

$cmme$

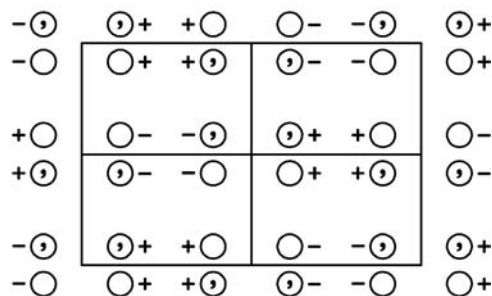
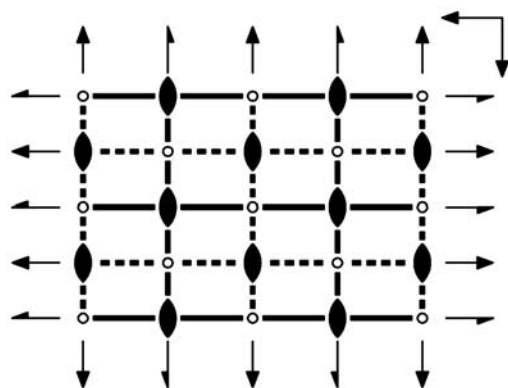
mmm

Orthorhombic/Rectangular

No. 48

$c2/m2/m2/e$

Patterson symmetry $cmmm$



Origin at centre ($2/m$) at $2/m2_1/e$

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

Symmetry operations

For $(0, 0, 0)$ + set

- | | | | |
|--|--|---|--------------------------------------|
| (1) 1
(1 0, 0, 0) | (2) $2_{z,0,\frac{1}{4},z}$
($2_z 0, \frac{1}{2}, 0$) | (3) $2(0, \frac{1}{2}, 0)$ $0, y, 0$
($2_y 0, \frac{1}{2}, 0$) | (4) $2_{x,0,0}$
($2_x 0, 0, 0$) |
| (5) $\bar{1}$ $0, 0, 0$
($\bar{1} 0, 0, 0$) | (6) $b_{x,y,0}$
($m_z 0, \frac{1}{2}, 0$) | (7) $m_{x,\frac{1}{4},z}$
($m_y 0, \frac{1}{2}, 0$) | (8) $m_{0,y,z}$
($m_x 0, 0, 0$) |

For $(\frac{1}{2}, \frac{1}{2}, 0)$ + set

- | | | | |
|--|--|--|---|
| (1) $t(\frac{1}{2}, \frac{1}{2}, 0)$
($1 \frac{1}{2}, \frac{1}{2}, 0$) | (2) $2_{\frac{1}{4},0,z}$
($2_z \frac{1}{2}, 0, 0$) | (3) $2_{\frac{1}{4},y,0}$
($2_y \frac{1}{2}, 0, 0$) | (4) $2(\frac{1}{2}, 0, 0)$ $x, \frac{1}{4}, 0$
($2_x \frac{1}{2}, \frac{1}{2}, 0$) |
| (5) $\bar{1}$ $\frac{1}{4}, \frac{1}{4}, 0$
($\bar{1} \frac{1}{2}, \frac{1}{2}, 0$) | (6) $a_{x,y,0}$
($m_z \frac{1}{2}, 0, 0$) | (7) $a_{x,0,z}$
($m_y \frac{1}{2}, 0, 0$) | (8) $b_{\frac{1}{4},y,z}$
($m_x \frac{1}{2}, \frac{1}{2}, 0$) |

Generators selected (1); $t(1,0,0)$; $t(0,1,0)$; $t(\frac{1}{2}, \frac{1}{2}, 0)$; (2); (3); (5)

Positions

Multiplicity, Wyckoff letter, Site symmetry	Coordinates	Reflection conditions
	$(0,0,0)+ (\frac{1}{2}, \frac{1}{2}, 0)+$	General: $hk: h, k = 2n$ $h0: h = 2n$ $0k: k = 2n$ Special: no extra conditions
16 <i>j</i> 1	(1) x, y, z (2) $\bar{x}, \bar{y} + \frac{1}{2}, z$ (3) $\bar{x}, y + \frac{1}{2}, \bar{z}$ (4) x, \bar{y}, \bar{z} (5) $\bar{x}, \bar{y}, \bar{z}$ (6) $x, y + \frac{1}{2}, \bar{z}$ (7) $x, \bar{y} + \frac{1}{2}, z$ (8) \bar{x}, y, z	
8 <i>i</i> . <i>m</i> .	$x, \frac{1}{4}, z$ $\bar{x}, \frac{1}{4}, z$ $\bar{x}, \frac{3}{4}, \bar{z}$ $x, \frac{3}{4}, \bar{z}$	
8 <i>h</i> <i>m</i> ..	$0, y, z$ $0, \bar{y} + \frac{1}{2}, z$ $0, y + \frac{1}{2}, \bar{z}$ $0, \bar{y}, \bar{z}$	
8 <i>g</i> ..2	$\frac{1}{4}, 0, z$ $\frac{3}{4}, \frac{1}{2}, \bar{z}$ $\frac{3}{4}, 0, \bar{z}$ $\frac{1}{4}, \frac{1}{2}, z$	
8 <i>f</i> .2.	$\frac{1}{4}, y, 0$ $\frac{3}{4}, \bar{y} + \frac{1}{2}, 0$ $\frac{3}{4}, \bar{y}, 0$ $\frac{1}{4}, y + \frac{1}{2}, 0$	
8 <i>e</i> 2..	$x, 0, 0$ $\bar{x}, \frac{1}{2}, 0$ $\bar{x}, 0, 0$ $x, \frac{1}{2}, 0$	
4 <i>d</i> <i>m</i> <i>m</i> 2	$0, \frac{1}{4}, z$ $0, \frac{3}{4}, \bar{z}$	
4 <i>c</i> .2/ <i>m</i> .	$\frac{1}{4}, \frac{1}{4}, 0$ $\frac{3}{4}, \frac{1}{4}, 0$	
4 <i>b</i> 2/ <i>m</i> ..	$0, 0, 0$ $0, \frac{1}{2}, 0$	
4 <i>a</i> 222	$\frac{1}{4}, 0, 0$ $\frac{3}{4}, 0, 0$	

Symmetry of special projections

Along [001] $p2mm$
 $\mathbf{a}' = \frac{1}{2}\mathbf{a}$ $\mathbf{b}' = \frac{1}{2}\mathbf{b}$
Origin at $0, 0, z$

Along [100] $\neq 2mm$
 $\mathbf{a}' = \frac{1}{2}\mathbf{b}$
Origin at $x, 0, 0$

Along [010] $\neq 2mm$
 $\mathbf{a}' = \frac{1}{2}\mathbf{a}$
Origin at $0, y, 0$

Maximal non-isotypic subgroups

I	[2] $cm2e$ (36)	(1; 3; 6; 8)+
	[2] $c2me$ ($cm2e$, 36)	(1; 4; 6; 7)+
	[2] $mmm2$ (26)	(1; 2; 7; 8)+
	[2] $c222$ (22)	(1; 2; 3; 4)+
	[2] $c12/m1$ ($c2/m11$, 18)	(1; 3; 5; 7)+
	[2] $c2/m11$ (18)	(1; 4; 5; 8)+
	[2] $c112/b$ ($p112/a$, 7)	(1; 2; 5; 6)+

IIa	[2] $pbma$ (45)	1; 3; 5; 7; (2; 4; 6; 8) + $(\frac{1}{2}, \frac{1}{2}, 0)$
	[2] $pmab$ ($pbma$, 45)	1; 3; 6; 8; (2; 4; 5; 7) + $(\frac{1}{2}, \frac{1}{2}, 0)$
	[2] $pbaa$ (43)	1; 2; 3; 4; (5; 6; 7; 8) + $(\frac{1}{2}, \frac{1}{2}, 0)$
	[2] $pbab$ ($pbaa$, 43)	1; 2; 5; 6; (3; 4; 7; 8) + $(\frac{1}{2}, \frac{1}{2}, 0)$
	[2] $pmmb$ ($pmma$, 41)	1; 2; 3; 4; 5; 6; 7; 8
	[2] $pmma$ (41)	1; 2; 7; 8; (3; 4; 5; 6) + $(\frac{1}{2}, \frac{1}{2}, 0)$
	[2] $pmaa$ (38)	1; 4; 5; 8; (2; 3; 6; 7) + $(\frac{1}{2}, \frac{1}{2}, 0)$
	[2] $pbmb$ ($pmaa$, 38)	1; 4; 6; 7; (2; 3; 5; 8) + $(\frac{1}{2}, \frac{1}{2}, 0)$

IIb none

Maximal isotypic subgroups of lowest index

IIc [3] $cmme$ ($\mathbf{a}' = 3\mathbf{a}$ or $\mathbf{b}' = 3\mathbf{b}$) (48)

Minimal non-isotypic supergroups

I [2] $p4/nbm$ (62); [2] $p4/nmm$ (64)

II [2] $pmmm$ ($\mathbf{a}' = \frac{1}{2}\mathbf{a}, \mathbf{b}' = \frac{1}{2}\mathbf{b}$) (37)