

MSG No. 139.536 $I4'/m'm'm$ [Type III, tetragonal]

Table 1: Wyckoff site: 2a, site symmetry: $4'/\bar{m}'\bar{m}'\bar{m}$

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

Table 2: Wyckoff site: 2b, site symmetry: $4'/\bar{m}'\bar{m}'\bar{m}$

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

Table 3: Wyckoff site: 4c, site symmetry: $\bar{m}'\bar{m}'\bar{m}'$.

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

Table 4: Wyckoff site: 4d, site symmetry: $-4\bar{m}'2'$

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

Table 5: Wyckoff site: 4e, site symmetry: $4'\bar{m}'\bar{m}$

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

Table 6: Wyckoff site: **8f**, site symmetry: $\dots 2^1/m$

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

Table 7: Wyckoff site: **8g**, site symmetry: $2m'm'$.

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

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

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

Table 9: Wyckoff site: **8i**, site symmetry: $m'2m'$.

No.	position	mapping
1	$[x, 0, 0]$	[1, 2, 15, 16]
2	$[-x, 0, 0]$	[3, 4, 13, 14]
3	$[0, -x, 0]$	[5, 7, 10, 12]

continued ...

Table 9

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

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

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

Table 11: Wyckoff site: 16k, site symmetry: $\dots 2'$

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

Table 12: Wyckoff site: 16l, site symmetry: $\mathbf{m}'\dots$

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

Table 13: Wyckoff site: 16m, site symmetry: $\dots\mathbf{m}$

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

Table 14: Wyckoff site: 16n, site symmetry: $\mathbf{.m}'$.

No.	position	mapping
1	$[0, y, z]$	[1,14]

continued ...

Table 14

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

Table 15: Wyckoff site: 32o, site symmetry: 1

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

continued ...

Table 15

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