

MSG No. 138.529 P_C4_2/nm [Type IV, tetragonal]

Table 1: Wyckoff site: 4a, site symmetry: $m' \cdot mm$

No.	position	mapping
1	$[\frac{3}{4}, \frac{3}{4}, \frac{1}{2}]$	[1, 6, 15, 16, 23, 24, 25, 30]
2	$[\frac{3}{4}, \frac{3}{4}, 0]$	[2, 3, 12, 13, 20, 21, 26, 27]
3	$[\frac{1}{4}, \frac{1}{4}, 0]$	[4, 5, 10, 11, 18, 19, 28, 29]
4	$[\frac{1}{4}, \frac{1}{4}, \frac{1}{2}]$	[7, 8, 9, 14, 17, 22, 31, 32]

Table 2: Wyckoff site: 4b, site symmetry: $m' \cdot m'm'$

No.	position	mapping
1	$[\frac{3}{4}, \frac{1}{4}, \frac{1}{2}]$	[1, 6, 7, 8, 25, 30, 31, 32]
2	$[\frac{1}{4}, \frac{3}{4}, 0]$	[2, 3, 4, 5, 26, 27, 28, 29]
3	$[\frac{1}{4}, \frac{3}{4}, \frac{1}{2}]$	[9, 14, 15, 16, 17, 22, 23, 24]
4	$[\frac{3}{4}, \frac{1}{4}, 0]$	[10, 11, 12, 13, 18, 19, 20, 21]

Table 3: Wyckoff site: 4c, site symmetry: $m' \cdot mm'$

No.	position	mapping
1	$[\frac{1}{2}, 0, \frac{1}{2}]$	[1, 7, 9, 15, 22, 24, 30, 32]
2	$[\frac{1}{2}, \frac{1}{2}, 0]$	[2, 5, 10, 13, 19, 20, 27, 28]
3	$[0, 0, 0]$	[3, 4, 11, 12, 18, 21, 26, 29]
4	$[0, \frac{1}{2}, \frac{1}{2}]$	[6, 8, 14, 16, 17, 23, 25, 31]

Table 4: Wyckoff site: 4d, site symmetry: $m' \cdot mm'$

No.	position	mapping
1	$[\frac{1}{2}, 0, 0]$	[1, 7, 9, 15, 22, 24, 30, 32]
2	$[\frac{1}{2}, \frac{1}{2}, \frac{1}{2}]$	[2, 5, 10, 13, 19, 20, 27, 28]
3	$[0, 0, \frac{1}{2}]$	[3, 4, 11, 12, 18, 21, 26, 29]
4	$[0, \frac{1}{2}, 0]$	[6, 8, 14, 16, 17, 23, 25, 31]

Table 5: Wyckoff site: 4e, site symmetry: $-4'2'm$

No.	position	mapping
1	$[\frac{3}{4}, \frac{3}{4}, \frac{3}{4}]$	[1, 6, 15, 16, 20, 21, 26, 27]
2	$[\frac{3}{4}, \frac{3}{4}, \frac{1}{4}]$	[2, 3, 12, 13, 23, 24, 25, 30]

continued ...

Table 5

No.	position	mapping
3	$[\frac{1}{4}, \frac{1}{4}, \frac{3}{4}]$	[4,5,10,11,17,22,31,32]
4	$[\frac{1}{4}, \frac{1}{4}, \frac{1}{4}]$	[7,8,9,14,18,19,28,29]

Table 6: Wyckoff site: 4f, site symmetry: -42'm'

No.	position	mapping
1	$[\frac{3}{4}, \frac{1}{4}, \frac{3}{4}]$	[1,6,10,11,20,21,31,32]
2	$[\frac{1}{4}, \frac{3}{4}, \frac{1}{4}]$	[2,3,9,14,23,24,28,29]
3	$[\frac{1}{4}, \frac{3}{4}, \frac{3}{4}]$	[4,5,15,16,17,22,26,27]
4	$[\frac{3}{4}, \frac{1}{4}, \frac{1}{4}]$	[7,8,12,13,18,19,25,30]

Table 7: Wyckoff site: 8g, site symmetry: 2.mmm

No.	position	mapping
1	$[\frac{3}{4}, \frac{3}{4}, z]$	[1,6,15,16]
2	$[\frac{3}{4}, \frac{3}{4}, z + \frac{1}{2}]$	[2,3,12,13]
3	$[\frac{1}{4}, \frac{1}{4}, \frac{1}{2} - z]$	[4,5,10,11]
4	$[\frac{1}{4}, \frac{1}{4}, -z]$	[7,8,9,14]
5	$[\frac{1}{4}, \frac{1}{4}, z]$	[17,22,31,32]
6	$[\frac{1}{4}, \frac{1}{4}, z + \frac{1}{2}]$	[18,19,28,29]
7	$[\frac{3}{4}, \frac{3}{4}, \frac{1}{2} - z]$	[20,21,26,27]
8	$[\frac{3}{4}, \frac{3}{4}, -z]$	[23,24,25,30]

Table 8: Wyckoff site: 8h, site symmetry: 2.m'm'

No.	position	mapping
1	$[\frac{3}{4}, \frac{1}{4}, z]$	[1,6,31,32]
2	$[\frac{1}{4}, \frac{3}{4}, z + \frac{1}{2}]$	[2,3,28,29]
3	$[\frac{1}{4}, \frac{3}{4}, \frac{1}{2} - z]$	[4,5,26,27]
4	$[\frac{3}{4}, \frac{1}{4}, -z]$	[7,8,25,30]
5	$[\frac{1}{4}, \frac{3}{4}, -z]$	[9,14,23,24]
6	$[\frac{3}{4}, \frac{1}{4}, \frac{1}{2} - z]$	[10,11,20,21]
7	$[\frac{3}{4}, \frac{1}{4}, z + \frac{1}{2}]$	[12,13,18,19]
8	$[\frac{1}{4}, \frac{3}{4}, z]$	[15,16,17,22]

Table 9: Wyckoff site: 8i, site symmetry: 2.m̄m

No.	position	mapping
1	$[\frac{1}{2}, 0, z]$	[1,15,22,32]
2	$[\frac{1}{2}, \frac{1}{2}, z + \frac{1}{2}]$	[2,13,19,28]
3	$[0, 0, z + \frac{1}{2}]$	[3,12,18,29]
4	$[0, 0, \frac{1}{2} - z]$	[4,11,21,26]
5	$[\frac{1}{2}, \frac{1}{2}, \frac{1}{2} - z]$	[5,10,20,27]
6	$[0, \frac{1}{2}, z]$	[6,16,17,31]
7	$[\frac{1}{2}, 0, -z]$	[7,9,24,30]
8	$[0, \frac{1}{2}, -z]$	[8,14,23,25]

Table 10: Wyckoff site: 8j, site symmetry: m'.2'm

No.	position	mapping
1	$[x, x, \frac{1}{2}]$	[1,16,23,30]
2	$[\frac{1}{2} - x, x, 0]$	[2,12,21,27]
3	$[x, \frac{1}{2} - x, 0]$	[3,13,20,26]
4	$[x + \frac{1}{2}, -x, 0]$	[4,10,19,29]
5	$[-x, x + \frac{1}{2}, 0]$	[5,11,18,28]
6	$[\frac{1}{2} - x, \frac{1}{2} - x, \frac{1}{2}]$	[6,15,24,25]
7	$[x + \frac{1}{2}, x + \frac{1}{2}, \frac{1}{2}]$	[7,14,17,32]
8	$[-x, -x, \frac{1}{2}]$	[8,9,22,31]

Table 11: Wyckoff site: 8k, site symmetry: m'.2m'

No.	position	mapping
1	$[x, x + \frac{1}{2}, 0]$	[1,7,30,32]
2	$[-x, x, \frac{1}{2}]$	[2,5,27,28]
3	$[x + \frac{1}{2}, \frac{1}{2} - x, \frac{1}{2}]$	[3,4,26,29]
4	$[\frac{1}{2} - x, -x, 0]$	[6,8,25,31]
5	$[-x, \frac{1}{2} - x, 0]$	[9,15,22,24]
6	$[x, -x, \frac{1}{2}]$	[10,13,19,20]
7	$[\frac{1}{2} - x, x + \frac{1}{2}, \frac{1}{2}]$	[11,12,18,21]
8	$[x + \frac{1}{2}, x, 0]$	[14,16,17,23]

Table 12: Wyckoff site: 8l, site symmetry: m'.2'm

No.	position	mapping
1	$[x, x, 0]$	[1,16,23,30]
2	$[\frac{1}{2} - x, x, \frac{1}{2}]$	[2,12,21,27]
3	$[x, \frac{1}{2} - x, \frac{1}{2}]$	[3,13,20,26]

continued ...

Table 12

No.	position	mapping
4	$[x + \frac{1}{2}, -x, \frac{1}{2}]$	[4,10,19,29]
5	$[-x, x + \frac{1}{2}, \frac{1}{2}]$	[5,11,18,28]
6	$[\frac{1}{2} - x, \frac{1}{2} - x, 0]$	[6,15,24,25]
7	$[x + \frac{1}{2}, x + \frac{1}{2}, 0]$	[7,14,17,32]
8	$[-x, -x, 0]$	[8,9,22,31]

Table 13: Wyckoff site: $8\bar{m}$, site symmetry: $\bar{m}' \cdot 2\bar{m}'$

No.	position	mapping
1	$[x, x + \frac{1}{2}, \frac{1}{2}]$	[1,7,30,32]
2	$[-x, x, 0]$	[2,5,27,28]
3	$[x + \frac{1}{2}, \frac{1}{2} - x, 0]$	[3,4,26,29]
4	$[\frac{1}{2} - x, -x, \frac{1}{2}]$	[6,8,25,31]
5	$[-x, \frac{1}{2} - x, \frac{1}{2}]$	[9,15,22,24]
6	$[x, -x, 0]$	[10,13,19,20]
7	$[\frac{1}{2} - x, x + \frac{1}{2}, 0]$	[11,12,18,21]
8	$[x + \frac{1}{2}, x, \frac{1}{2}]$	[14,16,17,23]

Table 14: Wyckoff site: $16n$, site symmetry: $.2'.$

No.	position	mapping
1	$[\frac{3}{4}, y, \frac{3}{4}]$	[1,21]
2	$[\frac{1}{2} - y, \frac{3}{4}, \frac{1}{4}]$	[2,24]
3	$[y, \frac{3}{4}, \frac{1}{4}]$	[3,23]
4	$[\frac{1}{4}, -y, \frac{3}{4}]$	[4,22]
5	$[\frac{1}{4}, y + \frac{1}{2}, \frac{3}{4}]$	[5,17]
6	$[\frac{3}{4}, \frac{1}{2} - y, \frac{3}{4}]$	[6,20]
7	$[y + \frac{1}{2}, \frac{1}{4}, \frac{1}{4}]$	[7,19]
8	$[-y, \frac{1}{4}, \frac{1}{4}]$	[8,18]
9	$[\frac{1}{4}, -y, \frac{1}{4}]$	[9,29]
10	$[y + \frac{1}{2}, \frac{1}{4}, \frac{3}{4}]$	[10,32]
11	$[-y, \frac{1}{4}, \frac{3}{4}]$	[11,31]
12	$[\frac{3}{4}, y, \frac{1}{4}]$	[12,30]
13	$[\frac{3}{4}, \frac{1}{2} - y, \frac{1}{4}]$	[13,25]
14	$[\frac{1}{4}, y + \frac{1}{2}, \frac{1}{4}]$	[14,28]
15	$[\frac{1}{2} - y, \frac{3}{4}, \frac{3}{4}]$	[15,27]
16	$[y, \frac{3}{4}, \frac{3}{4}]$	[16,26]

Table 15: Wyckoff site: 16o, site symmetry: $\dots\text{m}$

No.	position	mapping
1	$[x, \frac{1}{2} - x, z]$	[1,15]
2	$[x, x, z + \frac{1}{2}]$	[2,13]
3	$[\frac{1}{2} - x, \frac{1}{2} - x, z + \frac{1}{2}]$	[3,12]
4	$[x + \frac{1}{2}, x + \frac{1}{2}, \frac{1}{2} - z]$	[4,11]
5	$[-x, -x, \frac{1}{2} - z]$	[5,10]
6	$[\frac{1}{2} - x, x, z]$	[6,16]
7	$[-x, x + \frac{1}{2}, -z]$	[7,9]
8	$[x + \frac{1}{2}, -x, -z]$	[8,14]
9	$[x + \frac{1}{2}, -x, z]$	[17,31]
10	$[x + \frac{1}{2}, x + \frac{1}{2}, z + \frac{1}{2}]$	[18,29]
11	$[-x, -x, z + \frac{1}{2}]$	[19,28]
12	$[x, x, \frac{1}{2} - z]$	[20,27]
13	$[\frac{1}{2} - x, \frac{1}{2} - x, \frac{1}{2} - z]$	[21,26]
14	$[-x, x + \frac{1}{2}, z]$	[22,32]
15	$[\frac{1}{2} - x, x, -z]$	[23,25]
16	$[x, \frac{1}{2} - x, -z]$	[24,30]

Table 16: Wyckoff site: 16p, site symmetry: $\dots\text{m}'$

No.	position	mapping
1	$[x, -x, z]$	[1,31]
2	$[x + \frac{1}{2}, x, z + \frac{1}{2}]$	[2,29]
3	$[-x, \frac{1}{2} - x, z + \frac{1}{2}]$	[3,28]
4	$[x + \frac{1}{2}, x, \frac{1}{2} - z]$	[4,27]
5	$[-x, \frac{1}{2} - x, \frac{1}{2} - z]$	[5,26]
6	$[\frac{1}{2} - x, x + \frac{1}{2}, z]$	[6,32]
7	$[\frac{1}{2} - x, x + \frac{1}{2}, -z]$	[7,25]
8	$[x, -x, -z]$	[8,30]
9	$[-x, x, -z]$	[9,23]
10	$[\frac{1}{2} - x, -x, \frac{1}{2} - z]$	[10,21]
11	$[x, x + \frac{1}{2}, \frac{1}{2} - z]$	[11,20]
12	$[\frac{1}{2} - x, -x, z + \frac{1}{2}]$	[12,19]
13	$[x, x + \frac{1}{2}, z + \frac{1}{2}]$	[13,18]
14	$[x + \frac{1}{2}, \frac{1}{2} - x, -z]$	[14,24]
15	$[x + \frac{1}{2}, \frac{1}{2} - x, z]$	[15,17]
16	$[-x, x, z]$	[16,22]

Table 17: Wyckoff site: 16q, site symmetry: $\text{m}'\dots$

No.	position	mapping
1	$[x, y, \frac{1}{2}]$	[1,30]

continued ...

Table 17

No.	position	mapping
2	$[\frac{1}{2} - y, x, 0]$	[2,27]
3	$[y, \frac{1}{2} - x, 0]$	[3,26]
4	$[x + \frac{1}{2}, -y, 0]$	[4,29]
5	$[-x, y + \frac{1}{2}, 0]$	[5,28]
6	$[\frac{1}{2} - x, \frac{1}{2} - y, \frac{1}{2}]$	[6,25]
7	$[y + \frac{1}{2}, x + \frac{1}{2}, \frac{1}{2}]$	[7,32]
8	$[-y, -x, \frac{1}{2}]$	[8,31]
9	$[-x, -y, \frac{1}{2}]$	[9,22]
10	$[y + \frac{1}{2}, -x, 0]$	[10,19]
11	$[-y, x + \frac{1}{2}, 0]$	[11,18]
12	$[\frac{1}{2} - x, y, 0]$	[12,21]
13	$[x, \frac{1}{2} - y, 0]$	[13,20]
14	$[x + \frac{1}{2}, y + \frac{1}{2}, \frac{1}{2}]$	[14,17]
15	$[\frac{1}{2} - y, \frac{1}{2} - x, \frac{1}{2}]$	[15,24]
16	$[y, x, \frac{1}{2}]$	[16,23]

Table 18: Wyckoff site: 32r, site symmetry: 1

No.	position	mapping
1	$[x, y, z]$	[1]
2	$[\frac{1}{2} - y, x, z + \frac{1}{2}]$	[2]
3	$[y, \frac{1}{2} - x, z + \frac{1}{2}]$	[3]
4	$[x + \frac{1}{2}, -y, \frac{1}{2} - z]$	[4]
5	$[-x, y + \frac{1}{2}, \frac{1}{2} - z]$	[5]
6	$[\frac{1}{2} - x, \frac{1}{2} - y, z]$	[6]
7	$[y + \frac{1}{2}, x + \frac{1}{2}, -z]$	[7]
8	$[-y, -x, -z]$	[8]
9	$[-x, -y, -z]$	[9]
10	$[y + \frac{1}{2}, -x, \frac{1}{2} - z]$	[10]
11	$[-y, x + \frac{1}{2}, \frac{1}{2} - z]$	[11]
12	$[\frac{1}{2} - x, y, z + \frac{1}{2}]$	[12]
13	$[x, \frac{1}{2} - y, z + \frac{1}{2}]$	[13]
14	$[x + \frac{1}{2}, y + \frac{1}{2}, -z]$	[14]
15	$[\frac{1}{2} - y, \frac{1}{2} - x, z]$	[15]
16	$[y, x, z]$	[16]
17	$[x + \frac{1}{2}, y + \frac{1}{2}, z]$	[17]
18	$[-y, x + \frac{1}{2}, z + \frac{1}{2}]$	[18]
19	$[y + \frac{1}{2}, -x, z + \frac{1}{2}]$	[19]
20	$[x, \frac{1}{2} - y, \frac{1}{2} - z]$	[20]
21	$[\frac{1}{2} - x, y, \frac{1}{2} - z]$	[21]
22	$[-x, -y, z]$	[22]
23	$[y, x, -z]$	[23]
24	$[\frac{1}{2} - y, \frac{1}{2} - x, -z]$	[24]
25	$[\frac{1}{2} - x, \frac{1}{2} - y, -z]$	[25]

continued ...

Table 18

No.	position	mapping
26	$[y, \frac{1}{2} - x, \frac{1}{2} - z]$	[26]
27	$[\frac{1}{2} - y, x, \frac{1}{2} - z]$	[27]
28	$[-x, y + \frac{1}{2}, z + \frac{1}{2}]$	[28]
29	$[x + \frac{1}{2}, -y, z + \frac{1}{2}]$	[29]
30	$[x, y, -z]$	[30]
31	$[-y, -x, z]$	[31]
32	$[y + \frac{1}{2}, x + \frac{1}{2}, z]$	[32]