^- + O^+ \rightarrow O_2 + O$	5.96E-11	-1	0
92	$O_3^- + O_2^+ \rightarrow O_3 + O_2$	5.96E-11	-1	0
93	$O_3^- + O_2^+ \rightarrow O_3 + 2O$	1.00E-13	0	0
94	$O_3^- + O^+ \rightarrow O_3 + O$	5.96E-11	-1	0
95	$O^- + O_2^+ + O_2 \rightarrow O + 2\ O_2$	3.07E-31	-2.5	0
96	$O^- + O^+ + O_2 \rightarrow 2O + O_2$	3.07E-31	-2.5	0
97	$O + O^- \rightarrow O_2 + e$	1.16E-17	0.5	0
98	$O^- + O_2\ (a^1\Delta) \rightarrow O_3 + e$	1.74E-17	0.5	0
99	$O^- + O_2\ (b^1\Sigma) \rightarrow O + O_2 + e$	4.00E-17	0.5	0
100	$O^- + O_2 \rightarrow O_3 + e$	2.90E-22	0.5	0
101	$O^- + O_3 \rightarrow 2\ O_2 + e$	1.74E-17	0.5	0
102	$O^- + O_3 \rightarrow O_3^- + O$	1.15E-17	0.5	0
103	$O^- + O_3 \rightarrow O_2^- + O_2$	5.91E-19	0.5	0
104	$O_2^- + O \rightarrow O^- + O_2$	8.69E-18	0.5	0
105	$O_2^- + O \rightarrow O_3 + e$	8.69E-18	0.5	0
106	$O_2^- + O_2\ (a^1\Delta) \rightarrow 2O_2 + e$	1.16E-17	0.5	0
107	$O_2^- + O_3 \rightarrow O_3^- + O_2$	3.75E-17	0.5	0
108	$O_3^- + O \rightarrow O_2^- + O_2$	1.45E-17	0.5	0
109	$O + O^+ + O_2 \rightarrow O_2^+ + O_2$	5.79E-43	0.5	0

110	$O^+ + O_2 \rightarrow O_2^+ + O$	1.95E-16	-0.4	0
111	$O^+ + O_3 \rightarrow O_2 + O_2^+$	1.00E-16	0	0
112	$O(^1D) + O \rightarrow 2O$	8.00E-18	0	0
113	$O(^1D) + O_2 \rightarrow O + O_2(b^1\Sigma)$	2.56E-17	0	-67
114	$O(^1D) + O_2 \rightarrow O + O_2(a^1\Delta)$	1.60E-18	0	-67
115	$O(^1D) + O_2 \rightarrow O + O_2$	4.80E-18	0	-67
116	$O(^1D) + O_3 \rightarrow O_2 + 2O$	1.20E-16	0	0
117	$O(^1D) + O_3 \rightarrow 2\,O_2$	1.20E-16	0	0
118	$O(^1S) + O_2 \rightarrow O(^1D) + O_2$	3.20E-18	0	850
119	$O(^1S) + O_2 \rightarrow O + O_2$	1.60E-18	0	850
120	$O(^1S) + O_2(a^1\Delta) \rightarrow O + O$	1.10E-16	0	0
121	$O(^1S) + O_2(a^1\Delta) \rightarrow O(^1D) + O_2(b^1\Sigma)$	2.90E-17	0	0
122	$O(^1S) + O_2(a^1\Delta) \rightarrow 3O$	3.20E-17	0	0
123	$O(^1S) + O \rightarrow O(^1D) + O$	1.67E-17	0	300
124	$O(^1S) + O \rightarrow 2O$	3.33E-17	0	300
125	$O(^1S) + O_3 \rightarrow 2\,O_2$	5.80E-16	0	0
126	$O_2(a^1\Delta) + O \rightarrow O_2 + O$	2.00E-22	0	0
127	$O_2(a^1\Delta) + O_2 \rightarrow 2\,O_2$	3.00E-24	0	200
128	$2\,O_2(a^1\Delta) \rightarrow 2\,O_2$	9.00E-23	0	560
129	$2\,O_2(a^1\Delta) \rightarrow O_2 + O_2(b^1\Sigma)$	9.00E-23	0	560
130	$2\,O_2(a^1\Delta) + O_2 \rightarrow 2O_3$	1.00E-40	0	560
131	$O_2(a^1\Delta) + O_3 \rightarrow 2\,O_2 + O$	1.71E-28	0.5	0
132	$O_2(a^1\Delta) + O_3 \rightarrow 2\,O_2 + O$	5.20E-17	0	2840
133	$2\,O_2(b^1\Sigma) \rightarrow O_2 + O_2(a^1\Delta)$	2.09E-24	0.5	0
134	$O_2(b^1\Sigma) + O_2 \rightarrow O_2(a^1\Delta) + O_2$	2.09E-25	0.5	0
135	$O_2(b^1\Sigma) + O_2 \rightarrow 2\,O_2$	2.32E-25	0.5	0
136	$O_2(b^1\Sigma) + O \rightarrow O_2(a^1\Delta) + O$	4.17E-21	0.5	0
137	$O_2(b^1\Sigma) + O \rightarrow O_2 + O$	4.63E-22	0.5	0
138	$O_2(b^1\Sigma) + O_3 \rightarrow O + 2\,O_2$	4.25E-19	0.5	0
139	$O_2(b^1\Sigma) + O_3 \rightarrow O_2(b^1\Sigma) + O_3$	4.25E-19	0.5	0
140	$O_2(b^1\Sigma) + O_3 \rightarrow O_2 + O_3$	4.25E-19	0.5	0
141	$O_2(v) + O \rightarrow O_2 + O$	5.79E-22	0.5	0
142	$O_2(v) + O_2 \rightarrow 2\,O_2$	5.79E-22	0.5	0
143	$2O + O_2 \rightarrow 2\,O_2$	9.27E-45	-0.63	0
144	$3O \rightarrow O_2 + O$	3.33E-44	-0.63	0

145	$2O + O_2 \rightarrow O_2(a^1\Delta) + O_2$	6.99E-46	-0.63	0
146	$3O \rightarrow O_2(a^1\Delta) + O$	2.51E-45	-0.63	0
147	$O + 2\,O_2 \rightarrow O_3 + O_2$	5.08E-39	-2.8	0
148	$2O + O_2 \rightarrow O_3 + O$	3.17E-43	-1.2	0
149	$O + O_3 \rightarrow 2\,O_2$	8.00E-18	0	2060
150	$O_3 + O_2 \rightarrow 2\,O_2 + O$	1.56E-15	0	11490
151	$O_2^{**} \rightarrow O_2$	1.50E-02	0	0
152	$O_2^{**} + O_2 \rightarrow O_2(a^1\Delta) + O_2$	0.00	0	0
153	$O_2^{**} + O_2 \rightarrow O_2(b^1\Sigma) + O_2$	1.86E-19	0	0
154	$O(^1D) + O_2(a^1\Delta) \rightarrow O + O_2$	1.00E-17	0	0
155	$O(^1S) + O_2 \rightarrow O + O_2(a^1\Delta)$	1.50E-18	0	850
156	$O(^1S) + O_2 \rightarrow O + O_2(b^1\Sigma)$	7.30E-19	0	850
157	$O(^1S) + O_2 \rightarrow O + O_2^{**}$	7.30E-19	0	850
158	$O(^1S) + O_2(a^1\Delta) \rightarrow O + O_2^{**}$	1.30E-16	0	0
159	$O_2(b^1\Sigma) + O_3 \rightarrow O_2(a^1\Delta) + O_3$	7.10E-18	0	0
160	$O_2(a^1\Delta) + O + O_2 \rightarrow O_2(b^1\Sigma) + O_3$	1.56E-40	-1.5	0
161	$O_2(a^1\Delta) + O + O_2 \rightarrow 2\,O_2 + O$	3.00E-44	0	0
162	$O + O_3 \rightarrow O_2(a^1\Delta) + O_2$	2.40E-19	0	2060
163	$O + O_3 \rightarrow O_2(b^1\Sigma) + O_2$	8.00E-20	0	2060
164	$2O_3 \rightarrow O + O_2 + O_3$	1.65E-15	0	11435
165	$2O + O_2 \rightarrow O_2^{**} + O_2$	1.20E-46	0	0
166	$2O + O_2 \rightarrow O_2(b^1\Sigma) + O_2$	7.60E-44	-1	170
167	$O + O_3 + O_2 \rightarrow 2O_3$	1.30E-41	-2	0
168	$O_2^+ + 2\,O_2 \rightarrow O_4^+ + O_2$	1.25E-38	-1.5	0
169	$O_4^+ + O_2(a^1\Delta) \rightarrow O_2^+ + 2\,O_2$	1.00E-16	0	0
170	$O_4^+ + O_2(b^1\Sigma) \rightarrow O_2^+ + 2\,O_2$	1.00E-16	0	0
171	$O_4^+ + O \rightarrow O_2^+ + O_3$	3.00E-16	0	0
172	$O_4^+ + O_2 \rightarrow O_2^+ + 2\,O_2$	2.67E-02	-4	5030
173	$O^- + O_2(a^1\Delta) \rightarrow O_2^- + O$	3.30E-17	0	0
174	$O^- + O_2 \rightarrow O_2^- + O$	1.00E-20	0	0
175	$O^- + O_2 \rightarrow O + e + O_2$	2.00E-16	0	15000
176	$O^- + 2\,O_2 \rightarrow O_3^- + O_2$	3.30E-40	-1	0

177	$O_2^- + O_2 \rightarrow 2\ O_2 + e$	2.00E-16	0	5338
178	$O^- + O^+ \rightarrow O_2$	2.70E-13		0
179	$O^- + O_4^+ \rightarrow O_2 + O_3$	6.90E-12	-0.5	0
180	$O^- + O_2^+ + O_2 \rightarrow O_3 + O_2$	2.00E-37	0	0
181	$O_2^- + O_2^+ + O_2 \rightarrow 3\ O_2$	2.00E-37	0	0
182	$O_2^- + O_4^+ \rightarrow 3\ O_2$	1.00E-13	0	0
183	$O_3^- + O \rightarrow e + 2\ O_2$	3.00E-16	0	0
184	$O_3^- + O_2 \rightarrow O^- + 2\ O_2$	1.62E-06	-2	18260
185	$O_3^- + O_4^+ \rightarrow O + 3\ O_2$	1.00E-13	0	0
186	$O_2^- + O_4^+ + O_2 \rightarrow 4\ O_2$	4.00E-38	0	0
187	$O_3^- + O_4^+ + O_2 \rightarrow O + 4\ O_2$	4.00E-38	0	0
188	$e + O_3 + O_2 \rightarrow O_3^- + O_2$	4.60E-43	0	0
189	$e + O_2^+ \rightarrow O + O\ (^1S)$	2.42E-13	-0.55	0
190	$e + O_4^+ \rightarrow 2\ O_2$	2.42E-11	-0.5	0
191	$e + O_4^+ \rightarrow O_2^{**} + O_2$	2.43E-12	-0.5	0
192	$N_2\ (A^3\Sigma_u^+) + O_2 \rightarrow N_2 + 2O$	2.29E-12	0	0
193	$N_2\ (a^1\Sigma_u^-) + O_2 \rightarrow N_2 + 2O$	2.29E-12	0	0
194	$N_2\ (C^3\Pi_u) + O_2 \rightarrow N_2 + 2O$	2.00E-12	0	0
195	$N_2\ (B^3\Pi_g) + O_2 \rightarrow N_2 + 2O$	2.00E-12	0	0
196	$O_2^- + N_2 \rightarrow O_2 + N_2 + e$	1.56E-19	0.5	4990
197	$O_2^- + N \rightarrow O_2 + N + e$	5.00E-16	0	0

Table S2. Considered surface chemical reactions

No.	**Chemical reactions**	A, $m^3\ kmol^{-1}\ K^{-n}\ s^{-1}$	n	E_j/R, K
1	$N^+ \rightarrow N$	1	0	0
2	$N_2^+ \rightarrow N_2$	1	0	0

3	$N_3^+ \rightarrow N_2 + N$	1	0	0
4	$N_4^+ \rightarrow 2\ N_2$	1	0	0
5	$N_2\ (A^3\Sigma_u^+) \rightarrow N_2$	1	0	0
6	$N_2\ (a^1\Sigma_u^-) \rightarrow N_2$	1	0	0
7	$N_2\ (B^3\Pi_g) \rightarrow N_2$	1	0	0
8	$N_2\ (C^3\Pi_u) \rightarrow N_2$	1	0	0
9	$O_2^+ \rightarrow O_2$	1	0	0
10	$O \rightarrow 0.5\ O_2$	1	0	0
11	$O\ (^1D) \rightarrow O$	1	0	0
12	$O^- \rightarrow O$	1	0	0
13	$O_2\ (v) \rightarrow O_2$	1	0	0
14	$O^+ \rightarrow O$	1	0	0
15	$O\ (^1S) \rightarrow O$	1	0	0
16	$O_2\ (a^1\Delta) \rightarrow O_2$	1	0	0
17	$O_2\ (b^1\Sigma) \rightarrow O_2$	1	0	0
18	$O_2^- \rightarrow O_2$	1	0	0
19	$O_3^- \rightarrow O_3$	1	0	0
20	$O_2^{**} \rightarrow O_2$	1	0	0
21	$O_4^+ \rightarrow 2\ O_2$	1	0	0

Table S3.1. Collision cross section 1

E_e, eV	Cross section × 10^{16}, cm^2
0	0
15.6	0
16	0.0195
16.5	0.0428
17	0.066
17.5	0.0911
18	0.12
18.5	0.1516

19	0.1841
19.5	0.213
20	0.2502
21	0.3181
22	0.3869
23	0.4557
25	0.5924
30	0.9579
34	1.1718
45	1.6461
60	2.0181
75	2.2134
100	2.3436
150	2.2692
200	2.1018
300	1.7763
500	1.3485
700	1.0788
1000	0.8556
1500	0.744

Table S3.2. Collision cross section 2

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0
6.17	0
7	0.001
7.8	0.0028
8.5	0.0043

9	0.0057
10	0.0082
11	0.01
12	0.012
13	0.013
14	0.014
16	0.015
17	0.015
18	0.014
20	0.012
22	0.01
24	0.0089
26	0.0076
30	0.0059
34	0.0049
40	0.0039
50	0.0034
70	0.0007
150	0
500	0
1000	0

Table S3.3. Collision cross section 3

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0
8.4	0
9	0.0067
11	0.0302

13	0.0536
14	0.0643
15	0.0697
16	0.057
17	0.0429
18	0.0348
19	0.0308
20	0.0275
24	0.0201
30	0.0154
40	0.0124
50	0.0121
70	0.0101
150	0.0067
500	0
1000	0
46.17	0.00113
56.17	0.00101
76.17	0.000214
156.17	0
506.17	0
1006.17	0

Table S3.4. Collision cross section 4

E_e, eV	Cross section $\times 10^{16}$, cm^2
10.79	0
14.5	0.3
20	0.84

30	1.66
40	2.05
50	2.24
60	2.3
70	2.3
80	2.22
90	2.15
100	2.06
132	1.8
200	1.33

Table S3.5. Collision cross section 5

E_e, eV	Cross section × 10^{16}, cm^2
0	1.1
0.001	1.36
0.002	1.49
0.003	1.62
0.005	1.81
0.007	2
0.0085	2.1
0.01	2.19
0.015	2.55
0.02	2.85
0.03	3.4
0.04	3.85
0.05	4.33
0.07	5.1
0.1	5.95

0.12	6.45
0.15	7.1
0.17	7.4
0.2	7.9
0.25	8.5
0.3	9
0.35	9.4
0.4	9.7
0.5	9.9
0.7	10
1	10
1.2	10.4
1.3	11
1.5	12
1.7	13.8
1.9	19.6
2.1	27
2.2	28.5
2.5	30
2.8	28
3	21.7
3.3	17.2
3.6	14.7
4	12.6
4.5	11.3
5	10.9
6	10.4
7	10.1

8	10
10	10.4
12	10.9
15	11
17	10.7
20	10.2
25	9.5
30	9
50	8.6
75	6.6
100	5.8
150	4.9
200	4.2
300	3.3
500	2.44
700	1.96
1000	1.55

Table S3.6. Collision cross section 6

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0
4.4	0
4.9	0
5.38	0.0023
5.86	0.0072
6.1	0.0108
6.48	0.0138
6.77	0.0152

7.05	0.0156
7.3	0.0148
7.53	0.0131
7.77	0.011
8	0.0084
8.25	0.0054
8.73	0.0028
9.2	0.0014
9.68	0.0008
10.15	0.0008
11.35	0.0008
100	0

Table S3.7. Collision cross section 7

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0
0.19	0
0.2	0.001
0.21	0.001
0.23	0
0.32	0
0.33	0.415
0.35	0
0.44	0
0.45	1.35
0.47	0
0.56	0
0.57	1.85

0.59	0
0.68	0
0.69	1.65
0.71	0
0.79	0
0.8	1
0.82	0
0.9	0
0.91	0.6
0.93	0
1.02	0
1.03	0.285
1.05	0
1.13	0
1.14	0.1125
1.16	0
1.23	0
1.24	0.0475
1.26	0
1.34	0
1.35	0.0165
1.37	0
1.44	0
1.45	0.0055
1.47	0
1.54	0
1.55	0.002
1.57	0

1.63	0
1.65	0.0007
1.67	0
3.5	0
4	0
5	0
100	0

Table S3.8. Collision cross section 8

E_e, eV	Cross section × 10^{16}, cm^2
0	0
0.38	0
0.44	0
0.45	0
0.47	0
0.56	0
0.57	0.14
0.59	0
0.68	0
0.69	0.415
0.71	0
0.79	0
0.8	0.535
0.82	0
0.9	0
0.91	0.465
0.93	0
1.02	0

1.03	0.315
1.05	0
1.13	0
1.14	0.2
1.16	0
1.23	0
1.24	0.095
1.26	0
1.34	0
1.35	0.04
1.37	0
1.44	0
1.45	0.0185
1.47	0
1.54	0
1.55	0.0085
1.57	0
1.63	0
1.65	0.0034
1.67	0
3.5	0
4	0
5	0
100	0

Table S3.9. Collision cross section 9

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0

0.57	0
0.68	0
0.69	0.0037
0.71	0
0.79	0
0.8	0.0215
0.82	0
0.9	0
0.91	0.09
0.93	0
1.02	0
1.03	0.12
1.05	0
1.13	0
1.14	0.115
1.16	0
1.23	0
1.24	0.095
1.26	0
1.34	0
1.35	0.055
1.37	0
1.44	0
1.45	0.03
1.47	0
1.54	0
1.55	0.0165
1.57	0

1.63	0
1.65	0.008
1.67	0
3.5	0
4	0
5	0
6	0.0125
7	0.0363
8	0.0588
9	0.075
10	0.0675
11	0.0563
12	0.0475
13	0.03
14	0.0175
15	0.0088
20	0
45	0
100	0

Table S3.10. Collision cross section 10

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0
0.75	0
0.79	0
0.8	0.0015
0.82	0
0.9	0

0.91	0.0055
0.93	0
1.02	0
1.03	0.0004
1.05	0
1.13	0
1.14	0.0165
1.16	0
1.23	0
1.24	0.0315
1.26	0
1.34	0
1.35	0.0335
1.37	0
1.44	0
1.45	0.0285
1.47	0
1.54	0
1.55	0.0215
1.57	0
1.63	0
1.65	0.0165
1.67	0
6	0
7	0.0275
8	0.035
9	0.0413
10	0.0463

11	0.0313
12	0.025
13	0.0175
14	0.0088
15	0
100	0

Table S3.11. Collision cross section 11

E_e, eV	Cross section × 10^{16}, cm^2
0	0
0.977	0
1.5	0.0058
2	0.0153
3	0.038
3.5	0.049
4	0.057
5	0.074
5.62	0.0825
5.91	0.0862
6.19	0.0888
6.53	0.0908
6.99	0.0914
7.61	0.0891
7.89	0.0863
8.96	0.0768
10.04	0.0679
13	0.0527

15.1	0.0455
17.5	0.0387
20.5	0.0324
24.9	0.0256
30.9	0.0196
41	0.0137
45	0.012
100	0

Table S3.12. Collision cross section 12

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0
1.627	0
2	0.0026
3	0.0097
3.5	0.0133
4	0.0139
5	0.0182
5.69	0.0194
6.54	0.0194
7.34	0.0191
8.41	0.0183
9.26	0.0174
10	0.016
13	0.0131
14.9	0.0117
17	0.0103
19.4	0.0092

20.7	0.0086
22.5	0.008
24	0.0072
28	0.0061
35.1	0.0047
41.9	0.0034
45.1	0.0031
100	0

Table S3.13. Collision cross section 13

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0
4.5	0
4.8	0.003
5	0.009
5.5	0.03
6	0.065
6.5	0.085
7	0.095
7.5	0.1
8	0.1
9	0.085
10	0.07
12	0.045
15	0
50	0
100	0

Table S3.14. Collision cross section 14

E_e, eV	Cross section × 10^{16}, cm^2
0	0
6	0
7	0.15
7.8	0.23
9	0.23
10	0.21
12	0.165
15	0.105
17	0.065
20	0.0475
45	0.019
100	0

Table S3.15. Collision cross section 15

E_e, eV	Cross section × 10^{16}, cm^2
0	0
12.6	0
13	0.025
18	0.25
28	1.024
38	1.775
48	2.07
58	2.41
68	2.61
78	2.81
88	2.84
100	2.9

Table S3.16. Collision cross section 16

E_e, eV	Cross section × 10^{16}, cm^2
17	0
18	1.9E-19
19	2.7E-19
20	4.8E-19
22.5	1.8E-18
25	4.2E-18
27.5	7.8E-18
30	1.15E-17
32.5	1.62E-17
35	2.28E-17
40	3.22E-17
45	4.08E-17
50	4.8E-17
55	5.58E-17
60	6.307E-17
65	7.069E-17
70	7.596E-17
75	8.169E-17
80	8.639E-17
85	8.87E-17
90	9.149E-17
95	9.418E-17
100	9.657E-17
105	9.836E-17
110	9.984E-17

115	1.01E-16
120	1.017E-16
125	1.022E-16
130	1.024E-16
135	1.025E-16
140	1.026E-16
145	1.026E-16
150	1.023E-16
155	1.019E-16
160	1.015E-16
165	1.01E-16
170	1.005E-16
175	9.974E-17
180	9.937E-17
185	9.85E-17
190	9.785E-17
195	9.71E-17
200	9.636E-17
210	9.487E-17
220	9.32E-17
230	9.137E-17
240	8.966E-17
250	8.786E-17
260	8.617E-17
270	8.449E-17
280	8.283E-17
290	8.128E-17
300	7.932E-17

350	7.174E-17
400	6.498E-17
450	5.89E-17
500	5.439E-17
550	5.045E-17
600	4.717E-17
650	4.419E-17
700	4.168E-17
750	3.947E-17
800	3.735E-17
850	3.541E-17
900	3.389E-17
950	3.265E-17
1000	3.206E-17

Table S3.17. Collision cross section 17

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	2000
0.01	200
0.1	19.9
0.2	9.93
0.4	4.93
0.7	2.79
1	1.93
2	0.93
5	0.33
60	0.01

Table S3.18. Collision cross section 18

E_e, eV	Cross section × 10^{16}, cm^2
11.6	0
12.7	0.029
17.7	0.242
21.7	0.446
25.4	0.676
32	1.08
53.8	1.4
61.7	1.44
80.9	1.5
92.6	1.52
105	1.52
600	1.23
1000	1.05

Table S3.19. Collision cross section 19

E_e, eV	Cross section × 10^{16}, cm^2
0.2	0.036
0.4	0.0696
0.6	0.106
0.8	0.1454
1	0.183
1.2	0.2504
1.4	0.266667
1.6	0.212
1.8	0.1412
2	0.086
2.2	0.0516

2.4	0.0262
2.6	0.0114
2.8	0.00479999
3–39.8001	0

Table S3.20. Collision cross section 20

E_e, eV	Cross section × 10^{16}, cm^2
0.2	0
0.4	0.0036
0.6	0.0212
0.8	0.0806
1	0.163
1.2	0.170333
1.4	0.114
1.6	0.0479999
1.8	0.023
2	0.015
2.2	0.00699999
2.4	0.00199999
2.6	0
2.8	0
3–39.8001	0

Table S3.21. Collision cross section 21

E_e, eV	Cross section × 10^{16}, cm^2
1.967	0
2.1	0.0082
2.4	0.0541

2.7	0.107
3	0.154
4	0.249
4.4	0.267
4.8	0.277
5	0.28
6	0.283
7	0.274
8	0.26
9	0.244
10	0.228
12	0.198
14	0.171
16	0.148
18	0.129
20	0.112
25	0.0807
30	0.059
40	0.0334
45	0.0258
50	0.0202
55	0.0161
70	0.0087
100	0.0033
150	0.0011
200	0.0005

Table S3.22. Collision cross section 22

E_e, eV	Cross section × 10^{16}, cm^2
4.19	0
4.4	0.0054
4.8	0.013
5	0.016
6	0.0257
7	0.0302
8	0.0322
9	0.0328
10	0.0327
12	0.0315
14	0.0297
16	0.0279
18	0.0261
20	0.0244
25	0.0209
30	0.018
40	0.0137
45	0.0121
50	0.0107
55	0.0095
70	0.0069
100	0.0038
150	0.0016
200	0.0008

Table S3.23. Collision cross section 23

E_e, eV	Cross section × 10^{16}, cm^2

13.618	0
14	0.026
16	0.163
18	0.265
20	0.36
25	0.53
30	0.688
35	0.823
40	0.965
50	1.153
60	1.243
70	1.282
80	1.31
90	1.32
100	1.33
150	1.31
200	1.24
300	1.042
400	0.893
500	0.792
600	0.694
700	0.622
800	0.565
900	0.519
1000	0.481

Table S3.24. Collision cross section 24

E_e, eV	Cross section $\times 10^{16}$, cm^2

0.2	0.0605831
0.4	0.119172
0.6	0.172667
0.8	0.218381
1	0.256231
1.2	0.27584
1.4	0.292789
1.6	0.310268
1.8	0.328102
2	0.346182
2.2	0.352951
2.4	0.358084
2.6	0.359331
2.8	0.360289
3	0.359587
3.2	0.356378
3.4	0.353122
3.6	0.350257
3.8	0.347727
4	0.345484
4.2	0.341063
4.4	0.336418
4.6	0.332002
4.8	0.327789
5	0.323754
5.2	0.3189
5.4	0.314006
5.6	0.309252

5.8	0.304623
6	0.30011
6.2	0.295316
6.4	0.290545
6.6	0.285863
6.8	0.281264
7	0.27674
7.2	0.272286
7.4	0.267896
7.6	0.263565
7.8	0.259289
8	0.255064
8.2	0.251073
8.4	0.247162
8.6	0.243291
8.8	0.239458
9	0.23566
9.2	0.231896
9.4	0.228162
9.6	0.224458
9.8	0.220781
10	0.21713
10.2	0.213778
10.4	0.210501
10.6	0.207245
10.8	0.20401
11	0.200793
11.2	0.197593

11.4	0.194411
11.6	0.191244
11.8	0.188093
12	0.184956
12.2	0.182193
12.4	0.179514
12.6	0.176846
12.8	0.174189
13	0.171543
13.2	0.168906
13.4	0.16628
13.6	0.163663
13.8	0.161055
14	0.158455
14.2	0.15622
14.4	0.154062
14.6	0.151912
14.8	0.149768
15	0.14763
15.2	0.145498
15.4	0.143372
15.6	0.141252
15.8	0.139137
16	0.137028
16.2	0.1351
16.4	0.133212
16.6	0.131328
16.8	0.129448

17	0.127573
17.2	0.125702
17.4	0.123834
17.6	0.12197
17.8	0.12011
18	0.118253
18.2	0.116793
18.4	0.115414
18.6	0.114038
18.8	0.112664
19	0.111293
19.2	0.109924
19.4	0.108557
19.6	0.107193
19.8	0.105831
20	0.104471
20.2	0.103113
20.4	0.101758
20.6	0.100404
20.8	0.0990518
21	0.0977018
21.2	0.0963535
21.4	0.0950071
21.6	0.0936623
21.8	0.0923192
22	0.0909778
22.2	0.0896379
22.4	0.0882995

22.6	0.0869627
22.8	0.0856273
23	0.0842933
23.2	0.0832947
23.4	0.0823632
23.6	0.0814327
23.8	0.0805032
24	0.0795748
24.2	0.0786473
24.4	0.0777208
24.6	0.0767952
24.8	0.0758706
25	0.0749468
25.2	0.0740239
25.4	0.0731018
25.6	0.0721806
25.8	0.0712602
26	0.0703405
26.2	0.0694217
26.4	0.0685036
26.6	0.0675862
26.8	0.0666696
27	0.0657536
27.2	0.0648384
27.4	0.0639239
27.6	0.06301
27.8	0.0620967
28	0.0611841

28.2	0.0605796
28.4	0.0600363
28.6	0.0594934
28.8	0.0589509
29	0.0584089
29.2	0.0578672
29.4	0.057326
29.6	0.0567851
29.8	0.0562446
30	0.0557045
30.2	0.0551647
30.4	0.0546254
30.6	0.0540863
30.8	0.0535476
31	0.0530093
31.2	0.0524713
31.4	0.0519336
31.6	0.0513962
31.8	0.0508591
32	0.0503224
32.2001	0.0497859
32.4001	0.0492498
32.6001	0.0487139
32.8001	0.0481784
33.0001	0.0476431
33.2001	0.0471081
33.4001	0.0465733
33.6001	0.0460388

33.8001	0.0455046
34.0001	0.0449707
34.2001	0.044437
34.4001	0.0439035
34.6001	0.0433703
34.8001	0.0428374
35.0001	0.0423046
35.2001	0.0417721
35.4001	0.0412399
35.6001	0.0407078
35.8001	0.040176
36.0001	0.0396444
36.2001	0.039113
36.4001	0.0385818
36.6001	0.0380508
36.8001	0.0375201
37.0001	0.0369895
37.2001	0.0364591
37.4001	0.0359289
37.6001	0.0353989
37.8001	0.0348692
38.0001	0.0343395
38.2001	0.0339883
38.4001	0.0336723
38.6001	0.0333564
38.8001	0.0330406
39.0001	0.0327249
39.2001	0.0324094

39.4001	0.032094
39.6001	0.0317787
39.8001	0.0314635

Table S3.25. Collision cross section 25

E_e, eV	Cross section × 10^{16}, cm^2
0.2	0
0.4	0
0.6	0
0.8	0
1	0
1.2	0
1.4	0
1.6	0
1.8	0
2	0
2.2	0
2.4	0
2.6	0
2.8	0
3	0
3.2	0
3.4	0
3.6	0
3.8	0
4	0
4.2	0
4.4	0

4.6	0
4.8	0
5	0
5.2	0
5.4	0
5.6	0
5.8	0
6	0
6.2	0
6.4	0
6.6	0
6.8	0
7	0
7.2	0
7.4	0
7.6	0
7.8	0
8	0
8.2	0
8.4	0
8.6	0
8.8	0
9	0
9.2	0
9.4	0
9.6	0
9.8	0
10	0

10.2	0
10.4	0
10.6	0
10.8	0
11	0
11.2	0
11.4	0
11.6	0
11.8	0.0101409
12	0.0237535
12.2	0.037439
12.4	0.051139
12.6	0.064839
12.8	0.078539
13	0.092239
13.2	0.105939
13.4	0.119639
13.6	0.133339
13.8	0.147039
14	0.160739
14.2	0.171517
14.4	0.181717
14.6	0.191916
14.8	0.202117
15	0.212317
15.2	0.222517
15.4	0.232716
15.6	0.242917

15.8	0.253117
16	0.263317
16.2	0.272932
16.4	0.282432
16.6	0.291932
16.8	0.301432
17	0.310932
17.2	0.320432
17.4	0.329932
17.6	0.339432
17.8	0.348932
18	0.358432
18.2	0.365678
18.4	0.372478
18.6	0.379278
18.8	0.386078
19	0.392878
19.2	0.399678
19.4	0.406478
19.6	0.413278
19.8	0.420078
20	0.426878
20.2	0.433678
20.4	0.440478
20.6	0.447278
20.8	0.454078
21	0.460878
21.2	0.467678

21.4	0.474478
21.6	0.481278
21.8	0.488078
22	0.494878
22.2	0.501678
22.4	0.508478
22.6	0.515278
22.8	0.522079
23	0.528879
23.2	0.535278
23.4	0.541598
23.6	0.547918
23.8	0.554238
24	0.560558
24.2	0.566878
24.4	0.573198
24.6	0.579518
24.8	0.585838
25	0.592158
25.2	0.598478
25.4	0.604798
25.6	0.611118
25.8	0.617438
26	0.623758
26.2	0.630078
26.4	0.636398
26.6	0.642718
26.8	0.649038

27	0.655358
27.2	0.661678
27.4	0.667998
27.6	0.674318
27.8	0.680638
28	0.686958
28.2	0.69251
28.4	0.69791
28.6	0.70331
28.8	0.70871
29	0.71411
29.2	0.71951
29.4	0.72491
29.6	0.73031
29.8	0.73571
30	0.74111
30.2	0.74651
30.4	0.75191
30.6	0.75731
30.8	0.76271
31	0.76811
31.2	0.77351
31.4	0.77891
31.6	0.78431
31.8	0.78971
32	0.79511
32.2001	0.80051
32.4001	0.80591

32.6001	0.81131
32.8001	0.81671
33.0001	0.82211
33.2001	0.827744
33.4001	0.833424
33.6001	0.839104
33.8001	0.844784
34.0001	0.850464
34.2001	0.856144
34.4001	0.861824
34.6001	0.867505
34.8001	0.873185
35.0001	0.878865
35.2001	0.884545
35.4001	0.890224
35.6001	0.895904
35.8001	0.901585
36.0001	0.907265
36.2001	0.912945
36.4001	0.918625
36.6001	0.924305
36.8001	0.929985
37.0001	0.935665
37.2001	0.941345
37.4001	0.947025
37.6001	0.952705
37.8001	0.958385
38.0001	0.964065

38.2001	0.968141
38.4001	0.971901
38.6001	0.975661
38.8001	0.979421
39.0001	0.983181
39.2001	0.986941
39.4001	0.990701
39.6001	0.994461
39.8001	0.998221

Table S3.26. Collision cross section 26

E_e, eV	Cross section × 10^{16}, cm^2
0	4.206
0.9808	4.206
1.009	4.39
1.05	4.499
1.077	4.56
1.118	4.702
1.169	4.81
1.216	4.936
1.282	5.096
1.35	5.205
1.427	5.357
1.529	5.547
1.636	5.752
1.836	6.075
1.964	6.232
2.167	6.413

2.283	6.53
2.53	6.77
2.778	7.052
2.976	7.081
3.263	7.197
3.544	7.226
3.856	7.322
4.24	7.43
4.577	7.471
4.881	7.422
5.285	7.417
5.636	7.391
6.085	7.432
6.7	7.313
7.666	7.25
8.313	7.246
9.281	7.173
10.49	7.079
11.32	7.01
13.46	6.979
13.97	6.786
16.14	6.424
16.9	6.304
18.07	6.195
20.21	5.993
21.88	5.871
23.65	5.716
25.25	5.548

27.67	5.344
30.75	5.067
32.33	4.927
34.37	4.746
35.98	4.615
39.67	4.41
41.97	4.275
44.34	4.131
47.2	3.979
50.4	3.845
54.73	3.703
61.46	3.495
67.04	3.346
70.39	3.248
78.09	3.09
90.13	2.902
98.01	2.71
104.8	2.591
109.6	2.554
117.9	2.453
130.2	2.305
141.1	2.186
150.7	2.096
157.2	2.013
174.1	1.909
186.5	1.816
201.9	1.725
223.2	1.614

247.2	1.493
280.1	1.375
307	1.284
334.8	1.22
359.1	1.153
396.9	1.08
426	1.037
498.4	0.9433
550.3	0.8769
598.4	0.8228
676.9	0.7313
759.9	0.6591
828.7	0.6108
906.7	0.5722
957.9	0.5581
1024	0.5417

Table S3.27. Collision cross section 27

E_e, eV	Cross section $\times 10^{16}$, cm^2
9.146	0
9.9	0.0035
10.1	0.0054
10.5	0.0106
11	0.0137
12	0.0178
14	0.0233
16	0.0285
18	0.0319

20	0.0308
22	0.0278
25	0.0229
28	0.0177
30	0.0151
35	0.0091
40	0.0061
45	0.0043
50	0.0031
55	0.0023
60	0.0018
70	0.0011
100	0.0004
150	0.00011
200	5E-5

Table S3.28. Collision cross section 28

E_e, eV	Cross section $\times 10^{16}$, cm^2
9.51	0
9.9	0.0342
10.1	0.0441
10.5	0.0548
11	0.0628
12	0.0771
14	0.0987
16	0.105
18	0.11
20	0.111

22	0.108
25	0.105
28	0.093
30	0.0869
35	0.0837
40	0.081
45	0.0795
50	0.0781
55	0.0762
60	0.0745
70	0.0716
100	0.063
150	0.0527
200	0.0437

Table S3.29. Collision cross section 29

E_e, eV	Cross section $\times 10^{16}$, cm^2
10.73	0
11.1	0.0022
11.3	0.0071
11.5	0.01
12	0.0131
14	0.0231
16	0.0235
18	0.0223
20	0.021
22	0.0186
24	0.0161

26	0.0118
28	0.0088
30	0.0067
35	0.0042
40	0.0028
45	0.002
50	0.0014
55	0.0011
60	0.0008
70	0.0005
100	0.00018
150	5E-5
200	2E-5

Table S3.30. Collision cross section 30

E_e, eV	Cross section × 10^{16}, cm^2
10.98	0
11.1	0.0015
11.3	0.0047
11.5	0.0142
12	0.0272
14	0.0522
16	0.0663
18	0.0752
20	0.077
22	0.0713
24	0.0626
26	0.0532

28	0.0458
30	0.04
35	0.0341
40	0.0313
45	0.0295
50	0.028
55	0.0254
60	0.0232
70	0.0191
100	0.011
150	0.0073
200	0.0055

Table S3.31. Collision cross section 31

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0.35
0.001	0.35
0.002	0.36
0.003	0.4
0.005	0.5
0.007	0.58
0.0085	0.64
0.01	0.7
0.015	0.87
0.02	0.99
0.03	1.24
0.04	1.44
0.05	1.6

0.07	2.1
0.1	2.5
0.12	2.8
0.15	3.1
0.17	3.3
0.2	3.6
0.25	4.1
0.3	4.5
0.35	4.7
0.4	5.2
0.5	5.7
0.7	6.1
1	7.2
1.2	7.9
1.3	7.9
1.5	7.6
1.7	7.3
1.9	6.9
2.1	6.6
2.2	6.5
2.5	6.1
2.8	5.8
3	5.7
3.3	5.5
3.6	5.45
4	5.5
4.5	5.55
5	5.6

6	6
7	6.6
8	7.1
10	8
12	8.5
15	8.8
17	8.7
20	8.6
25	8.2
30	8
50	7.7
75	6.8
100	6.5

Table S3.32. Collision cross section 32

E_e, eV	Cross section × 10^{16}, cm^2
0	0
0.02	0
0.07	0
0.08	0.0054
0.1	0
0.2	0
0.21	0.0216
0.22	0
0.32	0
0.33	0.0384
0.35	0
0.44	0

0.45	0.054
0.47	0
0.56	0
0.57	0.0672
0.59	0
0.68	0
0.69	0.0804
0.71	0
0.79	0
0.8	0.0936
0.81	0
0.9	0
0.91	0.084
0.93	0
1.02	0
1.03	0.072
1.05	0
1.13	0
1.14	0.0468
1.16	0
1.22	0
1.23	0.06
1.26	0
1.34	0
1.35	0.036
1.37	0
1.44	0
1.45	0.024

1.47	0
1.54	0
1.55	0.012
1.57	0
1.64	0
1.65	0.0048
1.67	0
100	0

Table S3.33. Collision cross section 33

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0
4	0
5	0.042
6	0.1
7	0.176
8	0.231
9	0.247
10	0.234
11	0.186
12	0.143
13	0.102
14	0.071
15	0.04
20	0.01
45	0
100	0

Table S3.34. Collision cross section 34

E_e, eV	Cross section × 10^{16}, cm^2
0	0
4	0
5	0.028
6	0.04
7	0.073
8	0.094
9	0.11
10	0.109
11	0.093
12	0.073
13	0.051
14	0.028
15	0.013
20	0.005
45	0
100	0

Table S3.35. Collision cross section 35

E_e, eV	Cross section × 10^{16}, cm^2
0	0
8.4	0
9.4	1
30	1.2
50	1.17
100	0.94

Table S3.36. Collision cross section 36

E_e, eV	Cross section × 10^{16}, cm^2
0	0
10	0
20	0.013
30	0.026
40	0.04
50	0.05
60	0.06
70	0.065
80	0.07
100	0.07

Table S3.37. Collision cross section 37

E_e, eV	Cross section × 10^{16}, cm^2
0	0
14.7	0
20	0.0085
30	0.016
40	0.0225
50	0.028
60	0.037
70	0.038
80	0.039
100	0.038

Table S3.38. Collision cross section 38

E_e, eV	Cross section × 10^{16}, cm^2
0.5	0

0.8	0.03
1	0.05
1.5	0.1
1.8	0.12
2	0.13
2.5	0.16
3	0.18
3.5	0.21
4	0.23
4.5	0.24
5	0.25
5.5	0.25
6.2	0.24
7	0.22
8.5	0.21
9.5	0.19
10.5	0.18
11.5	0.17
12	0.16
14	0.15
16	0.12
18	0.1
50	0.1

Table S3.39. Collision cross section 39

E_e, eV	Cross section $\times 10^{16}$, cm^2
0	0.01
0.3	0.016

0.5	0.02
1	0.03
1.3	0.0332
1.5	0.0347
2	0.04
2.5	0.0432
3	0.049
3.5	0.0526
4	0.054
4.5	0.0556
5	0.055
5.7	0.0522
6.5	0.0474
8	0.0446
9	0.0401
10	0.0378
11	0.0355455
11.5	0.0333913
13.5	0.0311
15.5	0.0248
17.5	0.0206
49.5	0.0202

Table S3.40. Collision cross section 40

E_e, eV	Cross section × 10^{16}, cm^2
4.48	0
4.68	0.015
4.72	0.03

6.21	0.163
6.37	0.174
6.6	0.177
6.84	0.167
7.12	0.155
7.39	0.141
9.91	0.042
10.4	0.031
11.5	0.01
40	0
100	0

Table S3.41. Collision cross section 41

E_e, eV	Cross section × 10^{16}, cm^2
0	0.336
0.2	0.351
0.24	0.59
1.73	0.585
1.89	0.586
2.12	0.551
2.36	0.484017
2.64	0.41803
2.91	0.358072
5.43	0.0766519
5.94	0.0543805
7	0.0164
35.5	0
95.5	0

Table S3.42. Collision cross section 42

E_e, eV	Cross section × 10^{16}, cm^2
3.48	0
3.68	0.015
3.72	0.03
5.21	0.163
5.37	0.174
5.6	0.177
5.84	0.167
6.12	0.155
6.39	0.141
8.91	0.042
9.4	0.031
10.5	0.01
40	0
100	0

Table S3.43. Collision cross section 43

E_e, eV	Cross section × 10^{16}, cm^2
9.74	0
13	0.266
15.4	0.414
20.2	0.577
25.8	0.696
33	0.775
48	0.838
70	0.85
100	0.8

500	0.1

Table S3.44. Collision cross section 44

E_e, eV	Cross section × 10^{16}, cm^2
2.6	0
2.63	0.000636
3.1	0.0007
3.3	0.00261
3.6	0.00458
4	0.00516
4.27	0.00566
4.56	0.00987
4.72	0.0143
4.75	0.0198
4.81	0.0338
4.95	0.0438
5.12	0.0488
5.26	0.0496
5.42	0.0488
5.61	0.0442
5.94	0.0365
6.51	0.0238
7.03	0.0177
7.68	0.0155
8.15	0.00898
8.73	0.00643
8.94	0.00592
20	0.001

40	0

Table S3.45. Collision cross section 45

E_e, eV	Cross section × 10^{16}, cm^2
0	4E-8
0.01	4E-9
0.1	4E-10
0.2	2E-10
0.4	1E-10
0.7	5.6E-11
1	4E-11
2	1.8E-11
5	6.6E-12
60	2E-13

Table S3.46. Collision cross section 46

E_e, eV	Cross section × 10^{16}, cm^2
0.03	5
2	7.5
3	9.2
4	10.6
5	9.7
6	10
7	9.3
8	9.3
10	10.4
15	10.7
20	11.6

100	10