

cmme

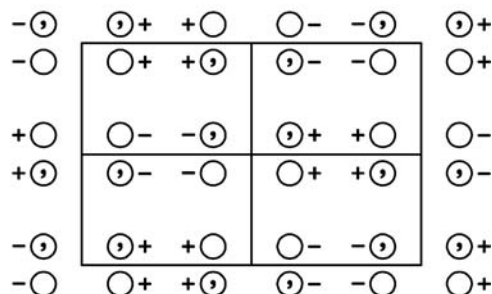
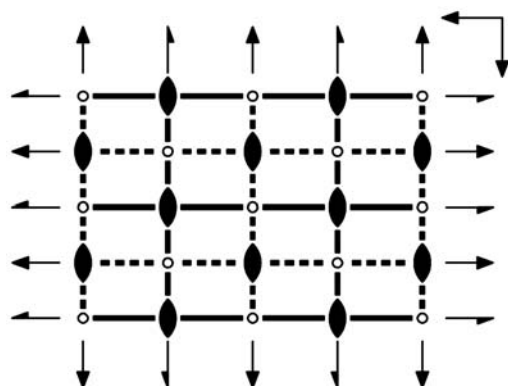
mmm

Orthorhombic/Rectangular

No. 48

c2/m2/m2/e

Patterson symmetry *cmmm*



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

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 | (2) $2 \quad 0, \frac{1}{4}, z$ | (3) $2(0, \frac{1}{2}, 0) \quad 0, y, 0$ | (4) $2 \quad x, 0, 0$ |
| (5) $\bar{1} \quad 0, 0, 0$ | (6) $b \quad x, y, 0$ | (7) $m \quad x, \frac{1}{4}, z$ | (8) $m \quad 0, y, z$ |

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

- | | | | |
|---|---------------------------------|---------------------------------|--|
| (1) $t(\frac{1}{2}, \frac{1}{2}, 0)$ | (2) $2 \quad \frac{1}{4}, 0, z$ | (3) $2 \quad \frac{1}{4}, y, 0$ | (4) $2(\frac{1}{2}, 0, 0) \quad x, \frac{1}{4}, 0$ |
| (5) $\bar{1} \quad \frac{1}{4}, \frac{1}{4}, 0$ | (6) $a \quad x, y, 0$ | (7) $a \quad x, 0, z$ | (8) $b \quad \frac{1}{4}, y, z$ |

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:
16 <i>j</i> 1	(1) x, y, z (5) $\bar{x}, \bar{y}, \bar{z}$	(2) $\bar{x}, \bar{y} + \frac{1}{2}, z$ (6) $x, y + \frac{1}{2}, \bar{z}$	(3) $\bar{x}, y + \frac{1}{2}, \bar{z}$ (7) $x, \bar{y} + \frac{1}{2}, z$	(4) x, \bar{y}, \bar{z} (8) \bar{x}, y, z	$hk: h, k = 2n$ $h0: h = 2n$ $0k: k = 2n$ Special: no extra conditions
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)