

$pmmn$

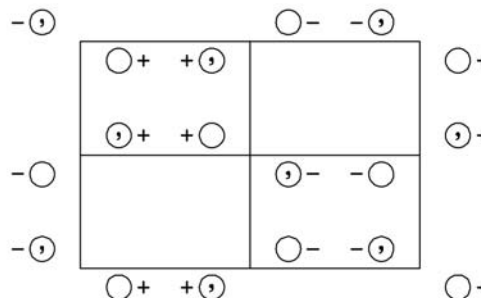
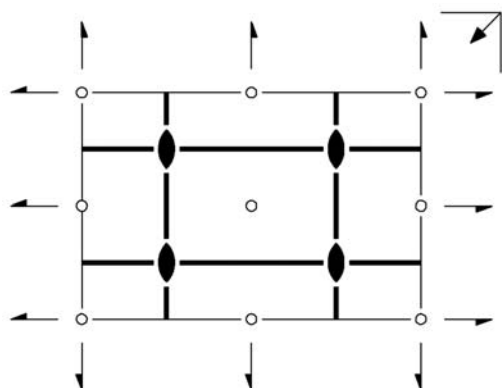
$mmm$

Orthorhombic/Rectangular

No. 46

$p2_1/m2_1/m2/n$

Patterson symmetry  $pmmm$



Origin at  $\bar{1}$  on  $2_12_1n$

Asymmetric unit  $0 \leq x \leq \frac{1}{4}; 0 \leq y \leq \frac{1}{2}$

Symmetry operations

- |  |   |   |   |
|--|---|---|---|
| (1) $1$<br>( $1 0,0,0$ )                       | (2) $2 \frac{1}{4}, \frac{1}{4}, z$<br>( $2_z \frac{1}{2}, \frac{1}{2}, 0$ )          | (3) $2(0, \frac{1}{2}, 0) 0, y, 0$<br>( $2_y 0, \frac{1}{2}, 0$ ) | (4) $2(\frac{1}{2}, 0, 0) x, 0, 0$<br>( $2_x \frac{1}{2}, 0, 0$ ) |
| (5) $\bar{1} 0, 0, 0$<br>( $\bar{1} 0, 0, 0$ ) | (6) $n(\frac{1}{2}, \frac{1}{2}, 0) x, y, 0$<br>( $m_z \frac{1}{2}, \frac{1}{2}, 0$ ) | (7) $m x, \frac{1}{4}, z$<br>( $m_y 0, \frac{1}{2}, 0$ )          | (8) $m \frac{1}{4}, y, z$<br>( $m_x \frac{1}{2}, 0, 0$ )          |

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

**Positions**

Multiplicity, Wyckoff letter, Site symmetry	Coordinates				Reflection conditions
8 <i>f</i> 1	(1) $x, y, z$ (5) $\bar{x}, \bar{y}, \bar{z}$	(2) $\bar{x} + \frac{1}{2}, \bar{y} + \frac{1}{2}, z$ (6) $x + \frac{1}{2}, y + \frac{1}{2}, \bar{z}$	(3) $\bar{x}, y + \frac{1}{2}, \bar{z}$ (7) $x, \bar{y} + \frac{1}{2}, z$	(4) $x + \frac{1}{2}, \bar{y}, \bar{z}$ (8) $\bar{x} + \frac{1}{2}, y, z$	General: $hk: h + k = 2n$ $h0: h = 2n$ $0k: k = 2n$  Special: as above, plus
4 <i>e</i> . <i>m</i> .	$x, \frac{1}{4}, z$	$\bar{x} + \frac{1}{2}, \frac{1}{4}, z$	$\bar{x}, \frac{3}{4}, \bar{z}$	$x + \frac{1}{2}, \frac{3}{4}, \bar{z}$	no extra conditions
4 <i>d</i> <i>m</i> ..	$\frac{1}{4}, y, z$	$\frac{1}{4}, \bar{y} + \frac{1}{2}, z$	$\frac{3}{4}, y + \frac{1}{2}, \bar{z}$	$\frac{3}{4}, \bar{y}, \bar{z}$	no extra conditions
4 <i>c</i> $\bar{1}$	0, 0, 0	$\frac{1}{2}, \frac{1}{2}, 0$	0, $\frac{1}{2}, 0$	$\frac{1}{2}, 0, 0$	$hk: h, k = 2n$
2 <i>b</i> <i>m m</i> 2	$\frac{1}{4}, \frac{3}{4}, z$	$\frac{3}{4}, \frac{1}{4}, \bar{z}$			no extra conditions
2 <i>a</i> <i>m m</i> 2	$\frac{1}{4}, \frac{1}{4}, z$	$\frac{3}{4}, \frac{3}{4}, \bar{z}$			no extra conditions

**Symmetry of special projections**

Along [001]  $c2mm$

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

Origin at  $\frac{1}{4}, \frac{1}{4}, z$

Along [100]  $\neq 2mg$

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

Origin at  $x, 0, 0$

Along [010]  $\neq 2mg$

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

Origin at  $0, y, 0$

**Maximal non-isotypic subgroups**

<b>I</b>	[2] $pm2_1n$ (32)	1; 3; 6; 8
	[2] $p2_1mn$ ( $pm2_1n$ , 32)	1; 4; 6; 7
	[2] $pmm2$ (23)	1; 2; 7; 8
	[2] $p2_12_12$ (21)	1; 2; 3; 4
	[2] $p12_1/m1$ ( $p2_1/m11$ , 15)	1; 3; 5; 7
	[2] $p2_1/m11$ (15)	1; 4; 5; 8
	[2] $p112/n$ ( $p112/a$ , 7)	1; 2; 5; 6

**IIa** none

**IIb** none

**Maximal isotypic subgroups of lowest index**

**IIc** [3]  $pmmn$  ( $\mathbf{a}' = 3\mathbf{a}$  or  $\mathbf{b}' = 3\mathbf{b}$ ) (46)

**Minimal non-isotypic supergroups**

**I** [2]  $p4/nmm$  (64)

**II** [2]  $cmmm$  (47); [2]  $pmma$  ( $\mathbf{b}' = \frac{1}{2}\mathbf{b}$ ) (41)