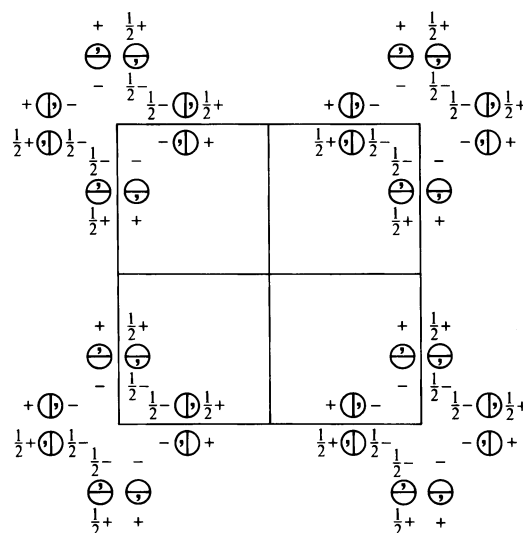
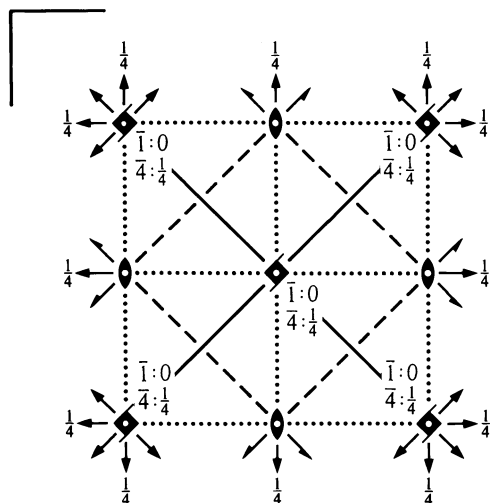


$P4_2/mcm$
 D_{4h}^{10}
 $4/mmm$

Tetragonal

No. 132

 $P 4_2/m 2/c 2/m$

 Patterson symmetry $P4/mmm$

Origin at centre (mmm) at $4_2/mc2/m$
Asymmetric unit $0 \leq x \leq \frac{1}{2}; 0 \leq y \leq \frac{1}{2}; 0 \leq z \leq \frac{1}{2}; x \leq y$
Symmetry operations

- | | | | |
|---------------------------|---------------------------|---|---|
| (1) 1 | (2) 2 $0, 0, z$ | (3) $4^+(0, 0, \frac{1}{2})$ $0, 0, z$ | (4) $4^-(0, 0, \frac{1}{2})$ $0, 0, z$ |
| (5) 2 $0, y, \frac{1}{4}$ | (6) 2 $x, 0, \frac{1}{4}$ | (7) 2 $x, x, 0$ | (8) 2 $x, \bar{x}, 0$ |
| (9) $\bar{1}$ $0, 0, 0$ | (10) m $x, y, 0$ | (11) $\bar{4}^+$ $0, 0, z; 0, 0, \frac{1}{4}$ | (12) $\bar{4}^-$ $0, 0, z; 0, 0, \frac{1}{4}$ |
| (13) c $x, 0, z$ | (14) c $0, y, z$ | (15) m x, \bar{x}, z | (16) m x, x, z |

Maximal non-isomorphic subgroups

- | | | |
|----------|---------------------------------|----------------------------|
| I | [2] $P\bar{4}c2$ (116) | 1; 2; 7; 8; 11; 12; 13; 14 |
| | [2] $P\bar{4}2m$ (111) | 1; 2; 5; 6; 11; 12; 15; 16 |
| | [2] $P4_2cm$ (101) | 1; 2; 3; 4; 13; 14; 15; 16 |
| | [2] $P4_222$ (93) | 1; 2; 3; 4; 5; 6; 7; 8 |
| | [2] $P4_2/m11$ ($P4_2/m$, 84) | 1; 2; 3; 4; 9; 10; 11; 12 |
| | [2] $P2/m12/m$ ($Cmmm$, 65) | 1; 2; 7; 8; 9; 10; 15; 16 |
| | [2] $P2/m2/c1$ ($Pccm$, 49) | 1; 2; 5; 6; 9; 10; 13; 14 |

IIa none

- | | |
|------------|---|
| IIb | [2] $C4_2/ecm$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}$) ($P4_2/nmc$, 137); [2] $C4_2/mcd$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}$) ($P4_2/mbc$, 135); |
| | [2] $C4_2/ecd$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}$) ($P4_2/nbc$, 133); [2] $C4_2/mcm$ ($\mathbf{a}' = 2\mathbf{a}, \mathbf{b}' = 2\mathbf{b}$) ($P4_2/mmc$, 131) |

Maximal isomorphic subgroups of lowest index

- | | |
|------------|---|
| IIc | [3] $P4_2/mcm$ ($\mathbf{c}' = 3\mathbf{c}$) (132); [9] $P4_2/mcm$ ($\mathbf{a}' = 3\mathbf{a}, \mathbf{b}' = 3\mathbf{b}$) (132) |
|------------|---|

Minimal non-isomorphic supergroups
I none

- | | |
|-----------|--|
| II | [2] $C4_2/mcm$ ($P4_2/mmc$, 131); [2] $I4/mcm$ (140); [2] $P4/mmm$ ($\mathbf{c}' = \frac{1}{2}\mathbf{c}$) (123) |
|-----------|--|

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(0,0,1)$; (2); (3); (5); (9)

Positions

Multiplicity, Wyckoff letter, Site symmetry	Coordinates				Reflection conditions
16 <i>p</i> 1	(1) x, y, z (5) $\bar{x}, y, \bar{z} + \frac{1}{2}$ (9) $\bar{x}, \bar{y}, \bar{z}$ (13) $x, \bar{y}, z + \frac{1}{2}$	(2) \bar{x}, \bar{y}, z (6) $x, \bar{y}, \bar{z} + \frac{1}{2}$ (10) x, y, \bar{z} (14) $\bar{x}, y, z + \frac{1}{2}$	(3) $\bar{y}, x, z + \frac{1}{2}$ (7) y, x, \bar{z} (11) $y, \bar{x}, \bar{z} + \frac{1}{2}$ (15) \bar{y}, \bar{x}, z	(4) $y, \bar{x}, z + \frac{1}{2}$ (8) $\bar{y}, \bar{x}, \bar{z}$ (12) $\bar{y}, x, \bar{z} + \frac{1}{2}$ (16) y, x, z	General: $Ok_l : l = 2n$ $00l : l = 2n$ Special: as above, plus no extra conditions
8 <i>o</i> $\dots m$	x, x, z $\bar{x}, x, \bar{z} + \frac{1}{2}$	\bar{x}, \bar{x}, z $x, \bar{x}, \bar{z} + \frac{1}{2}$	$\bar{x}, x, z + \frac{1}{2}$ x, x, \bar{z}	$x, \bar{x}, z + \frac{1}{2}$ $\bar{x}, \bar{x}, \bar{z}$	no extra conditions
8 <i>n</i> $m \dots$	$x, y, 0$ $\bar{x}, y, \frac{1}{2}$	$\bar{x}, \bar{y}, 0$ $x, \bar{y}, \frac{1}{2}$	$\bar{y}, x, \frac{1}{2}$ $y, x, 0$	$y, \bar{x}, \frac{1}{2}$ $\bar{y}, \bar{x}, 0$	no extra conditions
8 <i>m</i> $\dots 2 \dots$	$x, \frac{1}{2}, \frac{1}{4}$ $\bar{x}, \frac{1}{2}, \frac{3}{4}$	$\bar{x}, \frac{1}{2}, \frac{1}{4}$ $x, \frac{1}{2}, \frac{3}{4}$	$\frac{1}{2}, x, \frac{3}{4}$ $\frac{1}{2}, \bar{x}, \frac{1}{4}$	$\frac{1}{2}, \bar{x}, \frac{3}{4}$ $\frac{1}{2}, x, \frac{1}{4}$	$hkl : l = 2n$
8 <i>l</i> $\dots 2 \dots$	$x, 0, \frac{1}{4}$ $\bar{x}, 0, \frac{3}{4}$	$\bar{x}, 0, \frac{1}{4}$ $x, 0, \frac{3}{4}$	$0, x, \frac{3}{4}$ $0, \bar{x}, \frac{1}{4}$	$0, \bar{x}, \frac{3}{4}$ $0, x, \frac{1}{4}$	$hkl : l = 2n$
8 <i>k</i> $2 \dots$	$0, \frac{1}{2}, z$ $0, \frac{1}{2}, \bar{z}$	$\frac{1}{2}, 0, z + \frac{1}{2}$ $\frac{1}{2}, 0, \bar{z} + \frac{1}{2}$	$0, \frac{1}{2}, \bar{z} + \frac{1}{2}$ $0, \frac{1}{2}, z + \frac{1}{2}$	$\frac{1}{2}, 0, \bar{z}$ $\frac{1}{2}, 0, z$	$hkl : h + k, l = 2n$
4 <i>j</i> $m \dots 2m$	$x, x, \frac{1}{2}$	$\bar{x}, \bar{x}, \frac{1}{2}$	$\bar{x}, x, 0$	$x, \bar{x}, 0$	no extra conditions
4 <i>i</i> $m \dots 2m$	$x, x, 0$	$\bar{x}, \bar{x}, 0$	$\bar{x}, x, \frac{1}{2}$	$x, \bar{x}, \frac{1}{2}$	no extra conditions
4 <i>h</i> $2 \dots mm$	$\frac{1}{2}, \frac{1}{2}, z$	$\frac{1}{2}, \frac{1}{2}, z + \frac{1}{2}$	$\frac{1}{2}, \frac{1}{2}, \bar{z} + \frac{1}{2}$	$\frac{1}{2}, \frac{1}{2}, \bar{z}$	$hkl : l = 2n$
4 <i>g</i> $2 \dots mm$	$0, 0, z$	$0, 0, z + \frac{1}{2}$	$0, 0, \bar{z} + \frac{1}{2}$	$0, 0, \bar{z}$	$hkl : l = 2n$
4 <i>f</i> $2/m \dots$	$0, \frac{1}{2}, 0$	$\frac{1}{2}, 0, \frac{1}{2}$	$0, \frac{1}{2}, \frac{1}{2}$	$\frac{1}{2}, 0, 0$	$hkl : h + k, l = 2n$
4 <i>e</i> $222 \dots$	$0, \frac{1}{2}, \frac{1}{4}$	$\frac{1}{2}, 0, \frac{3}{4}$	$0, \frac{1}{2}, \frac{3}{4}$	$\frac{1}{2}, 0, \frac{1}{4}$	$hkl : h + k, l = 2n$
2 <i>d</i> $\bar{4}2m$	$\frac{1}{2}, \frac{1}{2}, \frac{1}{4}$	$\frac{1}{2}, \frac{1}{2}, \frac{3}{4}$			$hkl : l = 2n$
2 <i>c</i> $m \dots mm$	$\frac{1}{2}, \frac{1}{2}, 0$	$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}$			$hkl : l = 2n$
2 <i>b</i> $\bar{4}2m$	$0, 0, \frac{1}{4}$	$0, 0, \frac{3}{4}$			$hkl : l = 2n$
2 <i>a</i> $m \dots mm$	$0, 0, 0$	$0, 0, \frac{1}{2}$			$hkl : l = 2n$

Symmetry of special projections

Along [001] $p4mm$

$\mathbf{a}' = \mathbf{a}$ $\mathbf{b}' = \mathbf{b}$

Origin at $0, 0, z$

Along [100] $p2mm$

$\mathbf{a}' = \mathbf{b}$ $\mathbf{b}' = \frac{1}{2}\mathbf{c}$

Origin at $x, 0, 0$

Along [110] $p2mm$

$\mathbf{a}' = \frac{1}{2}(-\mathbf{a} + \mathbf{b})$ $\mathbf{b}' = \mathbf{c}$

Origin at $x, x, 0$

(Continued on preceding page)