Chapter 4
Spectral Lines in Low Pressure Synthetic (CVD) Diamond

In this chapter ca. 340 lines (and bands), which are observed in low pressure synthetic (CVD) diamond (see Sect. 1.2.3) are presented in 22 tables. The entries are assigned to 93 centers. The corresponding defect structure is established for 7 centers, is almost certain for 30 centers, and is incomplete or unknown for 56 centers.

Chapter 4 is subdivided into *absorption lines* (Sect. 4.1: 71 **LA** lines in 6 tables) (see Tables 4.1.1.1–4.1.4), into *photoluminescence excitation (PLE) lines* (Sect. 3.2: three **HE** lines in one table), into *photoluminescence excitation (PLE) lines* (Sect. 4.2: 144 **LE** lines in 2 tables), (see Tables 4.2.1–4.2.2), into *luminescence lines* (Sect. 4.3: 190 **LL** lines in 11 tables, (see Tables 4.3.1.1–4.3.9)), and into *broad bands* (Sect. 4.4: 33 **LB** bands in 3 tables, (see Tables 4.4.1–4.4.3).

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4.1 Absorption Lines (LA)

Table 4.1.1.1 Low pressure synthetic diamond (CVD): absorption lines; far infrared, part 1 (0.04–0.15 eV)

Line-label	Energy (meV)	Frequ. (cm^{-1})	Wavel. (μm)	Name	Impur./ defect	Comment	Figs. **3–6**. [Zai01]; Fig. **7.** [Zai98]	References
LA0057	57.03	460.0	21.740	...	Si?	...	**3.**17	[Ghe92b]
LA0069a	68.56	553.0	18.08	1LP(a)	...	One lattice phonon, 17 lines a–q (0.1667 eV)	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0069b	94.72	764.0	13.09	1LP(b)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0069c	102.8	829.0	12.06	1LP(c)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0105a′	105.4	850	11.76	**C**-cent.(a′)	N_I°	7 IR lines a′–g′ (166.6 meV), 3 UV lines: *C(a, b); indirect, *C(c) at 4.059 eV, see Table 9.1.1.1	...	[Zai01]
LA0069d	113.8	918.0	10.89	1LP(d)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0069e	121.2	978.0	10.23	1LP(e)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0069f	123.0	992.0	10.08	1LP(f)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0069g	126.3	1,019	9.814	1LP(g)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0126a	126.5	1,020	9.804	...	B?	2 lines a, b (133.9 meV)	**3.**13	[Che94b]
LA0069h	128.1	1,033	9.681	1LP(h)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0069i	129.2	1,042	9.596	1LP(i)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]

LA0105b′	129.6	1,045	9.566	C-cent.(b′)	N_I°	See Table 9.1.1.1	...	[Zai01]
LA0069j	132.9	1,072	9.329	1LP(j)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0126b	133.9	1,080	9.259	...	B?	...	**3.**13	[Che94b]
LA0105c′	136.0	1,097	9.116	C-cent.(c′)	N_I°	See Table 9.1.1.1	...	[Zai01]
LA0069k	137.7	1,111	9.003	1LP(k)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0105d′	140.1	1,130	8.849	C-cent.(d′)	N_I°	**Dominant** C-ce. line; var.(139–141 meV)	...	[Zai01]
LA0069-l	142.1	1,146	8.725	1LP(l)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0069m	147.7	1,191	8.394	1LP(m)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0105e	149.5	1,206	8.292	C-cent.(e′)	N_I°	See Table 9.1.1.1	...	[Zai01]

Table 4.1.1.2 Low pressure synthetic diamond (CVD): absorption lines; far infrared, part 2 (0.15–0.18 eV)

Line-label	Energy (meV)	Frequ. (cm^{-1})	Wavel. (μm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LA0069n	151.3	1,220	8.194	1LP(n)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0069-o	153.6	1,239	8.071	1LP(o)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0155a	155.2	1,252	7.987	C–H_1 bend	H	Lattice sp^3CH_1; Table 9.3.2.1	**3.**18...	[Jan92]
LA0069p	155.7	1,256	7.963	1LP(p)	...	...	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0160	159.8	1,289	7.756	...	B?	LVM of B?; calc. 159 meV	...	[Zai01]
LA0105f′	161.2	1,300	7.692	C-cent.(f′)	N_1°	var. 159.9–162.4 meV, see Table 9.1.1.1	...	[Zai01]
LA0165	165.1	1,332	7.508	*(V_1H_4)	*(V_1H_4)	2 lines a, b (412.0 meV); ZPL of DAP39, see i13-LA	**3.**18, **3.**19a	[Jan92, Fuc95b]
LA0069q	165.2	1,333	7.505	1LP(q)	...	Raman frequency	**3.**3a, Table 3.1	[Kle92, Zai01]
LA0105g′	166.6	1,344	7.442	C-cent.(g′)	N_1°	Last C-center line; sharp, FWHM=0.2%	...	[Zai01]

Table 4.1.2.1 Low pressure synthetic diamond (CVD): absorption lines; mid infrared, part 1 (0.18–0.51 eV)

Line-label	Energy (meV)	Frequ. (cm^{-1})	Wavel. (μm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LA0205	204.6	1,650	6.061	...	B?	...	...	[Zai01]
LA0216	215.6	1,739	5.750	...	O?	LVM?	**3.**10 = **7.**7	[Jan91]
LA0225c	244.0	1,968	5.080	2LP(c)	...	var. 244.0–245.5 meV, strong peak; abs. coefficient (12.3–14.9 cm^{-1}); other 2LP lines (a–q) see NA	**3.**4a,b, **3.**10 **7.**3, **7.**18	[Kle92, Jan91] [Kle92, Phi92]
LA0225e	251.1	2,025	4.938	2LP(e)	...	var. 251.1–251.7 meV, strong peak (12.3–14.9 cm^{-1})	**3.**4a, b, **3.**10	[Kle92, Jan91]
LA0260	259.7	2,095	4.774	2LP(g)	...	Weak line	**3.**4a, b	[Kle92]
LA0225i	267.0	2,154	4.642	2LP(i)	...	var. 267.0–269.0 meV, strong peak (12.3–14.9 cm^{-1})	**3.**4a, b, **3.**10	[Kle92, Jan91]
LA0225o	302.1	2,436	4.104	2LP(o)	...	Medium strong peak (4.6–5.2 cm^{-1})	**3.**4a, **3.**10	[Kle92, Jan91]
LA0304a	304.2	2,454	4.076	B-acc.(a)	B_1	B acceptor; other lines (a–r) see NA	**5.**2b	[Ert95]
LA0225p	315.0	2,541	3.935	2LP(p)	...	Medium strong peak (4.6–5.2 cm^{-1})	**3.**4a, **3.**10	[Kle92, Jan91]
LA0333	333.2	2,688	3.721	...	H?	Weak line in flame grown CVD film	**7.**18	[Phi92]

(continued)

Table 4.1.2.1 (continued)

Line-label	Energy (meV)	Frequ. (cm^{-1})	Wavel. (μm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LA0344	343.8	2,773	3.606	...	H?	Weak line	7.12	[Dis93]
LA0304j	347.1	2,800	3.572	B-acc.(j)	B_1	Dominant line; other lines (a–r) see NA	**5.**2b	[Ert95]
LA0155b	349.9	2,822	3.544	C–H_1 stretch	H	Lattice sp^3CH_1; Table 9.3.3; var. 0.3495–0.3510 eV	**7.**11, **7.**12	[Dis93]
LA0304p	362.7	2,926	3.418	B-acc.(p)	B_1	Other lines (a–r) see NA	**5.**2b	[Ert95]
LA0304r	372.0	3,001	3.333	B-acc.(r)	B_1	Bound to free?	**5.**2b	[Ert95]
LA0240i	387.3	3,124	3.201	$^*(V_1H_4)$a = —DAP39i	$^*(V_1H_4)$	$s = 26$, calc. 387.3; other DAP39 lines see i13-LA0237 homo epit. film; ^{12}C line (a) expected at 239.8 meV	...	[Fuc95b]
LA0378	390.5	3,150	3.175	N–H_1 stretch	$^*(V_1H_1)N_3^\circ$	See Table 9.3.1	...	[Mil95]
LA0165b = LA0599z	412.0	3,323	3.009	$^*(V_1H_4)$b = DAP40z	$^*(V_1H_4)$	ZPL of DAP40a-g(985.6 meV); homo epitaxial diamond film	...	[Fuc95b]
LA0304a-s1	466.0	3,759	2.660	B-acc.(a)-s1	B_1	B-acceptor(a) + phonon(162 meV)	**5.**2b	[Ert95]
LA0304j-s1	508.0	4,098	2.440	B-acc.(j)-s1	B_1	B-acceptor(j) + phonon(161 meV)	**5.**2b	[Ert95]

Table 4.1.2.2 Low pressure synthetic diamond (CVD): absorption lines; mid infrared, part 2 (0.59–1.24 eV)

Line-label	Energy (meV)	Frequ. (10^3 cm^{-1})	Wavel. (μm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LA599a	599.4	4.835	2.068	(V_1H_4)b-DAP40a	(V_1H_4)	7 lines a–g (0.9856 eV); homo epitaxial film; *shell* = 42; calc. 0.6040 eV	...	[Fuc95b]
LA599b	616.4	4.972	2.011	(V_1H_4)b-DAP40b	(V_1H_4)	$s = 36$; calc. 0.6180 eV	...	[Fuc95b]
LA599c	690.8	5.572	1.795	(V_1H_4)b-DAP40c	(V_1H_4)	$s = 20$; calc. 0.6890 eV	...	[Fuc95b]
LA599d	851.4	6.867	1.456	(V_1H_4)b-DAP40d	(V_1H_4)	$s = 8$; calc. 0.85500 eV	...	[Fuc95b]
LA599e	897.1	7.236	1.362	(V_1H_4)b-DAP40e	(V_1H_4)	$s = 7$; calc. 0.8880 eV	...	[Fuc95b]
LA599f	913.2	7.366	1.358	(V_1H_4)b-DAP40f	(V_1H_4)	$s = 6$; calc. 0.9170 eV	...	[Fuc95b]
LA599g	985.6	7.950	1.258	(V_1H_4)b-DAP40g	(V_1H_4)	$s = 4$; calc. 1.000 eV	...	[Fuc95b]

Table 4.1.3 Low pressure synthetic diamond (CVD): absorption lines; near infrared (1.24–1.77 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LA1310	1.310	10.57	946.4	...	...	...	...	[All95, Col97]
LA1423	1.423	11.48	871.2	...	...	...	...	[All95, Col97]
LA1446	1.446	11.66	857.4	...	...	...	...	[All95, Col97]
LA1493	1.493	12.05	830.2	...	...	...	...	[All95, Col97]
LA1681	1.682	13.57	736.9	2Si-1.68 eV center	*$(V_3Si_2)^+$	var. 1.667–1.691 eV; Si_2 from QLVM; ZPL of DAP53a-m, see LE	**5.**48a	[Iak00a, Zai01]

Table 4.1.4 Low pressure synthetic diamond (CVD): absorption lines; visible: purple to violet (1.77–3.10 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LA1785a	1.785	14.40	694.6	2Si-DAP53a	$^*(V_3Si_2)^+$	13 lines a–m (2.350 eV), see LE; $s = 162$, calc. 1.791 eV	...	[Fen93, Zai01]
LA1785b	1.810	14.60	685.0	2Si-DAP53b	$^*(V_3Si_2)^+$	$s = 118$, calc. 1.810 eV	...	[Fen93, Zai01]
LA1785d	1.836	14.81	675.3	2Si-DAP53d	$^*(V_3Si_2)^+$	$s = 86$, calc. 1.831 eV	...	[Fen93, Zai01]
LA1785f	1.859	14.99	666.9	2Si-DAP53f	$^*(V_3Si_2)^+$	$s = 64$, calc. 1.855 eV	...	[Fen93, Zai01]
LA1785g	1.878	15.15	660.2	2Si-DAP53g	$^*(V_3Si_2)^+$	$s = 50$, calc. 1.878 eV	...	[Fen93, Zai01]
LA1883	1.883	15.19	658.4	Ni-DAP107z	$^*(V_3Ni_2)^+$	Split into 3 lines: 1.883 (dominant), 1.906, 1.914 eV; ZPL of DAP107a-g, see HA	...	[Zai01]
LA2154	2.154	17.38	575.7	**NV** = 575 nm-center	$V_1N_1^\circ$	var. 2.154-2.156 eV; ZPL of DAP46a-f, see MA	...	[Zai01]
LA2985	2.985	24.08	415.3	**N3c**	$V_1N_3^\circ$	ZPL of DAP23a-p (3.762 eV), see NA; 0.59 meV excited state splitting	...	[Zai01]

4.2 Excitation of Photo Luminescence Lines (LE)

Table 4.2.1 Low pressure synthetic diamond (CVD): excitation of photo luminescence lines (PLE), visible: purple to blue (1.77–2.58 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LE1785a	1.785	14.40	694.6	2Si-DAP53a	$*(V_3Si_2)^+$	13 lines a–m (2.350 eV), lines (a, b) see LA; $s = 162$, calc. 1.791 eV; ZPL at 1.682 eV	...	[Fen93, Zai01]
LE1808a	1.808	14.58	685.7	***S7**-DAP11a	$*(V_2Ni_1)N_x^\circ$	14 lines a–n (2.620 eV); lines a–d, f see LL; sta-DAP; $s = 228$, calc. 1.815 eV; L at 1.724 eV	...	[Iak00a, Zai01]
LE1785b	1.810	14.60	685.0	2Si-DAP53b	$*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 118$, calc. 1.810 eV	...	[Fen93, Zai01]
LE1785c	1.817	14.66	682.3	2Si-DAP53b	$*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 106$, calc. 1.817 eV	**5**.48b	[Iak00a, Zai01]
LE1785d	1.836	14.81	675.3	2Si-DAP53d	$*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 86$, calc. 1.831 eV	**5**.48b	[Iak00a, Fen93]
LE1785e	1.848	14.81	675.3	2Si-DAP53e	$*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 72$, calc. 1.845 eV	**5**.48b	[Iak00a, Zai01]
LE1785f	1.859	14.99	666.9	2Si-DAP53f	$*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 64$, calc. 1.855 eV	**5**.48b	[Iak00a, Fen93]
LE1785g	1.878	15.15	660.2	2Si-DAP53g	$*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 50$, calc. 1.878 eV	**5**.48b	[Iak00a, Fen93]
LE1785h	1.897	15.30	653.5	2Si-DAP53h	$*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 42$, calc. 1.897 eV	**5**.48b	[Iak00a, Zai01]
LE1808e	2.020	16.29	613.7	DAP11e	$*(V_2Ni_1)N_x^\circ$	PLE of DAP11a-c; $s = 26$, calc. 1.811 eV	**5**.84b	[Iak00a, Zai01]

LE1785i	2.070	16.70	598.9	2Si-DAP53i	$^*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 12$, calc. 2.082 eV	**5.**48b	[Iak00a, Zai01]
LE1808g	2.099	16.93	590.6	DAP11g	$^*(V_2Ni_1)N_x^\circ$	PLE of DAP11a-c; $s = 14$, calc. 2.095 eV	**5.**84b	[Iak00a, Zai01]
LE1785j	2.125	17.14	583.4	2Si-DAP53j	$^*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 10$, calc. 2.120 eV	**5.**48b	[Iak00a, Zai01]
LE1785k	2.150	17.34	576.6	2Si-DAP53k	$^*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 8$, calc. 2.172 eV	**5.**48b	[Iak00a, Zai01]
LE1808h	2.190	17.66	566.1	DAP11h	$^*(V_2Ni_1)N_x^\circ$	PLE of DAP11a-g; $s = 9$, calc. 2.193 eV	**5.**84b	[Iak00a, Zai01]
LE1785-l	2.260	18.23	548.6	2Si-DAP53-l	$^*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 6$, calc. 2.247 eV	**5.**48b	[Iak00a, Zai01]
LE1808i	2.280	18.39	543.8	DAP11i	$^*(V_2Ni_1)N_x^\circ$	PLE of DAP11a-g; $s = 6$, calc. 2.289 eV	**5.**84b	[Iak00a, Zai01]
LE1808j	2.350	18.96	527.6	DAP11j	$^*(V_2Ni_1)N_x^\circ$	PLE of DAP11a-g; $s = 5$, calc. 2.340 eV	**5.**84b	[Iak00a, Zai01]
LE1785m	2.350	18.96	527.6	2Si-DAP53m	$^*(V_3Si_2)^+$	PLE of ZPL at 1.682 eV; $s = 4$, calc. 2.340 eV	**5.**48b	[Iak00a, Zai01]
LE1808k	2.400	19.36	516.6	DAP11k	$^*(V_2Ni_1)N_x^\circ$	PLE of DAP11a-g; $s = 4$, calc. 2.382 eV	**5.**84b	[Iak00a, Zai01]
LE1808-l	2.475	19.96	500.9	DAP11-l	$^*(V_2Ni_1)N_x^\circ$	PLE of DAP11a-g; $s = 3$, calc. 2.476 eV	**5.**84b	[Iak00a, Zai01]
LE1808m	2.520	20.33	492.0	DAP11m	$^*(V_2Ni_1)N_x^\circ$	PLE of DAP11a-g; $s = 2$, calc. 2.527 eV	**5.**84b	[Iak00a, Zai01]

Table 4.2.2 Low pressure synthetic diamond (CVD): excitation of photo luminescence lines (PLE), visible: ultramarine, violet (2.58–3.10 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LE1808n	2.620	21.13	473.2	DAP11n	$^*(V_2Ni_1)N_x^\circ$	PLE of DAP11a-g; $s = 1$, calc. 2.620 eV	**5.**84b	[Iak00a, Zai01]
LE2646 = LE2785z	2.646	21.34	468.5	DAP109z	$^*V_1Si_1^\circ$	var. 2.646–2.651 eV; PLE of DAP110 (see LL); ZPL of DAP109a-h (3.054 eV); QLVM at +74 meV (calc. 1Si = 74.5 meV)	**5.**128b	[Iak00a, Zai01]
LE2785a	2.785	22.46	445.2	DAP109a	$^*V_1Si_1^\circ$	PLE of DAP110; $s = 86$, calc. 2.785 eV	**5.**128b	[Iak00a, Zai01]
LE2785b	2.802	22.60	442.5	DAP109b	$^*V_1Si_1^\circ$	PLE of DAP110; $s = 72$, calc. 2.798 eV	**5.**128b	[Iak00a, Zai01]
LE2785c	2.828	22.81	438.4	DAP109c	$^*V_1Si_1^\circ$	PLE of DAP110; $s = 50$, calc. 2.828 eV	**5.**128b	[Iak00a, Zai01]
LE2785d	2.851	23.00	434.9	DAP109d	$^*V_1Si_1^\circ$	PLE of DAP110; $s = 42$, calc. 2.846 eV	**5.**128b	[Iak00a, Zai01]
LE2785e	2.884	23.26	429.9	DAP109e	$^*V_1Si_1^\circ$	PLE of DAP110; $s = 30$, calc. 2.881 eV	**5.**128b	[Iak00a, Zai01]
LE2785f	2.922	23.57	424.3	DAP109f	$^*V_1Si_1^\circ$	PLE of DAP110; $s = 22$, calc. 2.922 eV	**5.**128b	[Iak00a, Zai01]
LE2785g	2.982	24.05	415.8	DAP109g	$^*V_1Si_1^\circ$	PLE of DAP110; $s = 14$, calc. 2.992 eV	**5.**128b	[Iak00a, Zai01]
LE2785h	3.054	24.63	406.0	DAP109h	$^*V_1Si_1^\circ$	PLE of DAP110; $s = 10$, calc. 3.054 eV	**5.**128b	[Iak00a, Zai01]

4.3 Luminescence Lines (LL)

Table 4.3.1.1 Low pressure synthetic diamond (CVD): luminescence lines, near infrared, part 1 (1.24–1.69 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL1401a = DAP26z	1.401	11.30	884.9	1Ni-1.40a	$*V_1Ni_1^+$	2 lines a, b from 2.7 meV ground state splitting; named 1.4-eV cent. ZPL of 1Ni-DAP26*a*-k(1.000)	...	[Wol-10]
LL1401b = DAP26z	1.404	11.32	883.2	1Ni-1.40b	$*V_1Ni_1^+$	Main line.(intensities a:b = 4:6), named Ni-D_0, Ni_1 from isotopes (see Table 7.5)	...	[Wol-10]
LL1486a	1.486	11.99	834.3	DAP54a	$*(V_3Si_2)^+$	7 lines a–g (1.567 eV); $s = 50$, calc. 1.487 eV; ZPL at 1.682; 2Si from isotopes	**7.**69a	[Fen93, Zai01]
LL1486b	1.519	12.25	816.2	DAP54ba	$*(V_3Si_2)^+$	$s = 72$, calc. 1.519 eV	**5.**44	[Iak00a, Zai01]
LL1486c	1.524	12.29	813.5	DAP54c	$*(V_3Si_2)^+$	$s = 78$, calc. 1.525 eV	...	[Zai01]
LL1486d	1.527	12.32	811.9	DAP54d	$*(V_3Si_2)^+$	$s = 82$, calc. 1.529 eV	5.44	[Iak00a, Zai01]
LL1486e	1.534	12.37	808.2	DAP54e	$*(V_3Si_2)^+$	$s = 86$, calc. 1.533 eV	**5.**44	[Iak00a, Zai01]
LL1486f	1.556	12.55	796.8	DAP54f	$*(V_3Si_2)^+$	$s = 118$, calc. 1.554 eV	**5.**44, **7.**69	[Iak00a, Fen93]
LL1556a	1.556	12.55	796.8	DAP8a	$*(V_2Ni_1)N_x^-$	7 lines a–g (1.637 eV); $s = 198$, calc. 1.556 eV	**7.**67	[McC94a, Zai01]

(continued)

Table 4.3.1.1 (continued)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL1563	1.563	12.60	793.4	*S5-DAP60a	*$(V_2Ni_1)N_x^\circ$	11 lines a–k (see MA/ME/ML), $s = 162$, calc. 1.564 eV	...	[Wol-10]
LL1564a	1.564	12.62	792.7	DAP49a	*$V_1N_1^-$	15 lines a–o (1.870 eV); $s = 8$, calc. 1.564 eV; lines (b, d, e, h, I, l, m. o) see ML	**5.**57	[Dol95, Zai01]
LL1486g	1.567	12.64	791.2	DAP54g	*$(V_3Si_2)^+$	$s = 162$, calc. 1.573 eV	...	[Iak00a, Zai01]
LL1556b	1.575	12.70	787.2	DAP8b	*$(V_2Ni_1)N_x^-$	$s = 130$, calc. 1.575 eV	**7.**67	[McC94a, Zai01]
LL1556c	1.586	12.79	781.7	DAP8c	*$(V_2Ni_1)N_x^-$	$s = 106$, calc. 1.586 eV	**7.**67	[McC94a, Zai01]
LL1599	1.599	12.90	775.3	...	Ni?	...	**5.**21	[McC95, Zai01]
LL1556d	1.601	12.91	774.4	DAP8d	*$(V_2Ni_1)N_x^-$	$s = 86$, calc. 1.601 eV	**7.**67	[McC94a, Zai01]
LL1556e	1.623	13.09	763.9	DAP8e	*$(V_2Ni_1)N_x^-$	$s = 58$, calc. 1.625 eV	**7.**67	[McC94a, Zai01]
LL1556f	1.631	13.16	760.1	DAP8f	*$(V_2Ni_1)N_x^-$	$s = 54$, calc. 1.631 eV	**7.**67	[McC94a, Zai01]
LL1564c	1.636	13.20	757.8	DAP49c	*$V_1N_1^-$	$s = 12$, calc. 1.633 eV	**5.**57	[Dol95, Zai01]
LL1556g	1.637	13.20	757.3	DAP8g	*$(V_2Ni_1)N_x^-$	$s = 50$, calc. 1.637 eV	**7.**67	[McC94a, Zai01]
LL1681	1.681	13.56	737.5	2Si-1.68 eV	*$(V_3Si_2)^+$	ZPL of DAP54 a-g (1.486–1.567 eV); QLVM: −36, −45, LVM: −66, −83 meV	**5.**44, **5.**21	[Iak00a, McC95, Zai01]

Table 4.3.1.2 Low pressure synthetic diamond (CVD): luminescence lines, near infrared, part 2 (1.70–1.77 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL1564f	1.703	13.74	728.0	DAP49f	$^*V_1N_1^-$	$s = 20$, calc. 1.702 eV	**5.**57	[Dol95, Zai01]
LL1723a	1.723	13.90	719.5	DAP6a	$^*(V_2W_1)N_x^\circ$	6 lines a–f (1.759 eV); *shell* = 86; calc 1.723 eV	**5.**50	[Ste95, And97]
LL1564g	1.726	13.92	718.3	DAP49g	$^*V_1N_1^-$	$s = 24$, calc. 1.724 eV	**5.**57	[Dol95, Zai01]
LL1723b	1.735	13.99	714.6	DAP6b	$^*(V_2W_1)N_x^\circ$	$s = 72$; calc. 1.734 eV; named W5; dominant line; pseudo ZPL;3 SBs −24 meV; $L = 1.608$ eV	**5.**50	[Ste95, And97]
LL1723c	1.741	14.04	712.1	DAP6c	$^*(V_2W_1)N_x^\circ$	$s = 64$; calc. 1.742 eV; named W4	**5.**50	[Ste95, And97]
LL1723d	1.750	14.12	708.4	DAP6d	$^*(V_2W_1)N_x^\circ$	$s = 58$; calc. 1.749 eV; named W3	**5.**50	[Ste95, And97]
LL1723e	1.754	14.15	706.8	DAP6e	$^*(V_2W_1)N_x^\circ$	$s = 54$; calc. 1.754 eV; named W2	**5.**50	[Ste95, And97]
LL1723f	1.759	14.19	704.8	DAP6f	$^*(V_2W_1)N_x^\circ$	$s = 50$; calc. 1.759 eV; named W1	**5.**50	[Ste95, And97]
LL1748a	1.748	14.10	709.3	DAP7a	$^*(V_2Ta_1)^\circ$	7 lines a–g (1.817 eV); $s = 162$, calc. 1.751 eV	**5.**51	[Har96, Zai01]

Table 4.3.2 Low pressure synthetic diamond (CVD): luminescence lines, visible: purple, red (1.77–2.03 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL1748b	1.771	14.28	700.0	DAP7b	$^*(V_2Ta_1)^\circ$	$s = 106$, calc. 1.770 eV	**5.**51	[Har96, Zai01]
LL1748c	1.774	14.31	698.9	DAP7c	$^*(V_2Ta_1)^\circ$	$s = 98$; calc. 1.774 eV; pseudo ZPL; 2 SBs −25 meV; $L =$ 1.667 eV	**5.**51	[Har96, Zai01]
LL1748d	1.783	14.38	695.3	DAP7d	$^*(V_2Ta_1)^\circ$	$s = 130$; calc. 1.785 eV	**5.**51	[Har96, Zai01]
LL1789	1.789	14.43	693.0	DAP65	$^*(V_3Si_2)^\circ$	$s = 22$, calc. 1.795; lines (a–e) see NL	...	[Zai01]
LL1564j	1.792	14.45	691.8	DAP49j	$^*V_1N_1^-$	$s = 50$, calc. 1.791 eV	**5.**57	[Dol95, Zai01]
LL1748e	1.794	14.47	691.1	DAP7e	$^*(V_2Ta_1)^\circ$	$s = 106$; calc. 1.795 eV	**5.**51	[Har96, Zai01]
LL1748f	1.807	14.58	686.1	DAP7f	$^*(V_2Ta_1)^\circ$	$s = 86$; calc. 1.807 eV	**5.**51	[Har96, Zai01]
Ll1808a	1.808	14.58	685.7	*S7-DAP11a	$^*(V_2Ni_1)N_x^\circ$	14 lines a–n (2.620 eV), lines (i–n) see LE sta-DAP; $s = 228$, calc. 1.815 eV; L at 1.724 eV	**5.**84a	[Iak00a, Zai01]
LL1564k	1.809	14.59	685.3	DAP49k	$^*V_1N_1^-$	$s = 64$, calc. 1.809 eV	**5.**57	[Dol95, Zai01]
LL1748g	1.817	14.66	682.3	DAP7g	$^*(V_2Ta_1)^\circ$	$s = 74$; calc. 1.817 eV	**5.**51	[Har96, Zai01]
LL1829	1.829	14.76	677.7		N	...	...	[Bac93, Zai01]
LL1808b	1.833	14.78	676.4	*S7-DAP11b	$^*(V_2Ni_1)N_x^\circ$	$s = 162$, calc. 1.833 eV	**5.**84a	[Iak00a, Zai01]
LL1564n	1.859	14.99	666.9	DAP49n	$^*V_1N_1^-$	$s = 162$, calc. 1.859 eV	**5.**57	[Dol95, Zai01]
LL1808c	1.901	15.33	652.2	*S7-DAP11c	$^*(V_2Ni_1)N_x^\circ$	$s = 64$, calc. 1.897 eV	**5.**84a	[Iak00a, Zai01]

LL1923	1.923	15.51	644.7	...	...	...	...	[Cla94, Zai01]
LL1943 = LL1564z	1.943	15.67	638.1	NV^-	$V_1N_1^-$	ZPL of DAP49a-o (1.567–1.870 eV); QLVM-61 meV (calc. 3C: 60.9); named **638 nm** center	5.57	[Dol95, Fre90, Zai01]
LL1808d	1.965	15.85	630.9	*S7-DAP11d	$^*(V_2Ni_1)N_x^\circ$	$s = 34$, calc. 1.961 eV	**5.**84a	[Iak00a, Zai01]
LL1968	1.968	15.87	630.0	...	...	Split into 3 lines (1.962, 1.968, 1.977 eV)	**5.**21, **7.**81	[McC95, Rua91b]
LL1910e	2.002	16.15	619.3	NV-DAP47e	$^*V_1N_1^\circ$	3 lines (e, f, h), lines a–d, g (1.910–2.059 eV) see ML, $s = 64$, calc. 2.004 eV	**7.**95	[Jan91, Zai01]
LL1563h	2.005	16.17	618.3	*S5-DAP60h	$^*(V_2Ni_1)N_y^\circ$	3 lines (h–j), lines (a–g, k) see MA; $s = 6$, calc. 2.000 eV	...	[Iak00g]
LL2019	2.019	16.28	614.1	...	...	...	...	[Hei97, Zai01]
LL1808e	2.020	16.29	613.7	*S7-DAP11e	$^*(V_2Ni_1)N_x^\circ$	$s = 22$, calc. 2.019 eV	**5.**84a	[Iak00a, Zai01]
LL1910f	2.023	16.32	612.8	DAP47f	$^*V_1N_1^\circ$	$s = 86$, calc. 2.023 eV	**7.**95	[Jan91, Zai01]

Table 4.3.3 Low pressure synthetic diamond (CVD): luminescence lines, visible: orange, yellow (2.03–2.18 eV)

Line-label	Energy (eV)	Frequ. (cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL2055	2.055	16.58	603.2	...	...	...	...	[Hei97, Zai01]
LL1910h	2.059	16.61	602.1	DAP47h	$^*V_1N_1^\circ$	$s = 162$, calc. 2.059 eV	**7.**95	[Jan91, Zai01]
LL2070a	2.070	16.70	598.9	DAP1a	$^*N_1^\circ$+B_1°	13 lines a–m (2.668), $s = 50$, calc. 2.067 eV	**7.**128	[Dis94a, Dis94b]
LL1808f	2.073	16.72	598.1	*S7-DAP11f	$^*(V_2Ni_1)N_x^\circ$	$s = 16$, calc. 2.070 eV	**5.**84a	[Iak00a, Zai01]
LL1808g	2.095	16.90	591.8	*S7-DAP11g	$^*(V_2Ni_1)N_x^\circ$	$s = 14$, calc. 2.095 eV	**5.**84a	[Iak00a, Zai01]
LL1563i	2.095	16.90	591.8	*S5-DAP60i	$^*(V_2Ni_1)N_y^\circ$	$s = 4$, calc. 2.089 eV	...	[Iak00g]
LL2070b	2.108	17.00	588.1	DAP1b	$^*N_1^\circ$+B_1°	$s = 34$, calc. 2.105 eV	**7.**128	[Dis94a, Dis94b]
LL2154 = LL1910z	2.154	17.38	575.5	NV- DAP47z = **575 nm** center	$^*V_1N_1^\circ$	var. 2.153–2.156 eV; ZPL of DAP47a–h,, QLVM: −48 meV (calc. 1N + 3C:48.4)	**5.**57, **7.**95	[Dol95, Jan91, Zai01]

Table 4.3.4 Low pressure synthetic diamond (CVD): luminescence lines, visible: green (2.18–2.43 eV)

Line-label	Energy (eV)	Frequ. (cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL1808h	2.190	17.66	566.1	*S7-DAP11h	*$(V_2Ni_1)N_x^\circ$	$s = 9$, calc. 2.193 eV; lines (i–n) see LE	**5.**84a	[Iak00a, Zai01]
LL2070c	2.202	17.76	563.0	DAP1c	*$N_1^\circ + B_1^\circ$	$s = 16$; calc. 2.202 eV	**7.**128, **7.**129	[Dis94a, Dis94b, Col89d, Col90d]
LL1563j	2.220	17.91	558.5	*S5-DAP60j	*$(V_2Ni_1)N_y^\circ$	$s = 2$, calc. 2.228 eV	...	[Iak00g]
LL2070d	2.240	18.07	553.5	DAP1d	*$N_1^\circ + B_1^\circ$	$s = 13$; calc. 2.239 eV	**7.**128	[Dis94a, Dis94b, Kho93]
LL2241a	2.241	18.08	553.2	1Si-DAP110a	*$V_1Si_1^\circ$	7 lines a–g (2.507 eV); $s = 10$, calc. 2.238 eV	**5.**128a	[Iak00a, Zai01]
LL2246a	2.246	18.12	552.0	DAP113a	*$V_1Si_1^-$	11 lines a–k (2.845 eV); $s = 1$, calc. 2.246 eV	7.114	[Kho94, Zai98b]
LL2250	2.250	18.15	551.0	...	...	Main line of an unresolved doublet	**5.**21	[McC95, Zai01]
LL2241b	2.271	18.32	545.9	1Si-DAP110b	*$V_1Si_1^\circ$	$s = 12$, calc. 2.274 eV	**5.**128a	[Iak00a, Zai01]
LL2070e	2.284	18.42	542.8	DAP1e	*$N_1^\circ + B_1^\circ$	$s = 10$; calc. 2.285 eV	**7.**128	[Dis94a, Dis94b, Kho93]
LL2241c	2.291	17.75	563.3	1Si-DAP110c	*$V_1Si_1^\circ$	$s = 14$, calc. 2.300 eV	**5.**128a	[Iak00a, Zai01]
LL2329	2.329	18.79	532.3	...	N?	Single line in good quality, strain splitting in low quality (2.322 and 2.335 eV)	**7.**81, **7.**109, **7.**114, **7.**120, **7.**124, **7.**129	[Rua91b, Col92b, Kho94, Col89d, Zai01]

(continued)

Table 4.3.4 (continued)

Line-label	Energy (eV)	Frequ. (cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL2330a	2.330	18.79	532.1	DAP101a	$^*(N_1C_1)_i B_1^-$	Lines a–d (2.687 eV); $s = 1$, calc. 2.309 eV	...	[Ste96a]
LL2246b	2.330	18.79	532.1	DAP113b	$^*V_1Si_1^-$	$s = 2$, calc. 2.323 eV; decay time 1.0 μs	**7.**114, **7.**120, **7.**135	[Kho94, Zai98b]
LL2070f	2.331	18.80	531.9	DAP1f	$^*N_1^\circ + B_1^\circ$	$s = 8$; calc. 2.331 eV; also observed in boron doped CVD films [Hei97]	**7.**128, **7.**124, **7.**129	[Dis94a, Dis94b, Col89d, Col90d, Rua92b, Kho93]
LL2241d	2.362	19.05	524.9	1Si-DAP110d	$^*V_1Si_1^\circ$	$s = 22$, calc. 2.360 eV	**5.**128a	[Iak00a, Zai01]
LL2070g	2.373	19.14	522.4	DAP1g	$^*N_1^\circ + B_1^\circ$	$s = 7$; calc. 2.369 eV	**7.**128	[Dis94a, Dis94b, Kho93]
LL2070h	2.413	19.46	513.8	DAP1h	$^*N_1^\circ + B_1^\circ$	$s = 6$; calc. 2.398 eV	**7.**128, **7.**124, **7.**129	[Dis94a, Dis94b, Col89d, Col90d, Rua92b, Kho93]
LL2417a	2.417	19.50	512.9	DAP99a	$^*(N_1C_1)_i B_1^\circ$	Lines a–h (2.696 eV); $s = 8$, calc. 2.410 eV	...	[Ste96a]
LL2246c	2.430	19.60	510.2	DAP113c	$^*V_1Si_1^-$	$s = 4$, calc. 2.444 eV	**7.**114, **7.**120, **7.**135	[Kho94, Zai98b]

Table 4.3.5 Low pressure synthetic diamond (CVD): luminescence lines, visible: blue (2.43–2.58 eV)

Line-label	Energy (eV)	Frequ. (cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL2241e	2.440	19.68	508.1	1Si-DAP110e	$^*V_1Si_1^\circ$	$s = 42$, calc. 2.446 eV; resonant 3 × QLVM?	**5.**128a	[Iak00a, Zai01]
LL2070-i	2.456	19.81	504.8	DAP1-i	$^*N_1^\circ + B_1^\circ$	$s = 5$; calc. 2.444 eV	**7.**128, **7.**124, **7.**129	[Dis94a, Dis94b, Col89d, Col90d, Kho93]
LL2464	2.464	19.88	503.2	**H3a**-DAP51	$V_1N_2^\circ$	var. 2.462–2.465 eV; ZPL of DAP51a-f (see ML)	**3.**109	[Zai01]
LL2417b	2.467	19.90	502.5	DAP99b	$^*(N_1C_1)_i B_1^\circ$	$s = 12$, calc. 2.480 eV	...	[Ste96a]
LL2473	2.473	19.95	501.3		B?	var. 2.466–2.476 eV	...	[Zai01]
LL2246d	2.480	20.00	499.9	DAP113d	$^*V_1Si_1^-$	$s = 5$, calc. 2.479 eV; decay time 1.0 μs	**7.**114, **7.**120, **7.**135	[Kho94, Zai98b]
LL2330b	2.487	20.06	498.5	DAP101b	$^*(N_1C_1)_i B_1^-$	$s = 4$, calc. 2.491 eV	...	[Ste96a]
LL2241f	2.490	20.08	497.9	1Si-DAP110f	$^*V_1Si_1^\circ$	$s = 72$, calc. 2.494 eV;	**5.**128a	[Iak00a, Zai01]
LL2070j	2.495	20.12	496.9	DAP1j	$^*N_1^\circ + B_1^\circ$	$s = 4$; calc. 2.481 eV	**7.**128, **7.**129	[Dis94a, Dis94b, Col89d, Col90d, Rua92b, Kho93]
LL2241g	2.507	20.22	494.5	1Si-DAP110g	$^*V_1Si_1^\circ$	$s = 86$, calc. 2.507 eV;	**5.**128a	[Iak00a, Zai01]

(continued)

Table 4.3.5 (continued)

Line-label	Energy (eV)	Frequ. (cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL2417c	2.512	20.26	493.5	DAP99c	$^*(N_1C_1)_i B_1^\circ$	$s = 16$, calc. 2.522 eV		[Ste96a]
LL2246e	2.537	20.46	488.7	DAP113e	$^*V_1Si_1^-$	$s = 6$, calc. 2.522 eV	**7.**120	[Kho94, Zai98b]
LL2246f	2.550	20.57	486.2	DAP113f	$^*V_1Si_1^-$	var. 1.547–1.557 eV; $s = 7$, calc. 2.548 eV; decay time 1.3 μs	**7.**114, **7.**120, **7.**135	[Kho94, Zai98b]
LL2567a	2.567	20.70	483.0	...	B?	2 lines a, b (2.572 eV); weak lines at 2.52–2.58 eV	**7.**109, **7.**131	[Col92b, Rua93a, Rua93b]
LL2070k	2.568	20.71	482.8	DAP1k	$^*N_1^\circ + B_1^\circ$	var. 2.561–2.575; $s = 3$; calc. 2.564 eV	**7.**128, **7.**124, **7.**129 **7.**131	[Dis94a, Dis94b, Col89d, Col90d, Kho93]
LL2567b	2.572	20.75	482.0	...	B?	Weak lines at 2.52–2.58 eV	**7.**109, **7.**131	[Col92b, Rua93a, Rua93b]
LL2246g	2.580	20.81	480.5	DAP113g	$^*V_1Si_1^-$	$s = 8$, calc. 2.584 eV; decay time 1.4 μs	**7.**114, **7.**120, **7.**135	[Kho94, Zai98b]

Table 4.3.6 Low pressure synthetic diamond (CVD): luminescence lines, visible: ultramarine (2.58–2.75 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL2417d	2.582	20.83	480.2	DAP99d	$^*(N_1C_1)_i B_1^\circ$	$s = 26$, calc. 2.580 eV	...	[Ste96a]
LL2330c	2.597	20.95	477.4	DAP101c	$^*(N_1C_1)_i B_1^-$	$s = 7$, calc. 2.589 eV	...	[Ste96a]
LL2599	2.599	20.96	477.0	...	...	...	...	[Zai01]
LL2417e	2.612	21.07	474.6	DAP99e	$^*(N_1C_1)_i B_1^\circ$	$s = 34$, calc. 2.607 eV	...	[Ste96a]
LL2070-l	2.623	21.16	472.7	DAP1-l	$^*N_1^\circ + B_1^\circ$	$s = 2$; calc. 2.611 eV	**7.**128, **7.**129	[Dis94a, Dis94b, Col89d, Col90d]
LL2646 = LL2241z	2.646	21.34	468.5	DAP110z	$^*V_1Si_1^\circ$	var. 2.638–2.651 eV; ZPL of DAP110a-g; DAP109(LE); QLVM: 74 meV (calc. 1Si = 74.5)	**5.**128a	[Iak00a, Zai01, Rua91b]
LL2417f	2.657	21.43	466.6	DAP99f	$^*(N_1C_1)_i B_1^\circ$	$s = 72$, calc. 2.664 eV	...	[Ste96a]
LL2070m	2.668	21.52	464.7	DAP1m	$^*N_1^\circ + B_1^\circ$	$s = 1$; var. 2.60–2.68; calc. (incl. NSC) 2.694 eV	**7.**128, **7.**129	[Dis94a, Dis94b, Col89d, Col90d]
LL2676a	2.676	21.58	463.3	DAP17a	$^*O_1^\circ + B_1^\circ$	6 lines a–f (2.725 eV); $s = 62$, calc. 2.676 eV	**7.**131	[Rua93a, Zai01]
LL2676b	2.681	21.62	462.4	DAP17b	$^*O_1^\circ + B_1^\circ$	$s = 58$, calc. 2.676 eV	**7.**131	[Rua93a, Zai01]
LL2417g	2.687	21.67	461.4	DAP99g	$^*(N_1C_1)_i B_1^\circ$	$s = 106$, calc. 2.687 eV	...	[Ste96a]
LL2330d	2.687	21.67	461.4	DAP101d	$^*(N_1C_1)_i B_1^-$	$s = 8$, calc. 2.687 eV	...	[Ste96a]
LL2676c	2.692	21.71	460.5	DAP17c	$^*O_1^\circ + B_1^\circ$	$s = 50$, calc. 2.691 eV	**7.**131	[Rua93a, Zai01]
LL2608f	2.693	21.72	460.4	DAP98f	$^*(N_1C_1)_i^+$	Lines f–i (2.739 eV), a–e see ML; $s = 86$, calc. 2.691 eV	**7.**130b	[Dis94a]

(continued)

Table 4.3.6 (continued)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL2676d	2.696	21.75	459.9	DAP17d	$^*O_1^\circ + B_1^\circ$	$s = 48$, calc. 2.695 eV	**7.**131	[Rua93a, Zai01]
LL2417h	2.696	21.75	459.9	DAP99h	$^*(N_1C_1)_i B_1^\circ$	$s = 130$, calc. 2.697 eV	...	[Ste96a]
LL2676e	2.702	21.79	458.8	DAP17e	$^*O_1^\circ + B_1^\circ$	$s = 44$, calc. 2.703 eV	**7.**131	[Rua93a, Zai01]
LL2246h	2.709	21.85	457.6	DAP113h	$^*V_1Si_1^-$	$s = 16$, calc. 2.704 eV	...	[Kho94, Zai98b]
LL2608g	2.713	21.88	457.0	DAP98g	$^*(N_1C_1)_i^+$	$s = 130$, calc. 2.712 eV	**7.**130b	[Dis94a, Zai01]
LL2715a	2.715	21.90	456.6	DAP100a	$^*(N_1C_1)_i B_1^+$	9 lines a–i (2.987 eV); $s = 8$, calc. 2.703 eV	**7.**129b	[Col89d]
LL2676f	2.725	21.98	455.0	DAP17f	$^*O_1^\circ + B_1^\circ$	$s = 34$, calc. 2.725 eV	**7.**131	[Rua93a, Zai01]
LL2608h	2.725	21.98	455.0	DAP98h	$^*(N_1C_1)_i^+$	$s = 162$, calc. 2.722 eV	**7.**130b	[Dis94a]
LL2608i	2.739	22.09	452.6	DAP98i	$^*(N_1C_1)_i^+$	$s = 228$, calc. 2.736 eV	**7.**130b	[Dis94a]
LL2440f	2.741	22.11	452.3	N3c-DAP24f	$V_1N_3^\circ$	Lines f, j, n, o; others see NL; $s = 22$, calc. 2.739 eV	**7.**109	[Col92b, Zai01]
LL2748	2.748	22.16	451.2	...	...	...	...	[Hei97]

Table 4.3.7.1 Low pressure synthetic diamond (CVD): luminescence lines, visible: violet, part 1 (2.75–2.97 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL2715b	2.756	22.23	449.8	DAP100b	$^*(N_1C_1)_i B_1^+$	$s = 10$, calc. 2.744 eV	**7.**129b	[Col89d, Zai01]
LL2246i	2.760	22.26	449.2	DAP113i	$^*V_1Si_1^-$	$s = 24$, calc. 2.756 eV	...	[Kho94, Zai98b]
LL2792 = LL2417z	2.792	22.51	444.0	DAP99z	$^*(N_1C_1)_i B_1^\circ$	ZPL of DAP99a-h(2.417–2.696 eV)	...	[Ste96a]
LL2807 = LL2608z	2.807	22.64	441.7	DAP98z	$^*(N_1C_1)_i^+$	var.2.786–2.807 eV; ZPL of DAP98a-i	**7.**129a, **7.**130b	[Col89d, Dis94a]
LL2715c	2.811	22.67	441.0	DAP100c	$^*(N_1C_1)_i B_1^+$	$s = 16$, calc. 2.818 eV	**7.**130b	[Dis94a]
LL2246j	2.815	22.71	440.4	DAP113j	$^*V_1Si_1^-$	$s = 42$, calc. 2.813 eV	...	[Kho94, Zai98b]
LL2715d	2.831	22.83	437.9	DAP100d	$^*(N_1C_1)_i B_1^+$	$s = 18$, calc. 2.833 eV	**7.**129b, **7.**130b	[Col89d, Dis94a]
LL2440j	2.834	22.86	437.5	N3c-DAP24j	$V_1N_3^\circ$	$s = 58$, calc. 2.833 eV	**7.**109, **7.**113	[Col92b, Col89e]
LL2246k	2.845	22.95	435.8	DAP113k	$^*V_1Si_1^-$	$s = 64$, calc. 2.847 eV	...	[Kho94, Zai98b]
LL2440n	2.853	23.01	434.6	N3c-DAP24n	$V_1N_3^\circ$	$s = 74$, calc. 2.851 eV	**7.**109	[Col92b, Zai01]
LL2246-l	2.855	23.03	434.2	DAP113-l	$^*V_1Si_1^-$	$s = 72$, calc. 2.855 eV	**7.**135	[Kho94]
LL2440-o	2.872	23.17	431.7	N3c-DAP24-o	$V_1N_3^\circ$	$s = 106$, calc. 2.873 eV	**7.**109	[Col92b, Zai01]

(continued)

Table 4.3.7.1 (continued)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL2246m	2.874	23.18	431.4	DAP113m	$^*V_1Si_1^-$	$s = 86$, calc. 2.867 eV	**7.**135	[Kho94, Zai01]
LL2715e	2.903	23.42	427.1	DAP100e	$^*(N_1C_1)_iB_1^+$	$s = 34$, calc. 2.903 eV	**7.**129b, **7.**130b	[Col89d, Dis94a]
LL2913	2.913	23.50	425.6	...	...	...	...	[Mel96, Zai01]
LL2920	2.920	23.55	424.6	...	B?	...	...	[Zai01]
LL2715f	2.927	23.61	423.6	DAP100f	$^*(N_1C_1)_iB_1^+$	$s = 44$, calc. 2.926 eV	**7.**130b	[Dis94a]
LL2715g	2.938	23.70	422.0	DAP100g	$^*(N_1C_1)_iB_1^+$	$s = 50$, calc. 2.937 eV	**7.**129b, **7.**130b	[Col89d, Dis94a]
LL2941	2.941	23.72	421.5	...	...	...	...	[Mel96, Zai01]
LL3188-s1	2.950	23.80	420.3	3.188-s1	$(^*(C_2)_iN_1^-$	LVM-SB(−238 meV), see Table 11.1	**7.**129a, **7.**130a	[Col89d, Dis94a]
LL2950	2.950	23.80	420.3	...	Si?	...	...	[Yac91, Zai01]
LL2715h	2.962	23.89	418.6	DAP100h	$^*(N_1C_1)_iB_1^+$	$s = 72$, calc. 2.962 eV	**7.**130b	[Dis94a]

Table 4.3.7.2 Low pressure synthetic diamond (CVD): luminescence lines, visible: violet, part 1 (2.98–3.10 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL2985 = LL2440z	2.985	24.08	415.3	**N3c**-DAP24z	$V_1N_3^\circ$	ZPL of **N3c**-DAP24a-q(2.440–2897 eV); 0.59 meV excited state splitting	**7.**109, **7.**113	[Col92b, Col89e]
LL2715i	2.987	24.09	415.1	DAP100i	$^*(N_1C_1)_iB_1^+$	$s = 106$, calc. 2.985 eV	**7.**129b, **7.**130b	[Col89d, Dis94a]
LL2480 = LL2246z	2.991	24.13	414.5	DAP113z	$^*V_1Si_1^-$	ZPL of DAP113a-k(2.246–2.845 eV); in normal and time delayed spectra; QLVM: −74 meV (1Si)	**7.**114, **7.**135	[Kho94, Zai98b]
LL2992 = LL2330z	2.992	24.13	414.4	DAP101z	$^*(N_1C_1)_iB_1^-$	ZPL of DAP101a-d	...	[Ste96a]
LL3188-s2	2.997	24.17	413.7	3.188-s2	$^*(C_2)_iN_1^-$	LVM-SB(−190 meV), see Table 11.1	**7.**129a, **7.**130a	[Col89d, Dis94a]
LL3188-s3	3.009	24.27	412.0	3.188-s3	$^*(C_2)_iN_1^-$	LVM-SB(−179 meV), see Table 11.1	**7.**129a, **7.**130a	[Col89d, Dis94a]
LL3188-s4	3.026	24.41	409.7	3.188-s4	$^*(C_2)_iN_1^-$	LVM: −161 meV, C–C stretch (Table 11.1)	**7.**129a, **7.**130a	[Col89d, Dis94a]
LL3092 = LL2715z	3.092	24.94	401.0	DAP100z	$^*(N_1C_1)_iB_1^+$	var. 3.092–3.100 eV; ZPL of DAP100a-I; QLVM: −61 meV (calc. 3C = 60.9 meV)	**7.**129b, **7.**130b	[Col89d, Dis94a]

Table 4.3.8 Low pressure synthetic diamond (CVD): luminescence lines, near ultraviolet (3.10–3.94 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL3188-s5	3.111	25.09	398.5	3.188-s5	$^*(C_2)_iN_I^-$	QLVM: −77 meV, (calc. 1N + 1C = 79.7)	**7.**129a, **7.**130a	[Col89d, Dis94a]
LL3188 = LL2673z	3.188	25.71	388.9	**3.188 eV** = DAP72z	$^*(C_2)_iN_I^-$	var. 3.188–3.204 eV; ZPL of DAP72a-o(2.672–3.116 eV),see ML	**7.**129a, **7.**130a	[Col89d, Dis94a, Zai01]
LL3272	3.272	26.39	378.9	...	...	...	**5.**145	[Zai00a], [Zai01]
LL3487	3.487	28.13	355.5	...	...	...	...	[Mel96]
LL3853	3.853	31.08	321.8	...	...	...	...	[Fie92, Zai01]

Table 4.3.9 Low pressure synthetic diamond (CVD): luminescence lines, far ultraviolet (4.43–5.90 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL4582	4.582	36.96	270.6	**5RL**	$^*(C_2)_i N_1^\circ$	ZPL of DAP80a-f(4.204–4.481), see ML	**7.**129a	[Col89d, Zai01]
LL5283-s1	4.617	37.24	268.5	*BE-Li-s1	Li	6 sidebands of BE-Li NPL(5.283 eV), observed in LL and ML, SB −666 meV (=2× TO(282) + TA(87) + LO(163)), see also Table A.1.3	**7.**158	[Rob93]
LL4711a	4.711	38.00	263.2	DAP2a	$P_1 + B_1$	23 LL lines a–w (5.215 eV), all lines are listed at HL; shell = 50; calc. 4.711 eV	...	[Ste99a, Ste99b]
LL5283-s2	4.757	38.37	260.6	*BE-Li-s2	Li	SB −526 meV (=2× TO(282) + TA(87) + LO(163))	**7.**158	[Rob93]
LL4760	4.760	38.39	260.5	...	...	...	...	[Rua91b, Zai01]
LL5283-s3	4.832	38.97	256.6	*BE-Li-s3	Li	SB −451 meV (=2× TO(282) + 2× TA(174))	**7.**158	[Rob93]
LL4862a	4.862	39.22	255.0	...	B?	2 lines a, b (4.999 eV)	**5.**153	[Yok99]
LL5283-s4	4.950	39.93	250.4	*BE-Li-s4	Li	SB −333 meV (=2×TA(174) + LO(163))	**7.**158	[Rob93]
LL4862b	4.999	40.32	248.0	...	B	...	**5.**153	[Yok99]
LL5316a-s1	5.020	40.49	247.0	BE-P(a)-s1	P	SB −296 meV (=2×148(TO)?)	**5.**155a	[Ste96b, Tan01]
LL5356a-s4	5.048	40.72	245.6	BE-B(a)-s4	B	SB −308 meV (=TO + LA/O?); named D_2	**5.**157	[Ste96b]

(continued)

Table 4.3.9 (continued)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.** [Zai98]	References
LL5356b-s2	5.060	40.81	245.0	BE-B(b)-s2	B	SB −307 meV (= TO + LA/O?); named D_2'	**5.**157	[Ste96b]
LL5283-s5	5.120	41.30	242.1	*BE-Li-s5	Li	SB −163 meV(= LO(163))	**7.**158	[Rob93]
LL5316a-s2	5.170	41.70	239.8	BE-P(a)-s2	P	SB(−146 meV) = TO?	**5.**155a	[Ste96b, Tan01]
LL5316b-s1	5.190	41.86	238.9	BE-P(b)-s1	P	SB(−143 meV) = TO?	**5.**155a	[Ste96b, Tan01]
LL5356a-s5	5.193	41.89	238.7	BE-B(a)-s5	B	SB(−163 meV) = LA/O?; named D_1"	**5.**155a	[Ste96b, Tan01]
LL5356a-s6	5.215	42.06	237.7	BE-B(a)-s6	B	SB(−141 meV) = TO?; named D_1	**5.**155a	[Ste96b, Tan01]
LL5316a-s3	5.245	42.31	236.4	BE-P(a)-s3	P	SB(−71 meV)	**5.**155a	[Ste96b, Tan01]
LL5283	5.283	42.61	234.7	*BE-Li	Li	NPL of *BE-Li	**7.**158	[Rob93]
LL5316a	5.316	42.88	233.2	BE-P(a)	P	2 lines a, b (5.333 eV); NPL (upper VB)	...	[Tan01]
LL5316b	5.333	43.02	232.5	BE-P(b)	P	NPL (lower VB)	...	[Tan01]
LL5356a	5.356	43.20	231.5	BE-B(a)	B	NPL (upper VB); 2 lines a, b (5.367 eV)	**5.**159	[Ste97b]
LL5356b	5.367	43.29	231.0	BE-B(b)	B	NPL (lower VB)	**5.**159	[Ste97b]
LL5500	5.500	44.36	225.4	...	O?	...	...	[Hei97, Zai01]

4.4 Broad Bands (LB)

Table 4.4.1 Low pressure synthetic diamond (CVD): broad bands, mid infrared (0.18–1.24 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.***x*[Zai98]	References
LB0391	0.3905	3.150	3175	...	B	**A**; W =45%, high B doping	**7**.49...	[Enc94]
LB0399a	0.3986	3.215	3110	3LP(a)	...	**A**; W =23%,3 lattice phonons, var. 0.396–0.399 eV; 2 bands a, b (0.4500); abs. coeff. =1.7–3.0 cm^{-1}	**3.**6...	[Fuc95a]
LB0399b	0.4500	3.630	2755	3LP(b)	...	**A**; W =8%, 3 lattice phonons; var. 0.444–0.450 eV; abs. coeff. =1.7–3.0 cm^{-1}	**3.**6...	[Fuc95a]

Observation: *A* absorption; *CL, EL, IL, PL, XL* luminescence; *PLE* photoluminescence excitation

Table 4.4.2 Low pressure synthetic diamond (CVD): broad bands, visible: purple to violet (1.77–3.10 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.***x*[Zai98]	References
LB1800	1.800	14.52	688.8	B band	B?	**A, CL, PL**; W =20%; structure of 14 lines (1.742–2.138 eV, see DAP9=NL1743);	**7.**75	[Den92]
LB1880	1.880	15.16	659.5	...	Si?	**CL, PL**; W =21%	**7.**79	[Den93]
LB1900	1.900	15.33	652.4	...	P?	**CL**; W =10%	...	[Nij97]
LB1975	1.975	15.93	627.7	...	N, B?	**PL**; W =14%; var. 1.95–2.00 eV	...	[Ber93, Fre94a]
LB2020	2.020	16.29	613.7	...	W, Ta?	**PL**; W =30%	...	[Har96]
LB2100a	2.100	16.94	590.4	Green(a)	B?	**CL, PL, XL**; W =17–34%, 3 bands a–c (2.390 eV)	**5.**95	[Zai01]
LB2300	2.300	18.55	539.0	*C(α 1)	N_I°	**CL, PL**; W =8–16%, ZPL at 4.059 eV	**7.**79, **7.**124	[Den93, Col89d]
LB2100b	2.340	18.87	529.8	Green(b)	B?	**PL**; W =21%, named Green A, PLE at 2.41–2.95 eV; var. 2.15–2.34 eV	**5.**95, **5.**96, **7.**100, **7.**149	[Zai01, Iak00d, Law95]
LB2350	2.350	18.96	527.6	...	Si?	**CL**; W =36%	**7.**79	[Den93]
LB2360	2.360	19.04	525.3	...	Cr, Fe, Ni, Cu?	**Ion Beam Lum**	...	[Bet94]
LB2100c	2.390	19.28	518.7	Green(c)	B?	**PL**; W =21%, named Green B, PLE at >3.40 eV; var. 2.39–2.58 eV	**5.**96, **7.**100, **7.**149	[Iak00d, Law95]

LB2407	2.407	19.42	515.1	...	...	**PL**; intense excimer laser excitation	...	[Cre96]
LB2450	2.450	19.76	505.9	...	...	**PL**; W =13%; ZPL at 2.651 eV; PLE=LB2850	**5.**128, **7.**124	[Iak00a, Col89d]
LB2730a	2.730	22.02	454.1	Blue(a)	B?	**CL, PL, XL**; W =12%, 5 bands a–e (4.650 eV), var. 2.56–2.86 eV	**7.**109, **7.**123, **7.**124	[Col92b, Buh94, Col89d]
LB2740	2.740	22.10	452.5	...	...	**PL, XL**; W =18%; excited by LB3310	**5.**135, **7.**75	[Iak00a, Den92]
LB2850	2.850	22.99	435.0	...	...	**PLE** of LB2450; W =12%; ZPL at 2.651 eV	**5.**128	[Iak00a]
LB2880	2.880	23.23	430.5	$^*C(\beta\ 1)$	N_i°	**CL, PL**; W =8–16%, var. 2.75–3.0 eV, ZPL at 4.059 eV	**7.**79, **7.**113, **7.**124	[Den93, Col89e, Col89d]
LB2950	2.950	23.79	420.3	...	B?	**PLE** of LB2100b=Green(b)	**5.**96	[Iak00d]
LB3100	3.100	25.01	399.9	"N"-band	N?	**PL, EL, IL**; W =13%	**7.**124	[Col89d]

Observation: *A* absorption; *CL, EL, IL, PL, XL* luminescence; *PLE* photoluminescence excitation

Table 4.4.3 Low pressure synthetic diamond (CVD): broad bands, ultraviolet (3.10–5.90 eV)

Line-label	Energy (eV)	Frequ. (10^3 cm^{-1})	Wavel. (nm)	Name	Impur./ defect	Comment	Figs. **3–6.** [Zai01]; Fig. **7.***x*[Zai98]	References
LB3260	3.260	26.30	380.3	...	N?	**EL**; $W = 3\%$	...	[Zha96a]
LB3310	3.310	26.70	374.6	...	...	**PLE** of LB2740	**5.**135	[Iak00a]
LB3400	3.400	27.40	364.6	...	B?	**PLE** of LB2100c = Green(c)	**5.**96	[Iak00d]
LB3470	3.470	27.99	357.3	"Blue"(b)	B?	**CL**;$W = 10$–17%; var. 3.35–3.50 eV	**5.**149, **7.**100, **7.**149	[Ste96a, Law95]
LB3850	3.850	31.05	322.0	...	...	**EL**; $W = 4\%$	...	[Man95]
LB4350a	4.350	35.09	285.0	"Blue"(c)	B?	**CL**; $W = 10\%$	**5.**149, **7.**149	[Ste96a, Law95]
LB4350b	4.500	36.30	275.5	"Blue"(d)	B?	**CL**; $W = 6\%$, dominant "Blue" band	**5.**149, **7.**149	[Ste96a, Law95]
LB4350c	4.650	37.51	266.6	"Blue"(e)	B?	**CL**; $W = 9\%$	**5.**149, **7.**149	[Ste96a, Law95]

Observation: *A* absorption; *CL, EL, IL, PL, XL* luminescence; *PLE* photoluminescence excitation